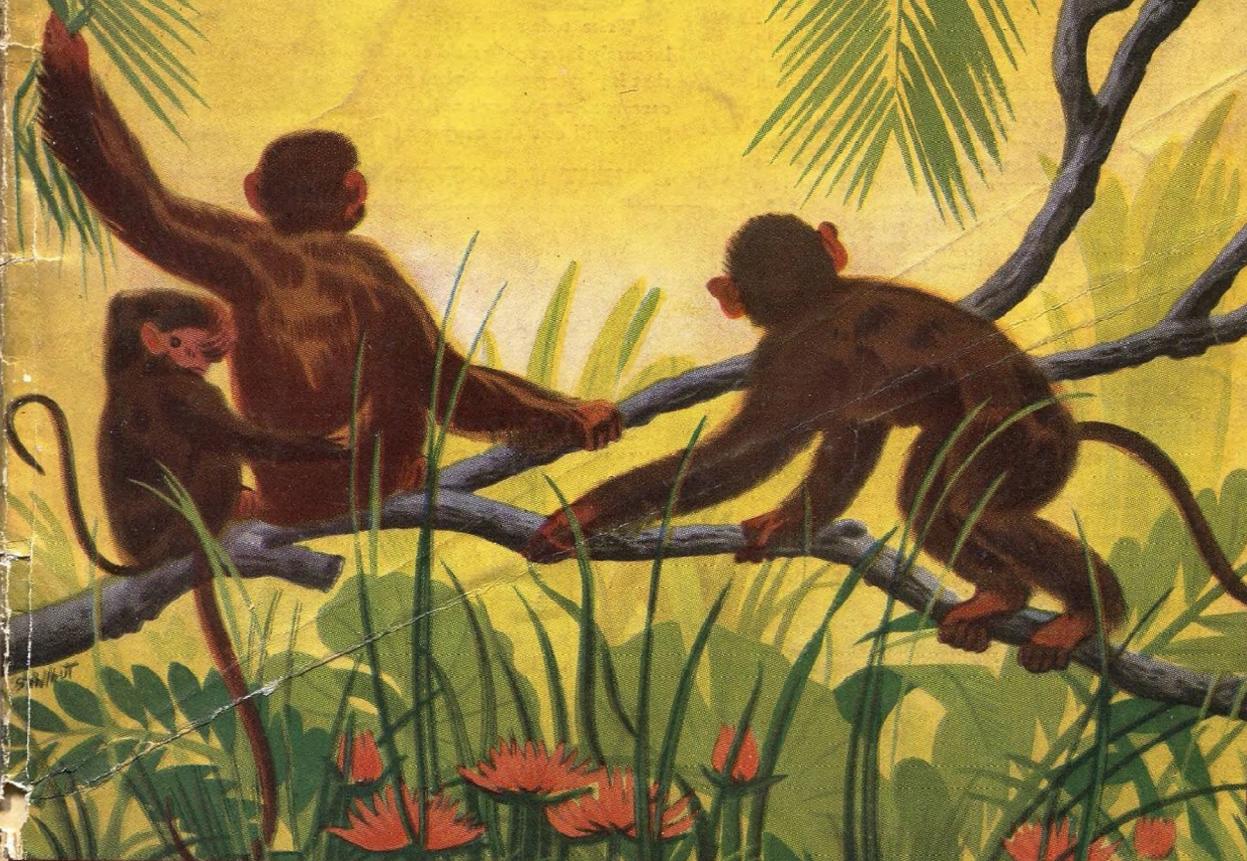
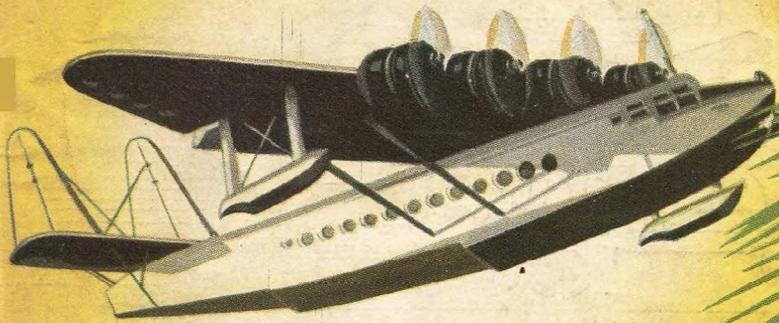


AIR TRAILS

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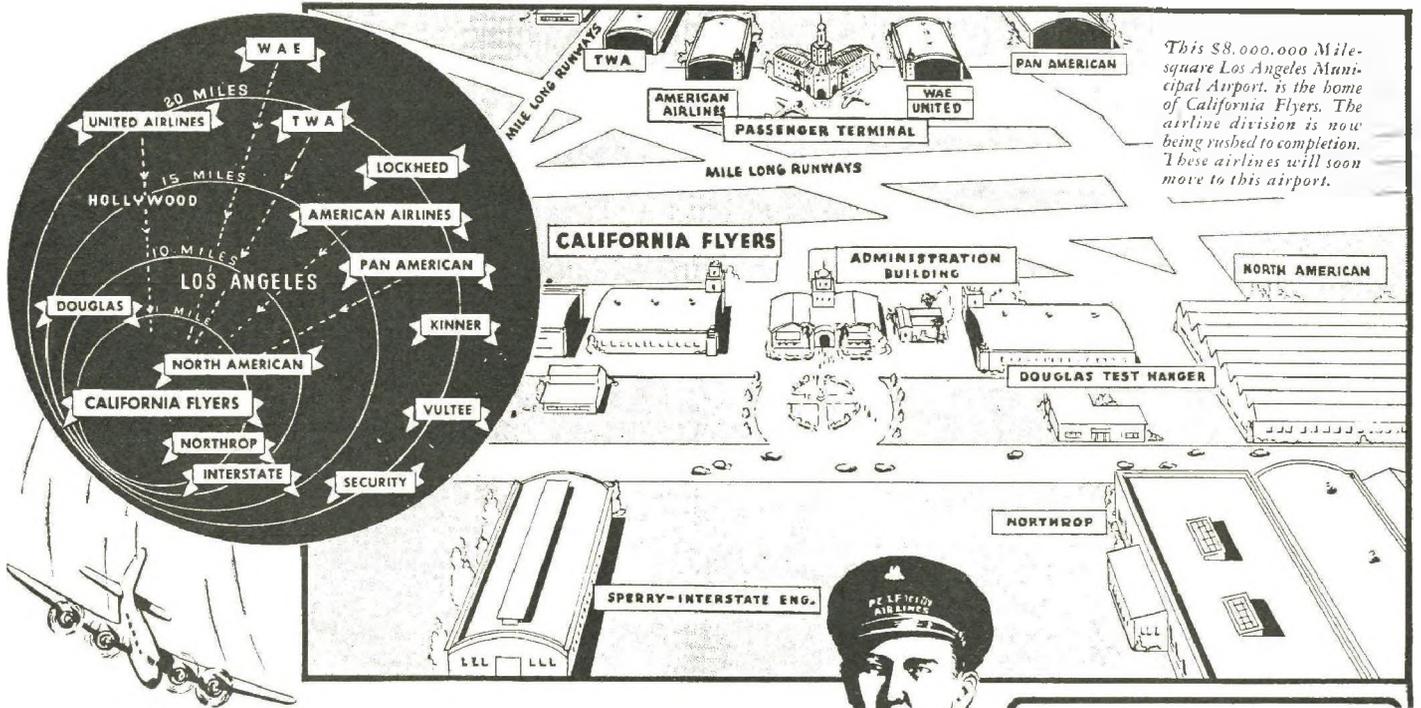
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JANUARY, 1939

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March 3, 1879. Subscriptions to Canada, Cuba, Dom. Republic, Haiti, Spain, Central and South American Countries except The Guianas and British Honduras, \$1.75 per year. To all other foreign countries, including The Guianas and British Honduras, \$2.25 per year.

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A FAR GREATER JOB

It is not difficult to understand why so many of our people are intensely interested in the development of American air transportation. The little boy in the back yard does not think of the airplane that he sees overhead as belonging to any individual air line; he thinks of it as one of "our" airplanes. He is right, for air transportation rightfully belongs to the nation.

We who are in charge of the operation of air lines have our responsibilities to our directors and to our stockholders, but we have a far greater job of making sure that America stays in the forefront of international air transportation. Air transportation must be conducted in the public interest, and no air line will ever be successful unless its conduct and its operation are predicated on that basis.

In some respects the following remarks may be a disappointment to you, for the reason that I am not going to attempt to gaze into the future and predict the time when airplanes will be flying at fifty thousand feet and traveling at a speed of five hundred miles per hour. While it is true that no business can succeed unless plans are made for the future, it is equally true that no business can succeed unless it does a good job with the tools at its command in the present. Let us devote a reasonable part of our time thinking of the future, but the greater part of it to doing a good job with the facilities which we have today. In that way our progress will be more sure, for the firmer the foundation the better will be our opportunity of erecting an outstanding and permanent structure.

You may reasonably ask: "What is the future of air transportation in this country?" It is my belief that air transporta-

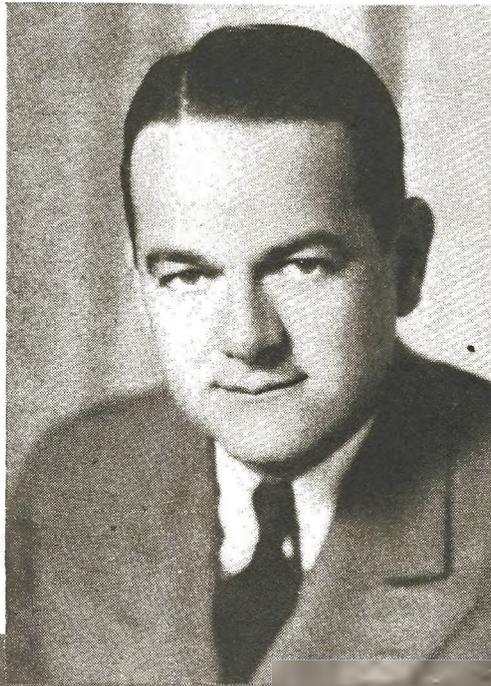
tion has so much inherent utility that nothing can prevent its ultimate success. Its financial success and progress in the immediate future will be determined by its record of safety in operation. Of what avail is it to tell a man that he can go from coast to coast by air in fifteen hours unless at the same time he can be convinced that the journey will be completed with reasonable assurance of safety?

Airplanes, even with the most modern of de-icing equipment, cannot be flown with utmost safety under certain conditions of severe ice. We are hopeful that these conditions will ultimately be overcome by equipment not now available.

It is fortunate that conditions of either intense static activity or severe icing conditions can usually be accurately predicted. Not always, but nearly always, the airline meteorologist can tell you when conditions of this sort will be encountered. When they are definitely predictable and predicted, airplane operations should cease until the conditions no longer exist. Where these conditions are encountered without previous prediction, the flight should be terminated at the nearest field. I believe

that this knowledge is encouraging to all of us, for it is much easier to overcome known handicaps than unknown problems.

We are coming, I believe soon, to a time when new records for safety of operation will be established. I do not say that there will be no more airplane accidents, for we still have accidents even in the older forms of transportation. I do say that airplane accidents will diminish and that airplane safety will soon be greater than that of nearly all forms of ground transportation.



an editorial by C. R. SMITH, guest editor

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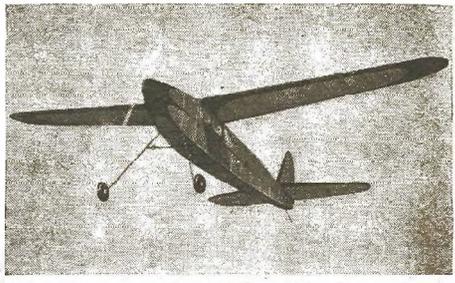
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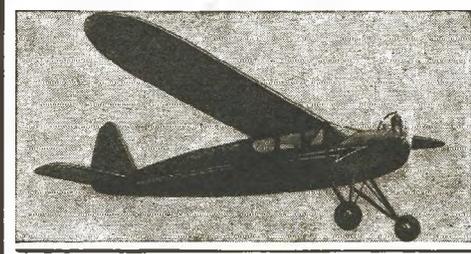
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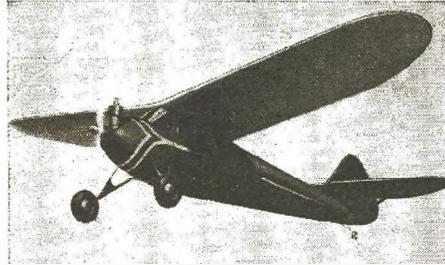
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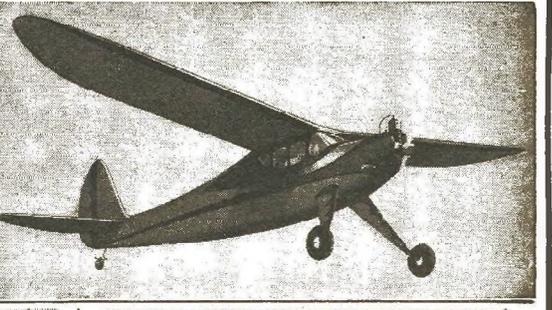
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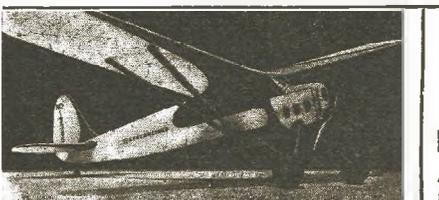


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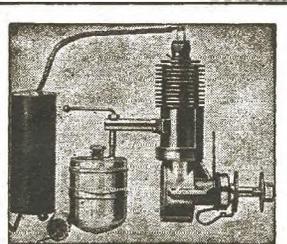
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ABOUT THE GUEST EDITOR

by Tracy Richardson

Cyrus Rowelett Smith (C. R. to his friends and business associates), president of the American Airlines, came to aviation through what might be termed the back door. Untrained in any division of aeronautics, he entered the employ of the Texas Air Transport Company as treasurer. Natural aggressiveness and interest in the new field impelled him to take up flying, shop practice and all phases of the intricate business of aerial transportation.

Born in Minerva, Texas, in 1899, he early showed the keen business traits that later were to place him at the helm of the largest aerial transportation company in the world. A four-year course in business administration at the University of Texas gave him the foundation for using the executive ability that has placed him at the head of his profession.

On completion of his scholastic work he moved to Dallas and engaged in business as an accountant. While working in that capacity he met A. P. Barrett of the Texas-Louisiana Power Company. It was Barrett who "kicked him upstairs" into aviation. Barrett's company had just purchased the Texas Air Transport Company, and he persuaded Smith to take the position of treasurer.

Hard work, aggressiveness and his ability to make friends brought him to the front so that when the Southern Air Transport Company was formed to replace the T. A. T., he stayed on as treasurer of the new and enlarged company. It was then he decided to perfect himself in every branch of the growing industry and began to take flying instruction. From that time on he was in the air or in the shops every minute of his spare time

during the day, while at night he studied the problems of transportation, equipment and personnel. The following year his diligence was rewarded with promotion to the vice presidency of Southern Air Transport.

In 1930 the Aviation Company secured control of a majority of stock in Southern Air Transport, and shortly thereafter American Airways came into being. During the reorganization Smith remained as vice president of the southern division, and in 1931 was elected vice president of the entire American Airways, remaining in charge of the southern division.

Then came the grand fanfaronade in Washington that nearly wrecked commercial aviation in the United States, the cancellation of the air-mail contracts. When the tumult died away and they were counting the skeletons of defunct companies and the government had proven itself incompetent, there emerged from the shadows of the old American Airways a new child, stronger than its parent and with wisdom gained through experience, the American Airlines. And riding high, in the seat of vice president, was C. R. Smith, the one-time Texas auditor.

The American Airlines, under the guidance of C. R., pioneered the first sleeper planes in the United States. He introduced the high-speed Vultecs to the air lines. He brought speed, comfort and safety to aerial transportation.

Now, as president of American, he directs activities that cover approximately 7,000 miles of airways and employs about 2,000 persons, including 270 pilots and co-pilots, and calls for an average of 50,000 miles every twenty-four hours.



With Radio City at the left and the Empire State Building towering in the background, an American Airlines "Flagship" soars over the spires of mid-town Manhattan. American Airlines was the first to have carried one million passengers.

of
hour, as
called for ninety-eight airplanes.
These will include thirteen addi-

fortress bombing ships went to
culmination of a year of intensi-
fied effort toward the reaching of

AIR PROGRESS

A Summary of Aviation News



The 41 1/2-ton Boeing Clipper lands on Lake Washington, Seattle, after a test flight. Note the large wing flaps, lowered to decrease landing speed.

TRANSPORT

The average air transportation pay roll, according to a new survey published in *Aviation* magazine, is now twenty-four million dollars a year. The survey presents some very interesting facts on salaries paid to various employees. For instance, first-line pilots receive an average of six hundred and seventy-five dollars a month, co-pilots two hundred and thirty dollars. The stewardesses get about a hundred and fifteen dollars a month, and the overhaul and maintenance crews draw down an average of a hundred and fifty dollars.

Dispatchers who handle the control towers get two hundred and forty dollars a month, the meteorologists are paid at the rate of a hundred and seventy-five dollars, radio operators a hundred and forty dollars, and the field and hangar crews get about ninety dollars a month. There are about eleven thousand, seven hundred and fifty workers connected with transport aviation, and the average monthly pay roll runs to something like two million dollars a year.

Ten years ago we paid on an average of eleven cents a mile for air travel at a hundred and twenty miles per hour. Today we can fly at an average speed of a hundred and ninety-five miles per hour for

about five and a half cents per mile. In 1930 domestic air lines flew about four million miles per fatal accident, whereas today there has been an improvement of three hundred percent. The score has gone up to twelve million air miles per fatal accident.

The hurricane which struck New England in September brought up air-transport figures to record heights, when travel by automobile, bus and rail was cut off. American Airlines which enjoyed most of this increase, had to invite United, I. W. A., and Eastern Air Lines to fly emergency trips over the routes. No less than sixteen hundred and forty-nine persons were flown in less than twenty-four hours, sixty percent of whom had never flown before.

The Civil Aeronautics Authority has begun a new survey of the country's airports which will be used as a basis for recommendations to Congress concerning Federal participation in construction, operation and maintenance of a national system of such airports and the extent of such participation. Actually about eight hundred of the twenty-three hundred listed fields will be studied as typical.

The long-drawn-out quarrel between officials of the city of Newark and those of New York concerning the transferring of major air-line bases to the North Beach Airport has taken on a new angle. Several of the air lines now state they do not intend to desert the Newark field, but hope to have North Beach named as an Eastern mail terminal along with Newark, so that they can use both airports. They hope to divide their schedules between the two fields when the improved North Beach Airport is opened for traffic in 1939.

With the initial flights of the new German LZ 130 Zeppelin, which is using hydrogen gas, some very interesting sidelights have come to the surface which have missed the columns of the daily newspapers. For instance, it has been stated that German engineers have been working on a formula for the synthetic production of a noninflammable gas which for all practical purposes will have the same advantages as helium. Other plans include a system for compressing released gas into metal bottles, and still another proposes to use condensers to save the water content from burned fuel. Readers will remember that as the fuel is used during flight the airship naturally gets lighter, which accounts for the fact that hydrogen must be valved out when landings are to be made, to allow for the difference in gross weight. It is hoped that a combination of the three plans will reduce fire and explosion hazard.

British commercial craft may be slow compared to those of this country, but they certainly make them to last. The airliner *Hercules*, of Imperial Airways, has flown a distance equaling fifty trips around the globe. She has carried ninety-five thousand passengers in her seven years of active service without one accident of any sort or a single forced landing.

AIR FORCES

Buzzards are attacking military airplanes again in Texas. A three-ship formation of observation

(Turn to page 90)

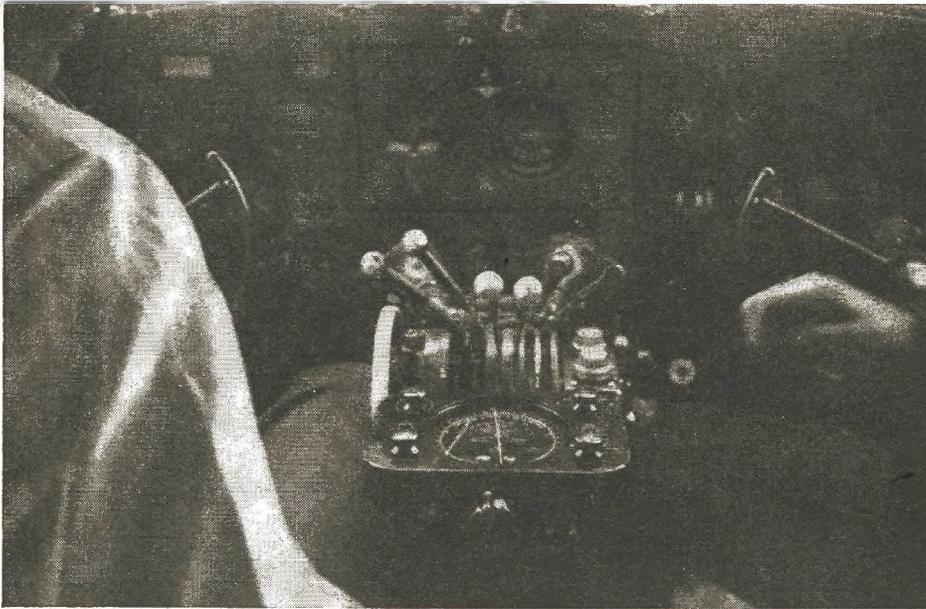
Completion of the thirteen planes gave the Army Air Force a total of fifty-two "flying

ARMY GETS SHIPS

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RADIO HOMING PIGEON

The Air Trails staff goes along on an epic flight.



The Editor snaps the "pigeon," mounted horizontally directly below the throttles of the DC-3 in flight. Left, the shoulder of W. H. Dunn, pilot. The hand belongs to F. Moseley of Sperry.

THE DC-3 was lost! Lost only in fun, of course. But if the DC-3 had been lost aloft in the foulest weather imaginable, the insignificant little gadget that was now guiding the ship in demonstration would have led it straight to its destination.

This newest gadget is going to revolutionize aerial navigation technique. Technically, it's called the Automatic Direction Finder, Automatic D/F for short. You will hear plenty about that catchy title during the coming year.

Developed by Sperry and the Radio Corporation of America, the Automatic Direction Finder has passed with

liner sped unerringly to the truck and passed directly over it. At this point the indicator did what no other direction finder yet designed has been capable of doing. Once beyond the radio truck the hand swung around and pointed back in the direction of the truck over which the ship had just passed! When banking, the needle circled continuously on the dial pointing all the time to the position of the truck. To conclude the demonstration the direction finder found immediately the exact course to every major metropolitan radio station.

The most noteworthy benefit of the new direction finder is that it need only be tuned to a radio station. It

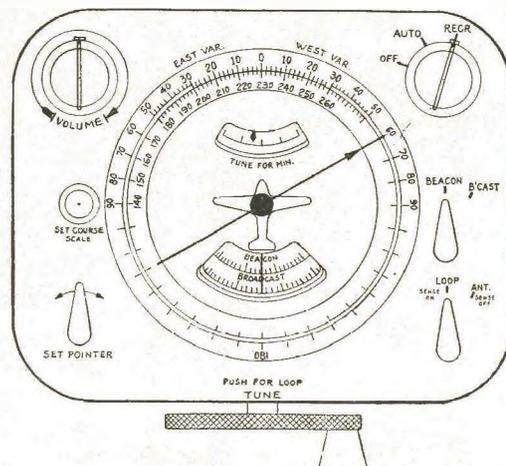
then not only performs all the duties of earlier direction finders, but it does so, because of its operational simplicity, continuously and automatically without requiring the pilot's attention at the expense of his other duties.

When conditions are so bad that static would render the ordinary type of hand-operated loop helpless to obtain a "null" or no-signal, this instrument is able to do so automatically. It can also be used by the pilot, at a glance, to check his position found by some other method of navigation.

(Turn to page 9)

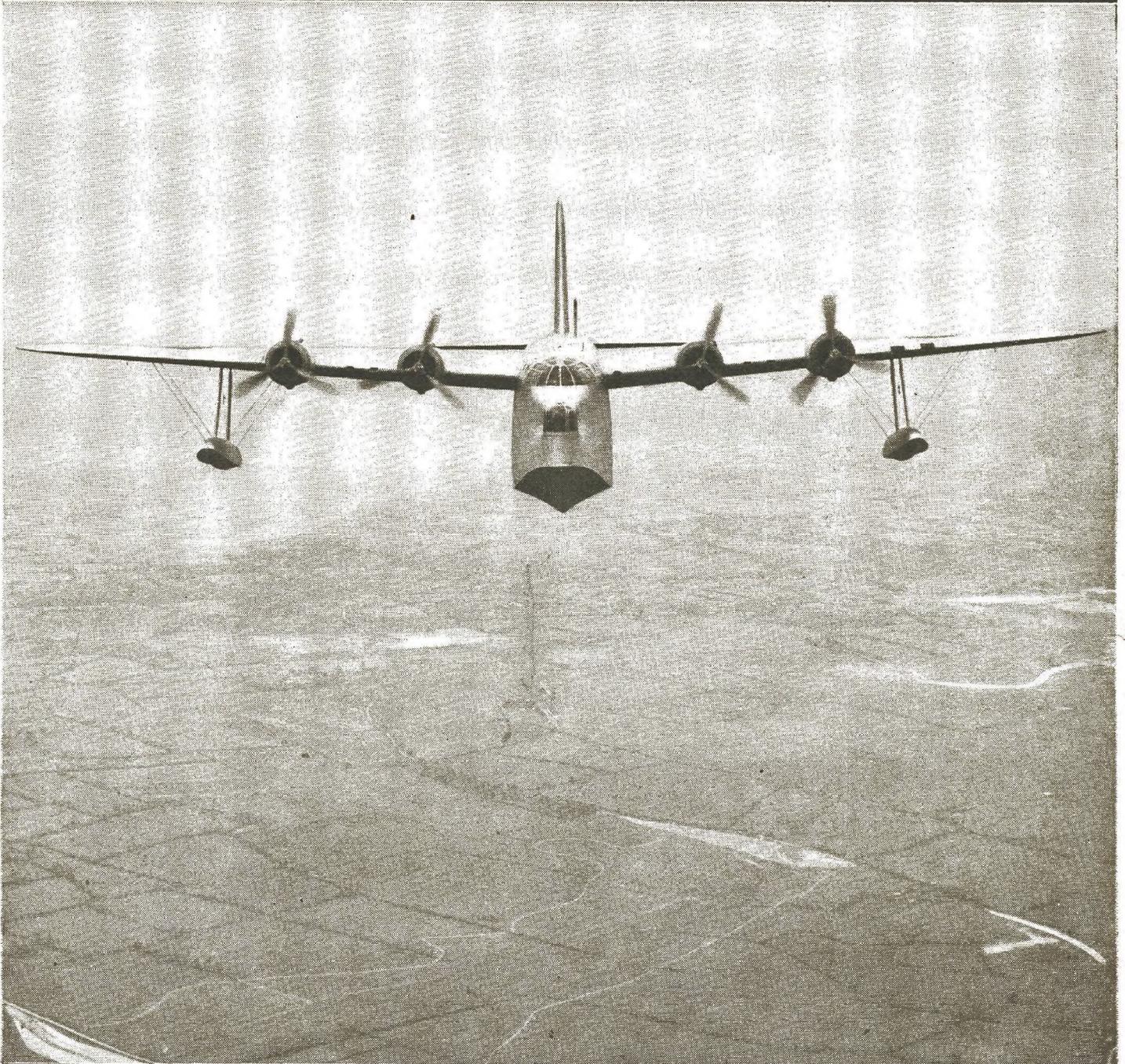


Associate Editor William Winter, aboard the DC-3.



Diagrammatic drawing of the face of the "pigeon." The crank at bottom revolves the inner dial band.

THIS WINGED WORLD



Apparently hanging in midair over peaceful English farmland, the giant flying boat bomber, Sunderland, presents an odd head-on view.

NEWS OF THE AERONAUTICAL WORLD

PRESENTED IN PICTURES

Wide World

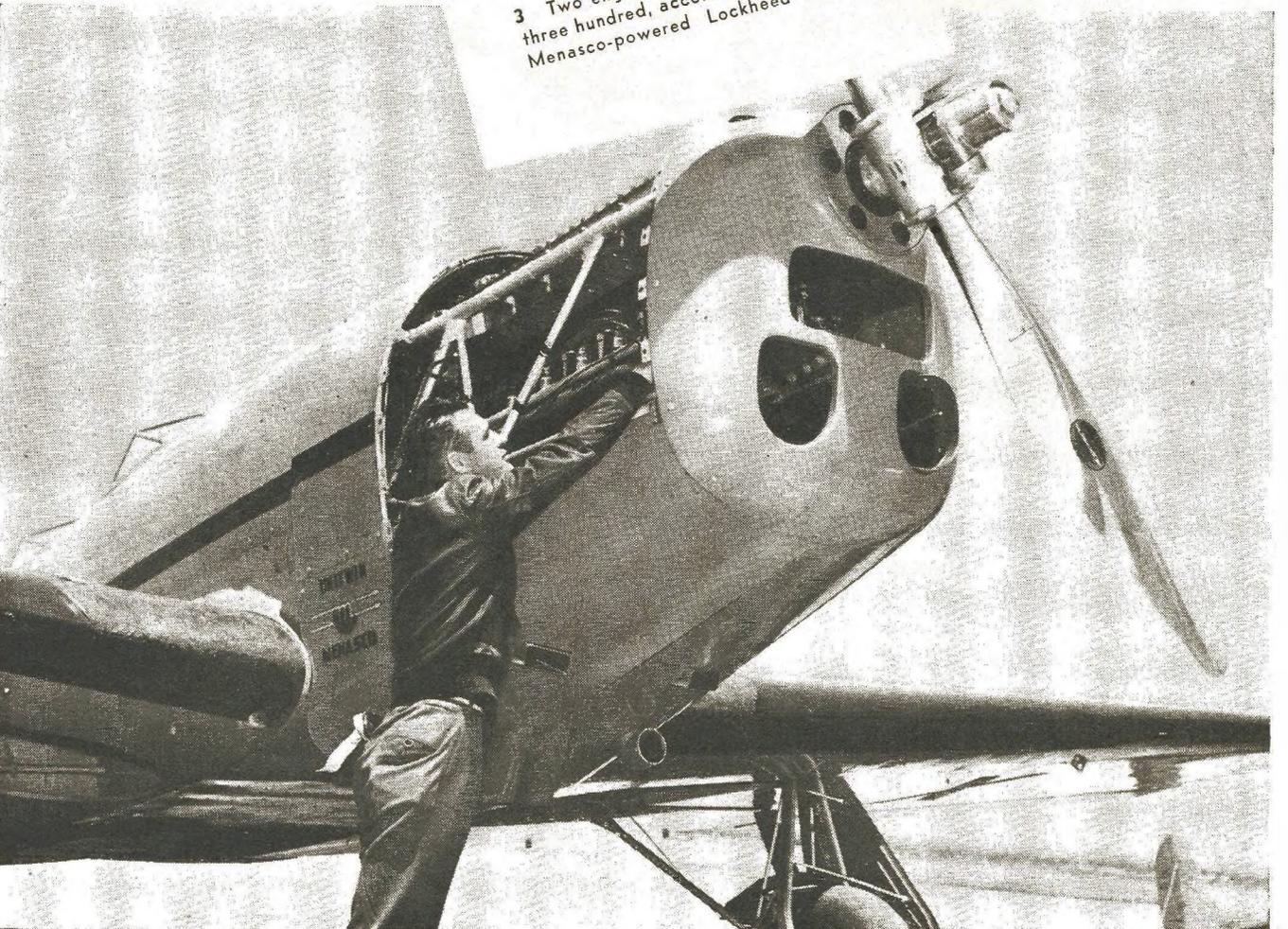


THEY ALL FLY

1 Apparently taking a bow for his many famous ships, G. R. de Havilland leaves the Albatross after a test.

2 A family affair. Mrs. T. A. Hiam and children arrive in Newark after a 2,969-mile flight from Vancouver, B.C.

3 Two engines plus one prop equals three hundred, according to this twin-Menasco-powered Lockheed Altair.

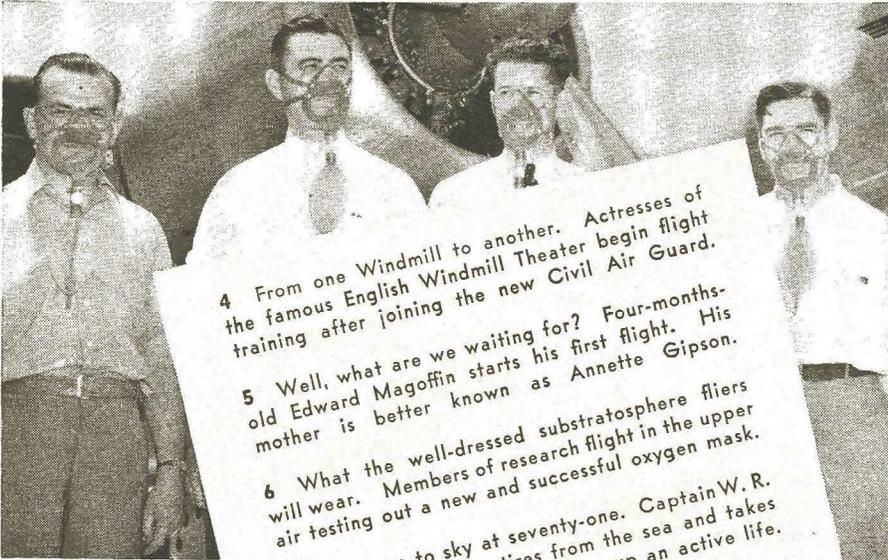


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Wide World



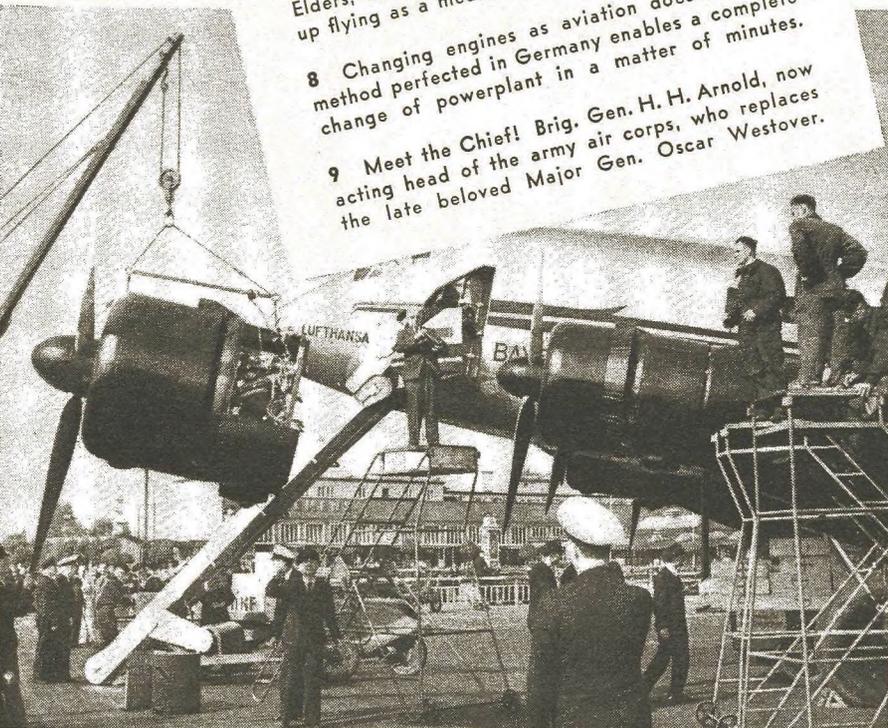
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6

Wide World

- 4 From one Windmill to another. Actresses of the famous English Windmill Theater begin flight training after joining the new Civil Air Guard.
- 5 Well, what are we waiting for? Four-months-old Edward Magoffin starts his first flight. His mother is better known as Annette Gipson.
- 6 What the well-dressed substratosphere fliers will wear. Members of research flight in the upper air testing out a new and successful oxygen mask.
- 7 From sea to sky at seventy-one. Captain W. R. Elders, of England, retires from the sea and takes up flying as a means of keeping up an active life.
- 8 Changing engines as aviation does it. New method perfected in Germany enables a complete change of powerplant in a matter of minutes.
- 9 Meet the Chief! Brig. Gen. H. H. Arnold, now acting head of the army air corps, who replaces the late beloved Major Gen. Oscar Westover.



8

International



5



Wide World

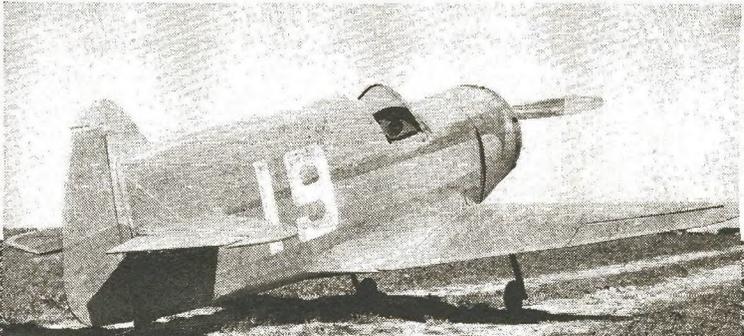
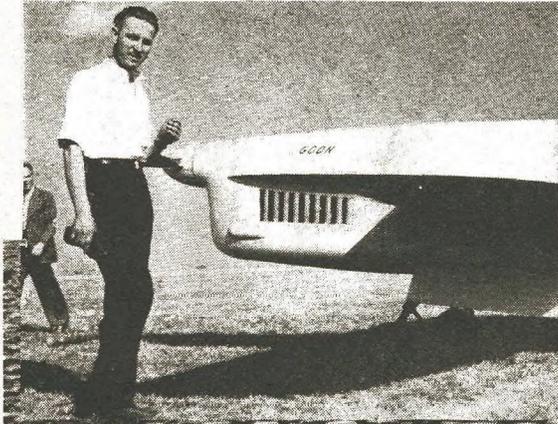
7



International

9

Art Chester, popular racing pilot, and the "Goon." The "San Diego Flagship" has only a 13-ft. span, 90 h.p. Pobjoy engine.

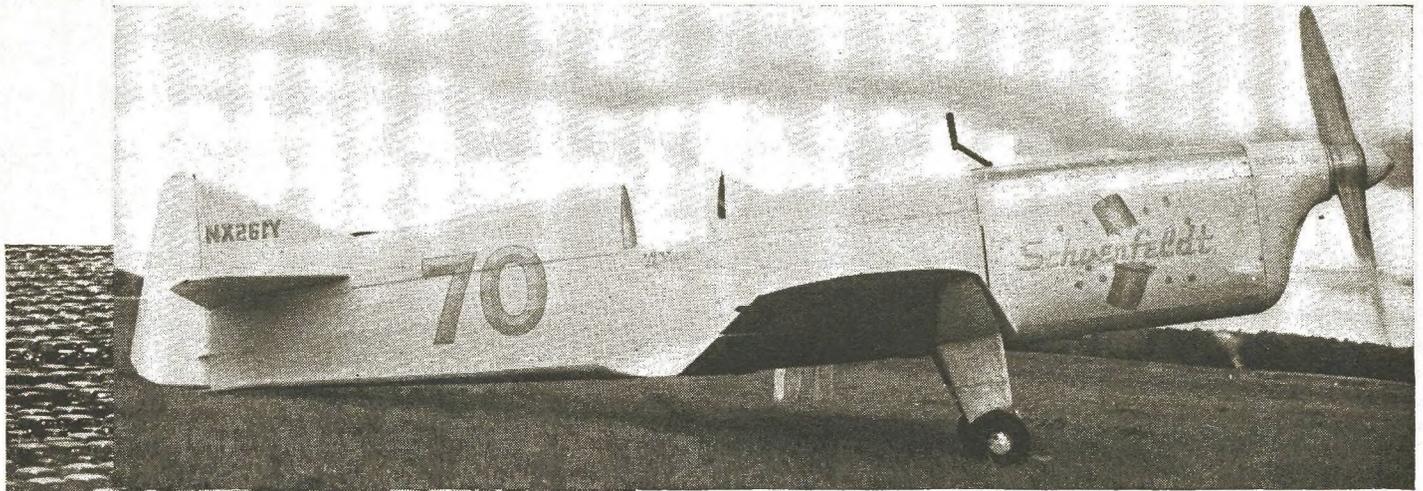


"CLIPPED WINGS"

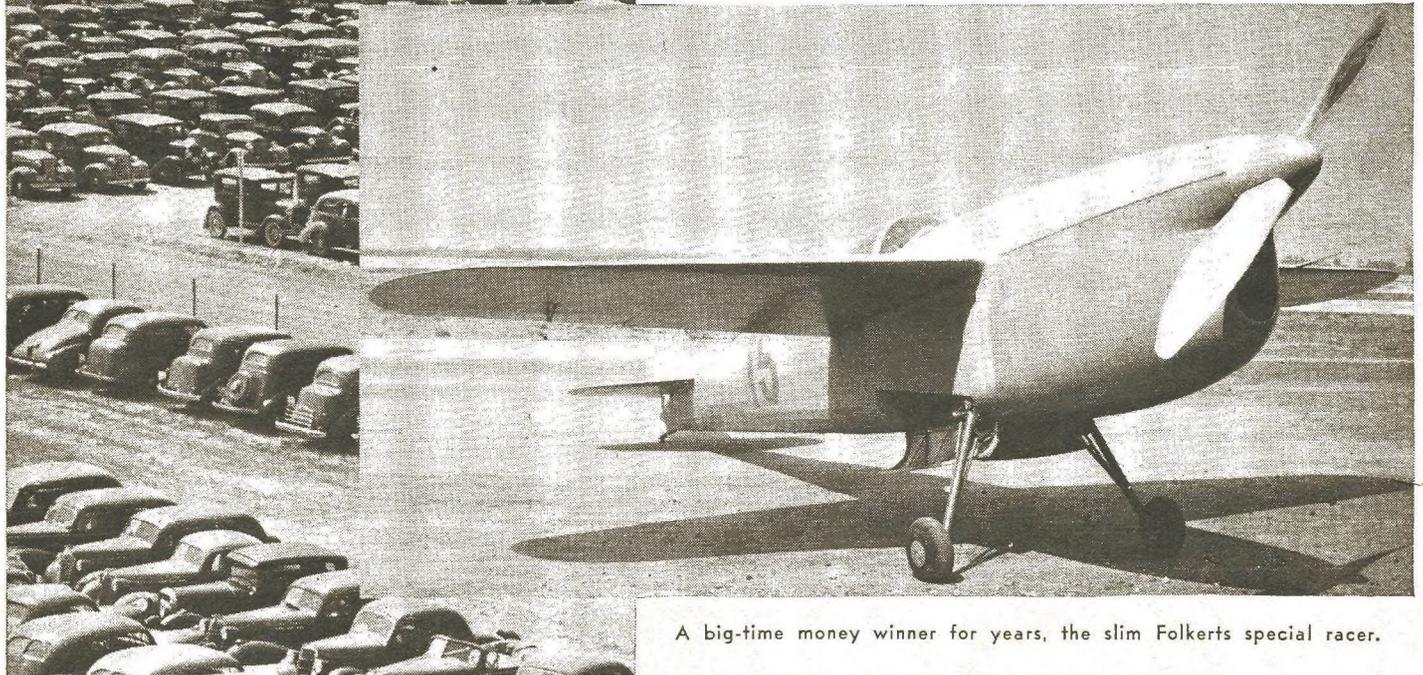
The smaller the wings the faster they go, seems to be the axiom of racing-plane design. Streamlining had reached the ultimate. And because a high-horsepower engine costs many thousands of dollars, small engines had been already supered-up to nearly double the horsepower the manufacturer had provided. Where competition is keen each mile an hour is important. So the wings were made smaller and smaller, until these tricky little clipped-winged bullets flash around pylons faster than ever, much to the crowd's delight. Their whining engines, jackrabbit landings and razor-thin, diminutive flying surfaces create the color and thrills that threaten to overshadow the famed Thompson Trophy Race itself. Witness the home-stretch duel in the Greve Trophy Race between Art Chester's "Goon" and Tony LeVier's "Firecracker," which the Firecracker finally won at a speed of 250.88 to 250.416!

A beautiful but unlucky racer, the "8 Ball."

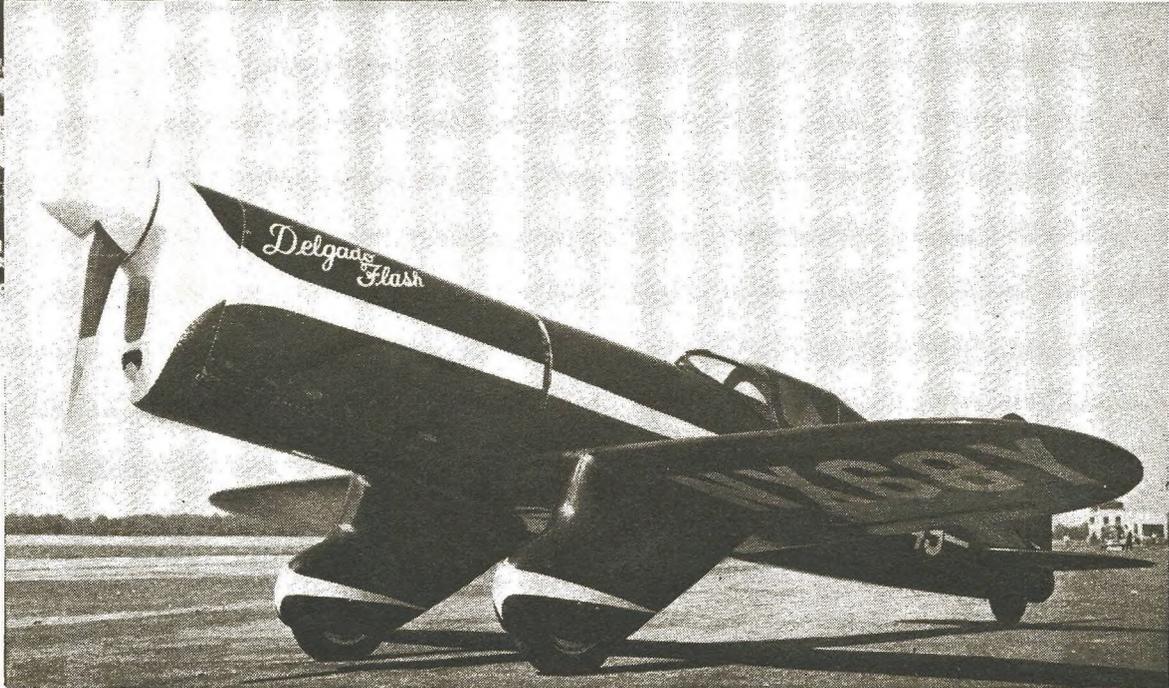




"Firecracker," Greve Trophy winner, has a suped-up 260 h.p. Menasco.



A big-time money winner for years, the slim Folkerts special racer.



The "Delgado Flash," built by the Delgado Trade Schools, holds the speed record for ships in its class.



1—With the wail of the fire siren men race to the suits.



3—CO₂ is poured onto the fire as an ambulance stands by.

"the seven dwarfs"

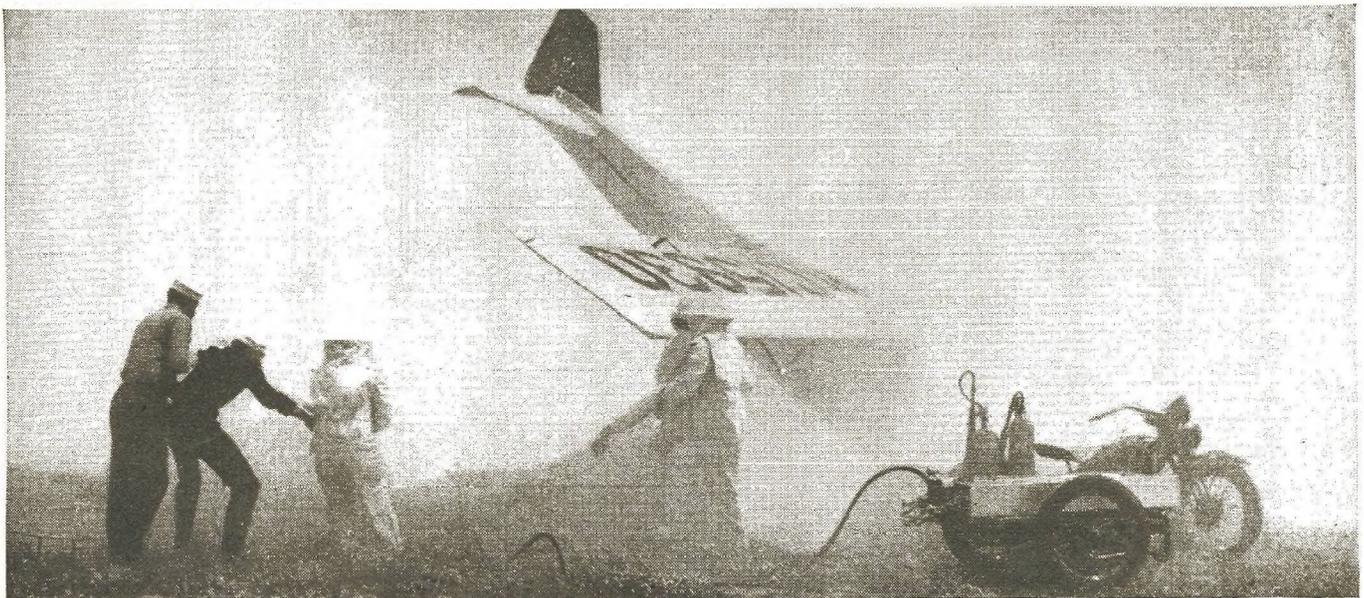
One of the deadliest dangers of aviation is fire after a crash. Many a fatal crash would be otherwise had not fire followed, or had there been means of getting to the occupants of the burning wreck. The authorities of Floyd Bennett Field, intent upon minimizing such hazards as far as possible, have trained men and equipment for this very thing ready day and night. Popularly known as the "Seven Dwarfs," these asbestos-garbed men carry out a "rescue" such as the one staged here in ten minutes from first picture to last. In this case a light plane was propped up and smothered with sky-writing smoke while the pilot, like Snow White, awaited rescue by the Seven Dwarfs.



5—While the pilot is placed on the stretcher, an overcome dwarf is pulled to safety by cable attached to back of suit.



2—While all traffic has been stopped on the field by a signal from the control tower, the first "dwarfs" arrive.



4—Protected by their asbestos suits, the "dwarfs" plunge into the fire and unstrap and carry out the ship's pilot.



6—Ten minutes have passed since the siren and the injured pilot is on the way to hospital. Note prop holding up "wreck."

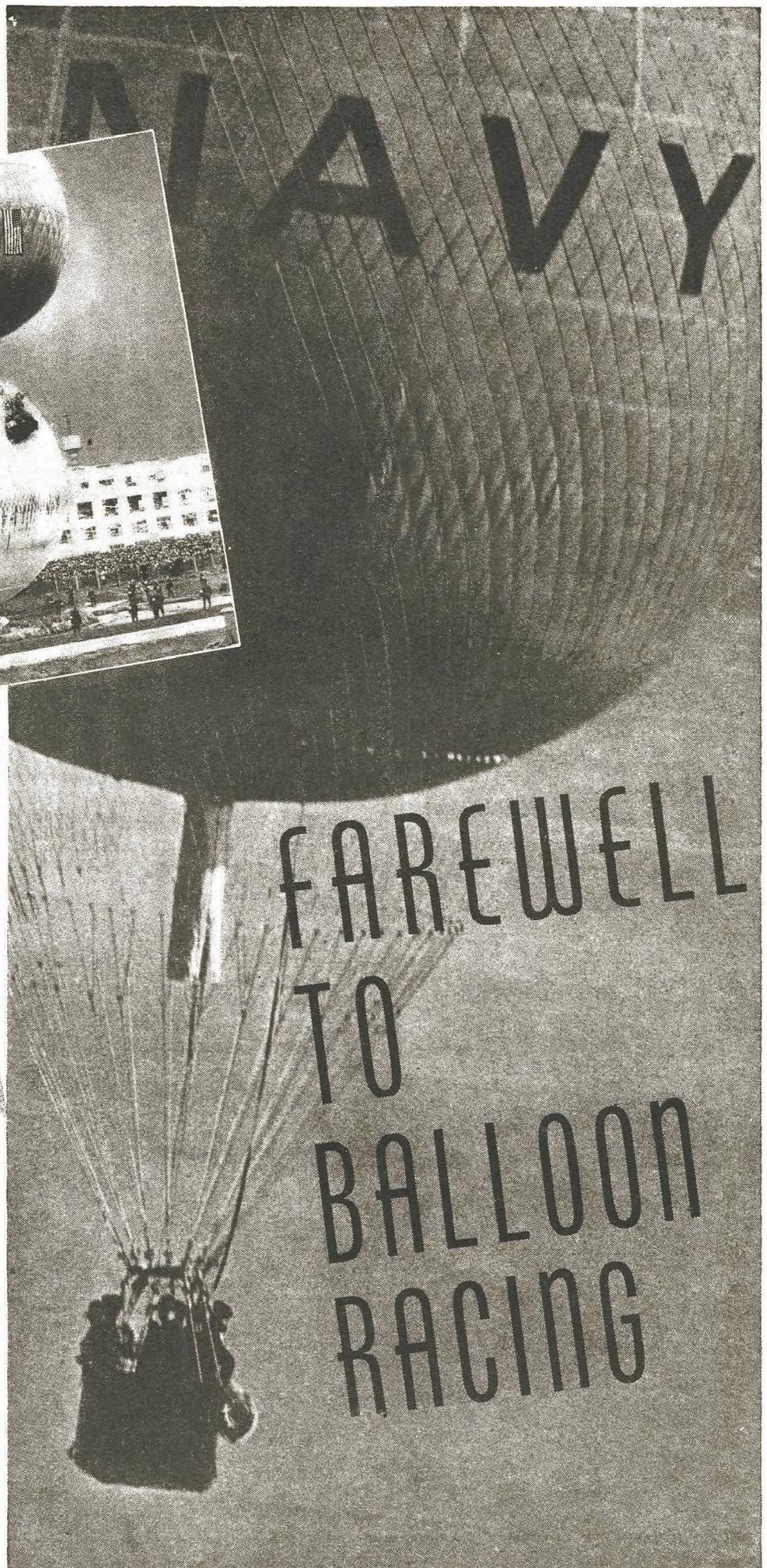


Lieuts. Olmstead and Choptaw of America in their fatal crash in 1923.



Safety valve of old-time racer being inspected before inflation for race.

Thrills, chills, and laughs in a grand sport, vividly told by a participant.



by Samuel Taylor Moore

At fourteen thousand feet we reached our ceiling. Except for half a bag of sand, two parachutes and the clothing we wore, nothing remained to use as ballast. Food supplies and drinking water had been going over the side of the basket ever since we had passed Red River, at almost the exact point where it marks a triangular boundary between Texas, Oklahoma and Arkansas.

A short three miles straight down thermometers were registering heat of 100°. In our wicker cubicle my teeth were rattling like castanets despite fleece-lined underwear. A feeling of lassitude was growing more pronounced. Now, 14,000 feet is not tall altitude. Airplane pilots take such high sky in stride—but that is because they fly above 12,000 feet in small doses, or with oxygen equipment. We had been climbing from 9,000 feet for more than six hours, since nine o'clock in the morning. Accustomed to sea-level pressures, the cumulative effect of thin air for such a long period was getting us. Moreover, we had been up altogether for twenty-one hours, and toiling like Hankow coolies on the ground preparing our balloon for ascension twelve long hours before that.

One doesn't sleep much the first night of a balloon race, in any event.

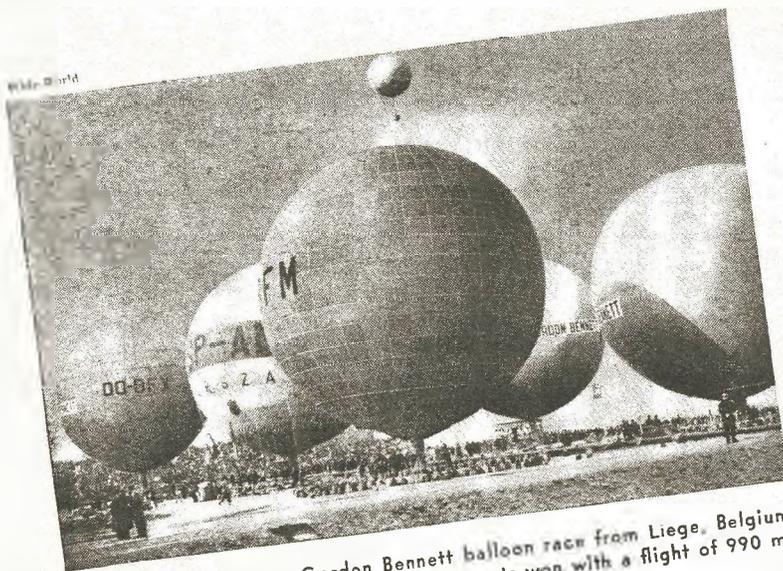
Sandbags make a poor couch, for one thing. For another, taking off from Houston, Texas, at dusk of July 4th, there had been some excitement near midnight. Over Conroe, Texas, an Independence Day celebrant armed with a rifle had taken pot shots at our bag silhouetted in bright moonlight. We had counted a dozen reports of the gun and two-thirds of his shots had zinged close by our craft; an uncomfortable but common experience in free balloon flight.

Besides, the sheer beauty of night flying under fair conditions is such an experience that one willingly forgoes slumber. In moonlight, starlight, or even utter darkness there is nothing to compare with its majestic quietness. Subconsciously the pilots talk in voices reverently hushed. The only noises reaching one's ears are the evening requiem of tree toads, the bark of occasional dogs baying the moon, the mournful mooing of lost cattle, or the muted horns of automobiles.

Where were we? Oh, yes, in a very tight spot!

Below us a limitless gray and white sea of convection cumulus clouds boiled in fury like a vast witches' cauldron. On every side at short intervals the seething mass exploded in eruptions suggesting ghostly volcanoes. We could feel the icy breath of the nearest towering cloud-spouts. We could only pray one didn't engulf us. The cold damp mass would contract the sensitive hydrogen beyond control, sending us down, because without ballast we could not correct lost buoyancy.

Nor was that our only worry. Apparently pursuing us like some invisible monster was the terror of all balloon racers, a line squall. Somewhere below, hidden by the swirling mass we looked down upon, its ominous rumblings, punctuated by angry roars, were growing louder and nearer. Lieutenant Eareckson, my companion, cared for that threat rising from (Turn to page 69)



Start of the 26th James Gordon Bennett balloon race from Liege, Belgium. September 3, 1938. One of the Polish entrants won with a flight of 990 mi.



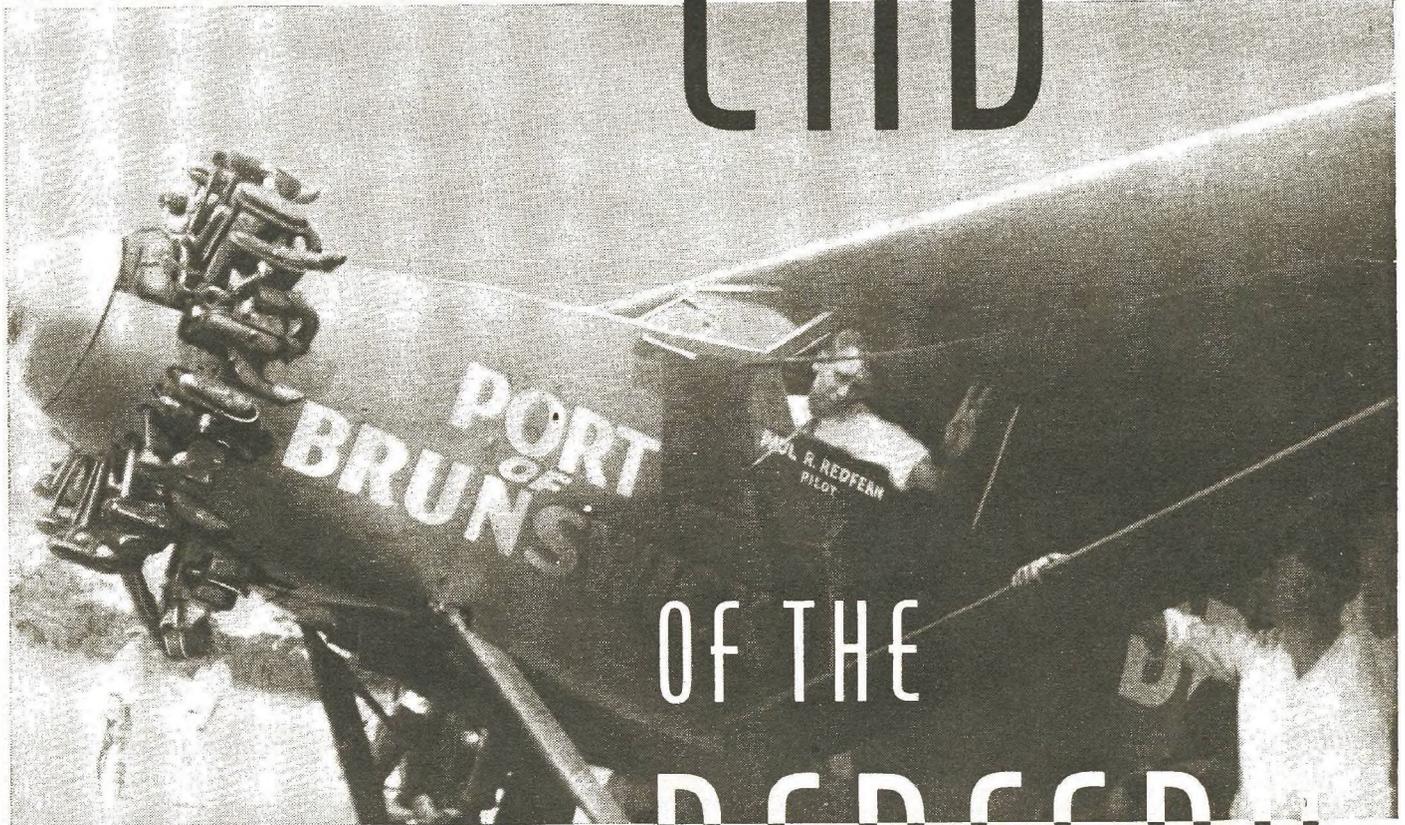
Like huge halved oranges these partially inflated balloons await but more hydrogen before soaring away to fame, fortune or possible destruction aloft.

Acrobatics begin before the balloons leave the ground. A last-minute check-up of the fabric of a Swiss entrant.



by Jo Besse Waldeck

END



With propeller spinning, Paul Redfern, youthful Georgia pilot, waves from the cockpit of his yellow Stinson, as he starts upon his tragic solo flight into jungles of Guiana.

OF THE REDFERN

A first-hand account of the last, and thirteenth, expedition that solved the Redfern mystery.

In 1927 Paul Redfern vanished in a flight from Brunswick, Georgia, to Rio de Janeiro, Brazil. Since his disappearance innumerable tales have come out of the jungle. He had been killed in the crash. He was alive and a prisoner of the Indians. He was a white god of the natives. Plenty of natives were reported to have seen him, alive, a kind of king in his own right.

None of these tales was true. I was a member of the thirteenth expedition into British Guiana, sent for the purpose of solving the mystery of the Redfern disappearance. I was the only woman with the expedition, or any other expedition that penetrated so far into the British Guiana jungles. My husband, Theodore J. Waldeck, headed the expedition. It took us seven months altogether to reach the spot where Redfern crashed, and return to civilization. We brought proof of the death of Redfern that satisfied his family completely. His father issued a statement to the press to that effect.



The authoress, Jo Besse Waldeck, only woman to be an expedition member.

We were close enough to see the spot where the plane crashed. We were led there by Yahos of the Akawai tribe, who claimed to have seen the Redfern Stinson dive into the jungle. Redfern couldn't have selected a more nearly inaccessible place had he deliberately tried to lose himself, nor one from which, had he survived, there was less chance of escape. When we reached the village of Yahos, of whom we had heard months before, when we had left Bartica by boat up the Cuyuni, we were in the midst of the worst rainy season they had suffered for years on end. The land where the plane went in—

Yahos showed us where the trees had been broken off, and we viewed it from every possible angle—was on the side of a mountain that might have been scalable in the dry season but not at that time, unless we had been able to spend at least four weeks in building a causeway or cutting a road. Moreover, the

plane was in a pothole that was a sea of mud and slime. From past experience we knew exactly what we would encounter in the gigantic task of trying to reach it.

There would be bushmasters, labari snakes, and snakes of many other varieties, some of them probably unknown to herpetologists; tarantulas, tiger spiders, black widow spiders two inches across, droger and moneria ants, mosquitoes that deposited the larvae of worms in their bite punctures—larvae which developed under the skin and had to be removed surgically. One of the reasons we didn't attempt to actually reach the Stinson then was that we had already performed a number of operations on ourselves for these same larvae. My husband had narrowly escaped being bitten by a labari and a tiger spider.

Moreover, after months spent reaching this place portaging endlessly along the Cuyuni, fighting off all manner of attackers, taking time to learn the language and win the confidence of the Indians, because nothing could be accomplished without their help, our supplies were barely enough to get us back down the river. This even though we had left caches all the way back as far as Devil's Hole Island where, on our journey up, we had been marooned for forty-four days because of the mutiny and desertion of our boat crew, with our boat. The expedition's doctor, Frederick Fox, had died on

operation to find the motor would have to be undertaken. However, now, with friendly Indians along the way—friendly principally because I was initiated into the sisterhood of Arawak—there would be plenty of hands to lend help. My husband is determined to bring the plane out, somehow. Some three weeks' travel from the spot there is a lake on which he believes he can set down an amphibian. This lake happens to be near a gold-bearing area we also discovered on our recent trek, so we hope to finance our operations from gold we can pan near the landing. That this is feasible we know, for we picked up nuggets over an area of approximately two hundred and seventy-five acres. If bringing this gold out by plane proves practicable—and we see no reason why it should not—our expedition, at least, will have accomplished something in addition to solving the Redfern mystery.

Our corroborative testimony to the effect that the mystery has been solved is Redfern's hunting knife and part

of the breeches he was wearing on his flight. We brought them back with us, and they were identified by members of his immediate family.

Until, however, we who have actually found the spot have brought back the remains of the plane and possibly of its pilot, there will in all likelihood still be adventurous souls who'll keep going into British Guiana and perhaps dying, to add their bit to a tale that has become increasingly gruesome as the years go by.

Redfern, though he perished, did something for aviation in British Guiana. He was, in a small way, a trail blazer, and where he flew there

will soon be regular transport service, particularly for the purpose of linking mines with the sea coast.

Editor's Note: This article by the only woman to be a member of any of the thirteen expeditions to try and find evidence of either the death or safety of Paul Redfern should be extremely interesting to those whose air memory goes back to 1927. During the months immediately after Lindbergh's great solo flight to Paris, many brave and to some, foolish, airmen took off upon hazardous flights seeking the fame and fortune won by the first pilot to fly the Atlantic alone. Paul Redfern, famous commercial and stunt flier attempting to fly from Brunswick, Georgia, to Rio de Janeiro, Brazil, became one of this gallant band of intrepid and daring pioneers of aviation, too many of whom reached a far greater goal than that for which their all too few instruments were directed. For more than ten years the fate of Redfern has been a tantalizing subject of both conjecture and action, and we pay tribute not only to this brave pilot but to the many expeditions which have sought to set at rest the rumors and legends built up about the final scene of a tragic aviation drama of ten years ago.

MYSTERY



He saw Redfern's Stinson dive into the steaming Guiana jungle. Yahos, the Aka-wai chief, showed where Redfern fell.

Devil's Hole Island, and been buried there. Others of us had been constantly ill with a variety of fevers. William Chanler had been sent back from Warwah Creek, with a raging fever, and in delirium.

Four more weeks of it were insupportable. My husband and I were the only two white people left of the expedition. We were half mad with bush sores, fever and lack of sleep. We had to content ourselves with getting as close as we could, cutting our way within sight of the spot, yet finding the jungle approach so nearly impenetrable that often, for long distances, we had to crawl on our stomachs. And always we had the horrible thought that our faces and necks were vulnerable to the fangs of darting snakes, the spiders, scorpions—everything poisonous which crawled and squirmed through the jungles.

However, now that we are back, my husband intends to return to British Guiana in an attempt to reach and bring out whatever may be left of the plane. There won't be much. Ants destroy wood and fabric, but probably could do little against the motor, which may have been buried in the plunge—for during our visit the area was a quagmire. In the dry season it might be possible to reach the spot without boats or dredges, when a digging

MAKE WAY FOR

AN

APPRENTICE

by EDWIN LAIRD CADY

TO Mickey Kennedy and Swede Olson, apprentices fresh out of high school, it seemed a peaceful morning in the grinding room of the Double Stroke Diesel Co. True, John Bangor, manager of the whole works, was spending his time on the machines instead of in his comfortably modernistic office. And two big flat-footed men, new that morning, seemed to spend more time watching others than in even trying to run the machines with which they clearly were unfamiliar. And Slobski—if the man had any other name, no one outside of the personnel department knew what it was—stupid Slobski had just taken a nasty bawling out from Bangor for leaving a slippery pool on the floor after cleaning the muck of spent abrasive and grinder chips from the sump of a hydraulic profiler.

Everything seemed calm enough. But for no apparent reason, five key machines had gone out of adjustment that morning, and were off the production line. This sort of thing had happened on several successive days, and as a result, the grinding room was holding up deliveries of engines for army and navy war planes. Yet most of the machines were filling the room with their usual sleepy, swishing noise, and the sweetish soda smell of grinding compound was over everything, and anyway, the two apprentices were more interested in each other than in the worries of the big shots.

Mickey Kennedy was making hard work of his filing, his shoulders humped over his vise, sweat beading his forehead.

"No, no, Mickey! See, you take hold of the file at both ends, then you can bend its blade a little upward like this —" Swede Olson demonstrated as he spoke, his big-boned, pinkish face showing eager earnestness.

"The dumb Swede does bend the file a little at that," Mickey said to himself, "and he'll feel hurt if I don't try it."

So Mickey bent his file at a slight upward arc, then pushed it across the steel. At once it bit in. And it came alive in his hands, sending a tingling message through his fingers, much as a baseball bat does on a hard-hit ball.

"Gee, Swede," he exclaimed, his brown Irish eyes alight with enthusiasm, "I never thought that filing could be fun, like playing pool, or something."

Swede's china-blue eyes rolled ceilingward. Didn't these dumb Irishers know that working with steel is more fun than playing games? A hundred generations of armorers, blacksmiths and tool makers had long since sung that song in his blood!

"Look at Bangor," said Mickey. "He must have lost a dime."

Swede looked. Bangor was going over the conked-out machines with a magnifying glass. "No," said Swede, "probably setting them up finer." He picked up his file, and its rhythmic *zziz! zziz!* became music to him.

But it was monotony to Mickey. Mickey had to talk. "Hey, Swede," he asked, "why did you take on this apprentice course, anyway? One day of headache in school, then one of backache in the shop, and repeat. Why not be a salesman, or something easy?"

Swede grinned and flushed a little in shy embarrassment. "I can't explain it, Mickey," he said. "But my dad is a tool maker, and when I was a little kid he used to tell me I would grow up to feel the life in steel. And when I touch good clean steel with my fingertips, I can feel its life. You know, Mick, the professor said yesterday that steel is atoms held together by tremendously strong forces. All I can say is, steel is alive. And I like to shape that life."

"Yeah? You sound like I feel when I'm teaching some kid to box." Then Mickey laughed. "Swede, you're just plain nuts! Steel is just a very hard substance, that's all. As for me, I took this four-year apprentice rap because it pays dough to keep me alive while I go through aviation school at night. The daily aches are a way out."

"Some day," Swede said solemnly, "I make the best airplane engines in the world and you fly them. The life my fingers feel in the steel, I build to its strongest so the engines can be light. And with your mind and—"

They were interrupted by the angry voice of Bangor. He had noticed the slowing down of the rhythm of filing, and strode over.

"What do you apprentices think this factory is," he snapped, "a ladies sewing circle?"

He noticed that Mickey's tool drawer was not flush with the bench apron, as it should have been, but was open a little. "Kennedy," he rasped, "a slightly open tool drawer is against safety rules. You might cut your legs on it."

Then, grasping the drawer by its



He dashed toward the multistage grinder. But faster was the dash of Mickey. With a beautiful sweeping tackle he crashed him to the floor.

safety handle, he rolled it out on its ball-bearing hangers. "And, Kennedy," he continued, "your wrenches are mixed and crossed in this drawer again. You know apprentices must keep their tools in order. I have spoken of this before. If you kept your clothes the way you do these tools, your shirt sleeves would be on your ankles and your shoes on your ears. What's the matter? Trying to get fired for carelessness?"

Mickey's face paled with quick temper, but he said nothing.

Bangor turned and walked to where Slobski was cleaning out the sump of a centerless grinder. Again there was a puddle, and again Slobski felt the boss' tongue. The hot language made the boys turn and look.

Mickey continued gazing down the grinding room even after the manager had finished his tirade and passed on. The panorama had an arresting quality, he admitted, whether you cared for it or not. Row upon row of gracefully designed machines. There by the windows the air-chucking internals, and over there the centerless, with tall, magnetic-chuck flat grinders and taller hydraulic honing machines looming up like mountains among foothills. Each machine immaculate as a hospital bed, but painted gray to absorb the light and avoid reflecting it into the eyes of the workmen. Each with its special electric lamps, their narrowly focused beams searching like surgeon lancets to the tiny work areas which alone needed brightness. And overhead the diffused light to kill all shadows and optical illusions. Thousands of horsepower driv-

ing billions of abrasive chisels at mile-a-minute speeds, bit by bit tearing the toughest tempered steel down to exquisite accuracy, yet making no more fuss than the ocean on a quiet day.

A kind of mechanical jail, Mickey decided. "Swede," he said aloud, "why can't those guys get those stalled machines going?"

"Mick, there's something funny about this. The works manager ought not to be spending his time here on stalled machines. That is the foreman's job. Something is driving the boss nuts."

Swede shrugged and left the room to wash his hands. Apprentices had to keep themselves neat, that being one of the rules.

Slobski walked over to the bench, his bow legs and springy knees showing that he had spent much of his life in the saddle. Going to the tool drawer assigned to him, he changed his gauntleted, oil-soaked safety gloves for a dry pair, throwing the oily ones into a safety can to be taken to the plant laundry. As he did he whispered: "Somebody iss mak fool of Mickey. Maybe there iss too many boys, and someone mak sure Mickey's wrenches iss out of order, so the one to be fired iss you an' not him, hah?" Then he started back for his barrow, leering over his shoulder.

Suspicion darted in Mickey's mind. Would the Swede do a thing like that? —he asked himself. He tried to fight the poisonous thought down. But it took root in his anger, and in his jealousy over the fact that although in high school he had been the leader, here in the factory Swede was forging ahead.

He tried to divert his mind, for he was ashamed.

He looked toward the machines. Bangor was busy again with the magnifying glass, and was dusting powder on the control handles and the safety covers of the idle machines. Even at the distance, Mickey could tell that he was cursing to himself in frustration. Then the manager straightened up, began walking slowly toward his office, a course which would lead him past Mickey. His face was a mask of furious concentration.

Mickey's Irish curiosity was aroused. Whom was Bangor fighting, how, and why? Apprentices were privileged to ask questions. He decided to chance one. "Mr. Bangor, may I speak with you a minute?"

Bangor evidently felt contrite about the overdone bawling out. "Yes, Kennedy?"

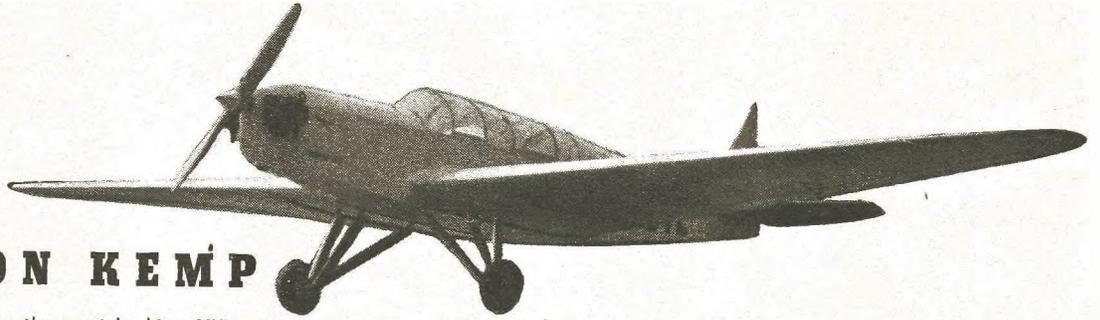
"Why were you using that powder on the machines? Do you test for accuracy that way, use it to put special scratch marks on the steel, the way the Swede does for extra-close filing, or something?"

Mickey was shocked at the intensity of the suspicion his question brought to the other's face. Bangor's eyes became opaque balls of blue ice, cataloguing every line of Mickey's face and every slightest movement of his body. Mickey knew that at that moment not even a clever crook could have lied to Bangor. Then, as abruptly as it had come, the look of suspicion left, and he became friendly again. "Don't you think there are enough standard (Turn to page 71)

THAT little country with the long name over in Europe is still in a solvent enough state to devote some time to the advancement of everyday flying with a very fine little light plane. We're speaking of Czechoslovakia and the plane is known as the Zlin XII.

The Zlin is a very conventional type of airplane, simply constructed and exceedingly simple to operate. A Czech engine of 45 h.p. is the power plant for this plane and is known as the Persy. Almost exactly like our own very

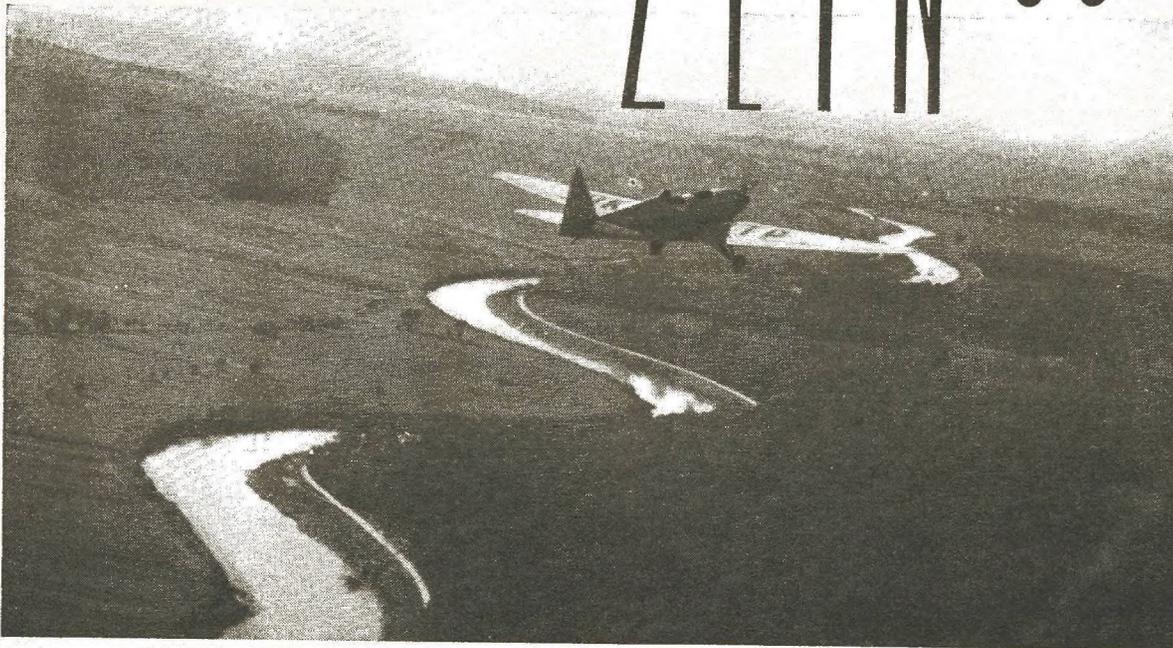
is not so high, making the pilot's head project slightly above it; small windshields are fitted to each cockpit. The cabin-type ship has a very spacious half-round transparent inclosure with a minimum of formers. This is in five portions, with the first one forward acting as the windshield, the third covering the space between the two cockpits, and the fifth curving slightly backward to blend this entire assembly into the tapering turtleback. Sandwiched between these three sections are the two movable



by BURTON KEMP

A 45 h.p. Persy engine drives the neat-looking XII at 95 m.p.h. Below—A stout ship for cross-country.

ZLIN XII



popular Continental A-40 series, it's a four-cylinder, horizontally opposed, air-cooled unit, and one that is very compact.

The full-cantilever low wing contains two wooden spars and is plywood-covered. This covering is also used on the fuselage, which has a square cross-section except for the rounded top to the rear of the cabin and the rounded corners at the nose. Seated in tandem in seats to accommodate seat-type parachutes, the two occupants are separated by a panel which forms a brace between the fuselage sides. This panel also houses the instruments for the rear cockpit, as dual controls are fitted to the ship.

Available as either an open or closed ship, the Zlin has found widest acceptance with the latter arrangement. In the open version the rounded top section of the fuselage

A product of Czechoslovakia is this trim and efficient light plane.

panels. These are hinged at the right side and offer quite a large opening for easy access and quick exit, should the latter ever be necessary.

A hinged V-strut which attaches to the bottom fuselage longeron is used with an upright oleo strut to form the tripod landing gear. The latter strut is secured at the top to the main wing spar and the spring-leaf tail skid at the rear completes the landing gear. Only one wire is used to brace the very clean tail surfaces.

At present the Zlin factory is turning out this plane in very large quantities. It is being used in many Czech training schools, as well as by private (Turn to page 93)

IN every vehicle ever designed for man's transportation there exists the possibility of mishap. Aviation's amazing record for safety was given in the article "Twenty Thousand to One" which appeared in this magazine a few months ago. Yet progress must be made, can be made while even the most minute improvement remains possible.

Aeronautical engineers work unceasingly to solve problems regarding development. Ingenious gadgets are devised to seek out and analyze the causes of failures. Frequently, the research to fool-proof one part of an airplane, motor or propeller will lead to a totally new technique in designing and fabricating other parts, remote from the immediate problems.

Hamilton Standard's development of a new vibration study technique—developed to overcome a propeller design problem—led to revolutionary improvements in design, not only in propellers, but also in engines and other parts.

Propeller-tip failure is a rare thing today, occurring only once in every 50,000,000 passenger miles of flight. Shank failure, or the breaking of a propeller blade near the hub, has never taken place in the more than 20,000 controllable-pitch propellers engineered by Hamilton Standard.

For years, engineers had endeavored to solve the riddle of propeller-tip breakage. For, until the precise excitation of propeller vibration could be found and corrected,

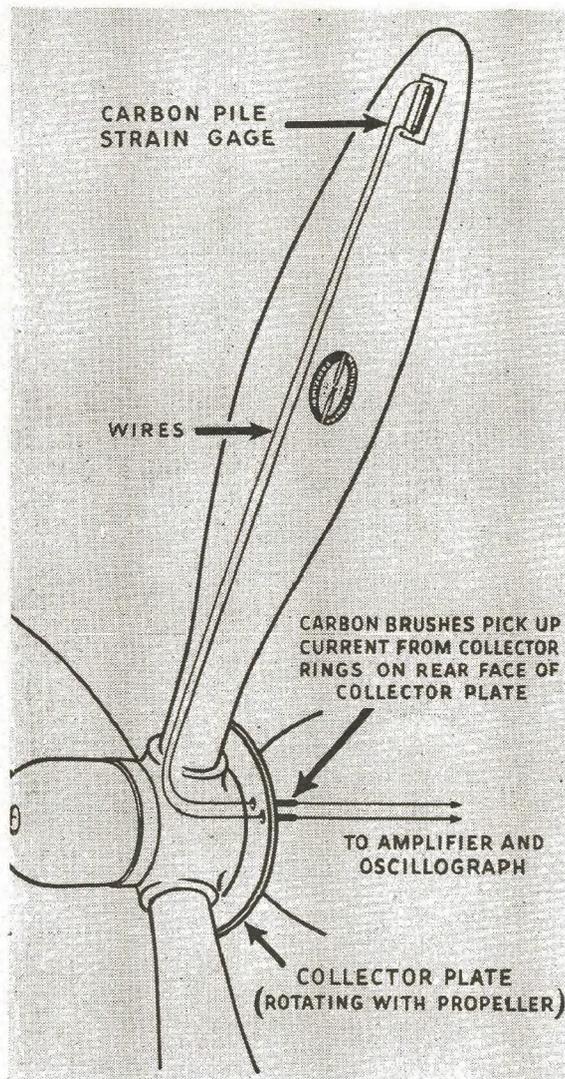
CONQUERING THE VIBRATION BUG

by **WILLIAM WINTER**

engineers had to design propellers considerably overweight. Thus, they were inefficiently overcoming by sheer brute force the problem that was baffling them. Actually, the point had been reached where bigger propellers would be impossible, their weight being impractical for motor operation. Those visionary Clipper ships to which we are now looking forward could not materialize unless adequate propellers were forthcoming.

Hamilton Standard engineers knew, of course, that the evident cause of tip failure was the fatigue (*Turn to page 74*)

How propeller vibration stresses are measured.



Equipment devised by Hamilton Standard engineers to record vibration stresses.

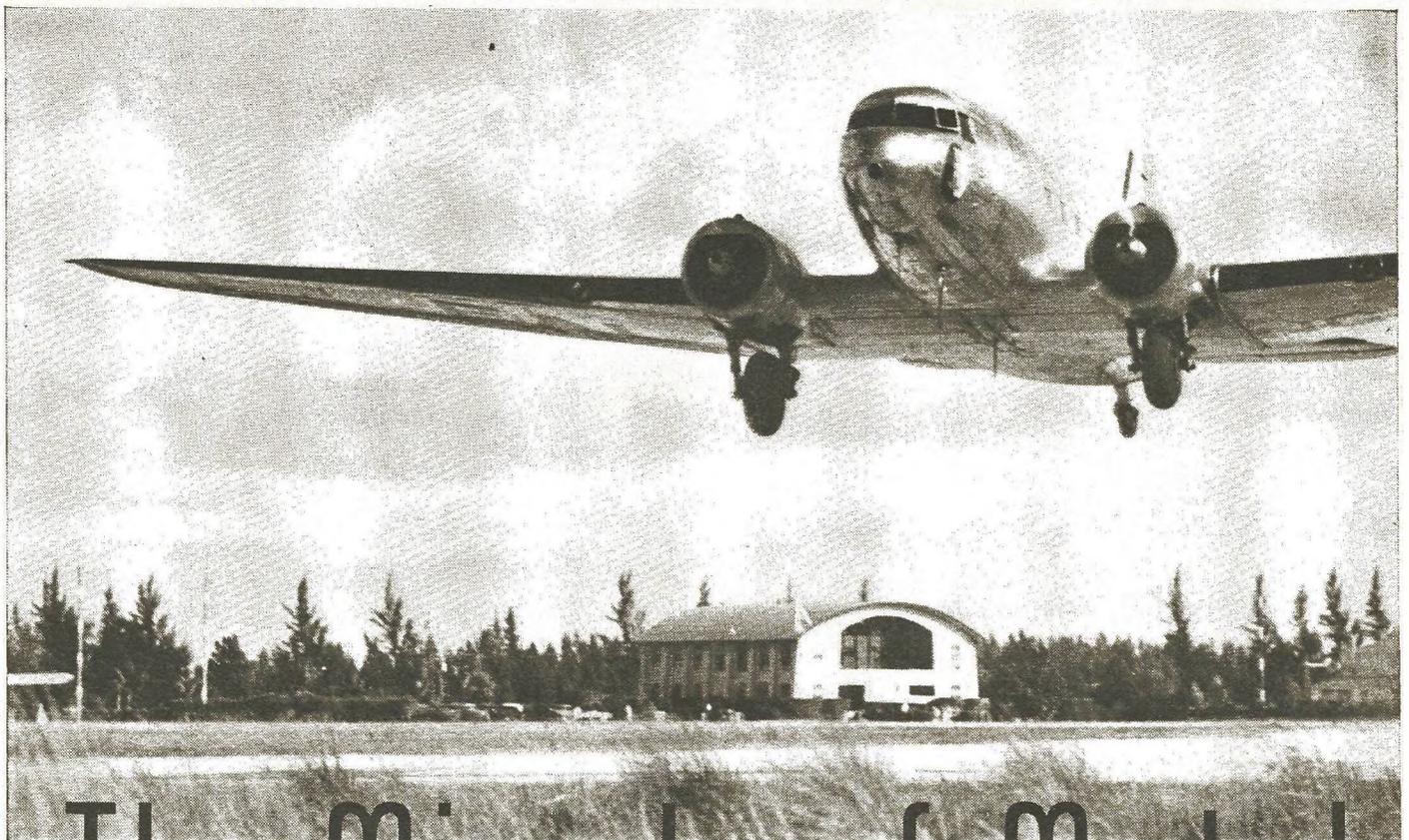


More than any other thing the use of metal in aircraft has revolution

Modern metal airplane construction has been a process of technical evolution. The use and application of metals in a scientific manner to airplane construction, while not necessarily new, has made phenomenal strides in recent years. Availability of materials, perfection of manufacturing methods, and ten years of technical research are responsible for the present-day airliner.

The test of time has made evident the desirability of all-metal ships for airline and military purposes. There is a consistent demand for all-metal airliners, fighting planes and civilian craft. No other factor has expedited

refining, coupled with the production at the mill of aluminum alloys, has resulted in a large demand for flat sheets, tubes, flats, shapes and extrusions of high physical properties. Furthermore, technical advancement in the methods of fabrication of thin sheets has expedited the production of metal structures so that it can be said the initial mass production programs are now under way. The use of metal has made possible the fabrication of thousands of parts all uniform in weight, size and strength, an accomplishment heretofore considered practically impossible.



The Miracle of Metal

the growth of the American aviation industry in the past three years as much as the widespread call for all-metal ships.

The fundamental requirement in the process of manufacture is the availability of the necessary raw material. Without this commodity, no production program can be undertaken. Next in the order of importance, aside from cost, which is a secondary factor, are the physical properties and the availability of the basic materials.

Consistent with the foregoing statements are the development and perfection of manufacturing processes which have made aluminum base alloys available to the industry in large quantities at a moderate cost combined with a satisfactory strength to weight ratio. The gradual perfection of the reduction and chemical processes and

Aluminum is the parent metal from which the structural and nonstructural alloys are derived. The weight is one third that of steel. The stiffness ratio is compatible with the requirements of airplane construction. For instance, for a beam of equal stiffness, the weight of a similar aluminum beam is sixty-one percent that of the steel beam. The strength is one hundred and thirty-two percent greater. For beams of equal weight, the stiffness of the aluminum beam is two hundred and sixty-six percent that of the steel beam, and its strength is two hundred and seventy-five percent. These are random examples to show why aluminum and its related alloys are suitable airplane construction materials.

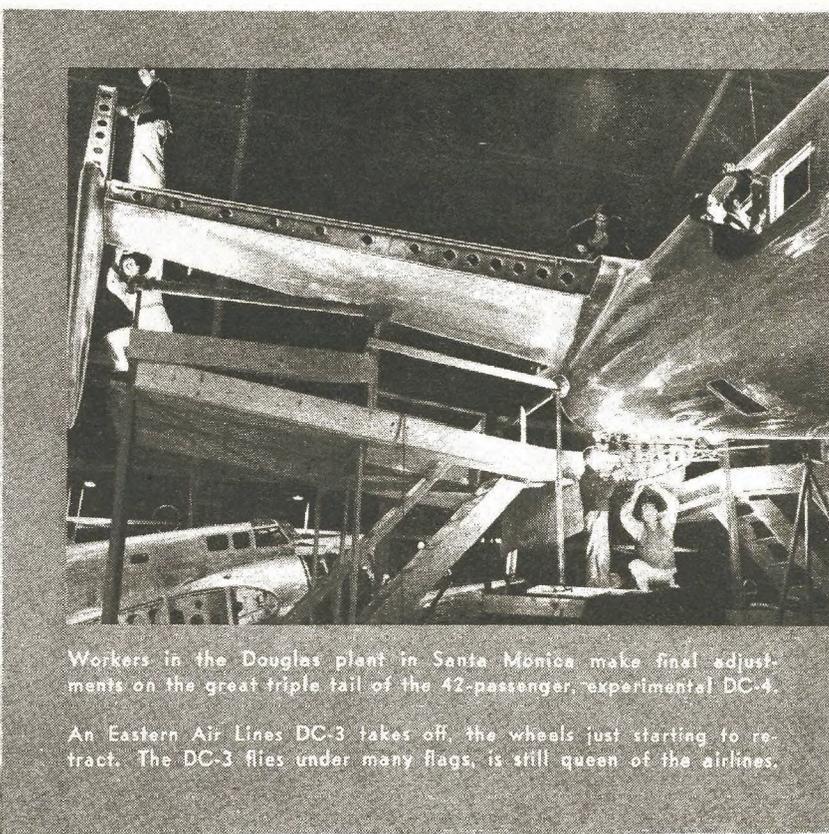
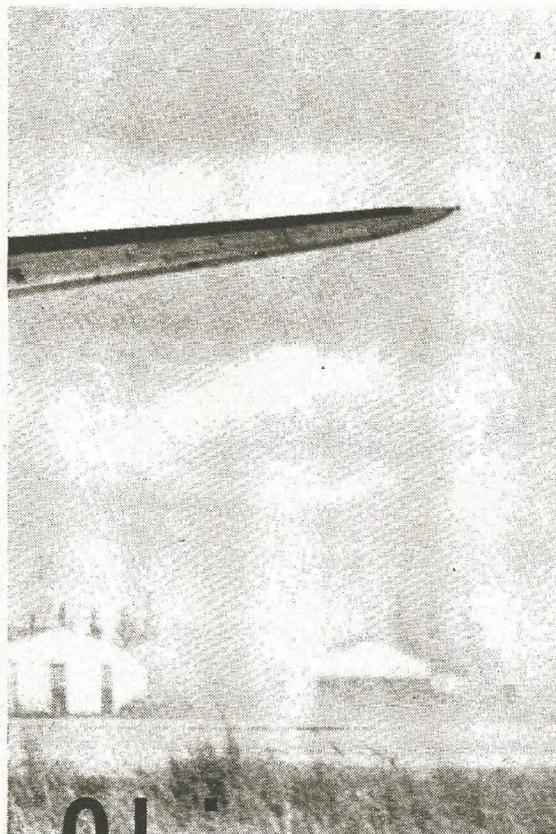
The strength alloys of aluminum are known as dural. Dural is an alloy of aluminum, copper, silicon, manganese

ized aviation. Technically minded readers will find this article vital.

and small quantities of magnesium. This material can be cast and forged. Dural alloys which are tempered bear the designation ST or SRT preceded by the numerical number which designates the alloy, such as 25-SRT. Aluminum is subject to the corrosive inroads of the elements and for that reason a coating of one hundred percent pure aluminum is impregnated over the core of the material. This surface coating protects the core, which, after all, is the strength element, from corrosion. Alloys designated 24STAL signify an Alclad coating. Alloys 25S are soft, while alloys designated

weight ratio of all materials which are employed in airplane structures. Steel tubing has been employed for years in trussed airplane structures. In metal aircraft the fittings and engine mounts are made from steel. As a material which is suitable for stressed-skin construction in its ordinary form, it is out of the question, and a newer material known as 18-8 stainless steel performs this function on a limited scale.

Stainless steel permits the realization of a high strength to weight ratio, it has a high degree of elasticity, it may be welded by the "shot" method, and it is resistant to



Workers in the Douglas plant in Santa Monica make final adjustments on the great triple tail of the 42-passenger, experimental DC-4.

An Eastern Air Lines DC-3 takes off, the wheels just starting to retract. The DC-3 flies under many flags, is still queen of the airlines.

Ships

by WILLIS L. NYE

25SRT are tempered, are wrought and heat-treated. The dural sheets are employed for stressed elements, while the softer alloys are used for nonstructural parts.

Magnesium is a metal which is limited in its application as a structural material. However, it holds the promise of extensive use in the future when better working technique is developed. At present the metal's use is confined to fittings, brackets, light castings and other nonstructural functions. In the United States this material is marketed under the trade name of Dow Metal. The weight of magnesium is approximately twenty-five percent less than aluminum, but its strength characteristics are lower, so low, in fact, that its use as a stressed plating is out of the question.

Steel as a material combines the highest strength to

the ravages of the elements, both salt water and air. Stainless steel weighs considerably more for its stiffness than dural, and therefore is somewhat restricted in its use unless it is well engineered as a stressed-skin structure. Notwithstanding the minor structural difficulties presented by the discrepancy in the weight relation, excellent airplane structures have been fabricated from this material and a decided trend toward this type of construction is now in progress.

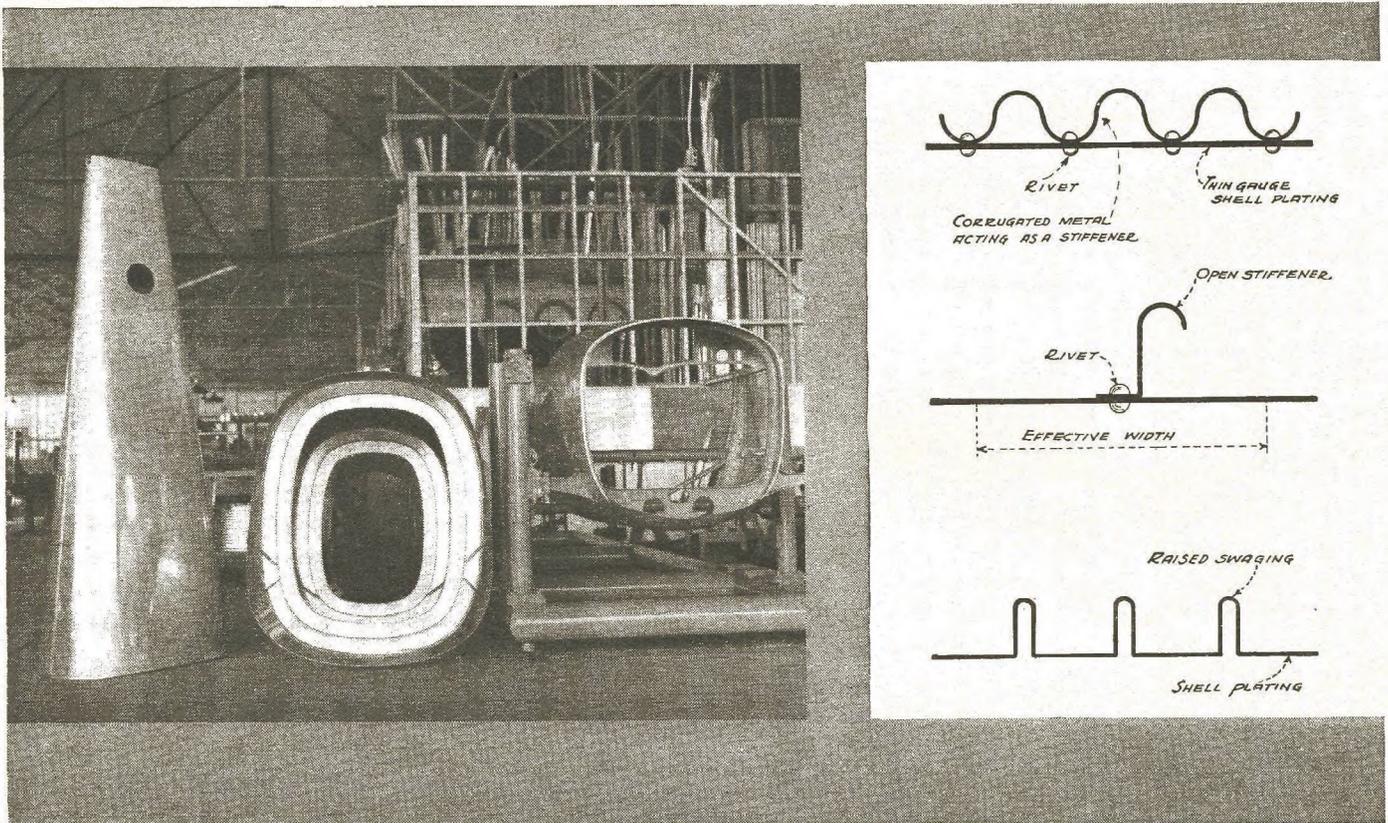
The advent of the all-metal airplane has engendered a close technical application of the available means to the production in quantity of stressed-skin equipment. A specific technique must be exercised in forming up the special shapes in sheets and column elements which are used in large numbers in the present type of equipment.

Since the available rolled or extruded commercial shapes in many instances are not quite adaptable to the problems on hand, built-up and formed sections are used, being either riveted, bolted and in some cases welded.

The procedure involved in forming long, flat strip material into special shapes is one of experience in the operation of the powder drop brake. The drop brake is one of the most important tools in production. The machine consists of a moving die set in a large, massive frame. The die moves in the up-and-down direction, and is actuated by electric power. The stationary die, or the matrix or female die, as it is often called, completes the forming operation as the flat strip is forced

grams has several of these machines in operation. This tool forms up large flat sheets to some specific contour or radii. It is also capable of forming large curved portions such as bulkheads or structural extrusions. The dies are made of lead or steel, as the case may be. The female die is cushioned with rubber, which is restrained by a steel form. The machine consists of a working table and a large weight which is raised into position on a framework and allowed to fall. The potential energy of the falling die executes the forming operation. The machines are economical to operate and permit a wide degree of versatility as to use.

Many uses for forgings and castings are to be found



into the female die by the action of the forming die. There are countless other tools used for manufacturing operations, and perhaps none is so adaptable to production as the large type of hydraulic press.

The hydraulic press can form up several parts at one operation. These parts may be multiple parts or one large part, depending upon the capacity of the press. Countless other tools such as shears, saws, draw benches, rollers, punchers, swaging machines, leaf brakes, nibblers and the usual array of bench and hand tools complete the equipment. The wings and fuselage are built in massive jigs, often two stories in height, and providing two working decks about the hull, or structure. In the forming of the dural alloy, special care is exercised that the material is not formed or bent beyond its point of elasticity and tend to rupture. In other words, the material for each gauge has a specific least minimum radius of bending.

The perfection of drop-hammer equipment has reached a point where every factory engaged in production pro-

duction work. Dural and aluminum are cast, then machined to size and heat-treated. Forgings are frequently used where strength and not weight is a governing factor. These fittings are heat-treated and aged to meet some specific strength requirement. Heat treating consists of a process whereby the manufactured parts are heated to a specific temperature in a hot-air electrically heated furnace and then allowed to cool, or else quenched in a salt bath. Aging is the process whereby the material is allowed to cool at room temperature for a specified time before it is used in some manufactured parts. Heat treatment serves to increase the strength of the material after it has been softened for working purposes, or else it anneals a hard alloy so it may be worked easily prior to heat treatment to restore its strength through aging.

The stiffness of the thin plate as a structural element is a comparatively new innovation in the science of mechanics. All-metal airplanes employ thin plates as a stressed covering which carries the entire structural

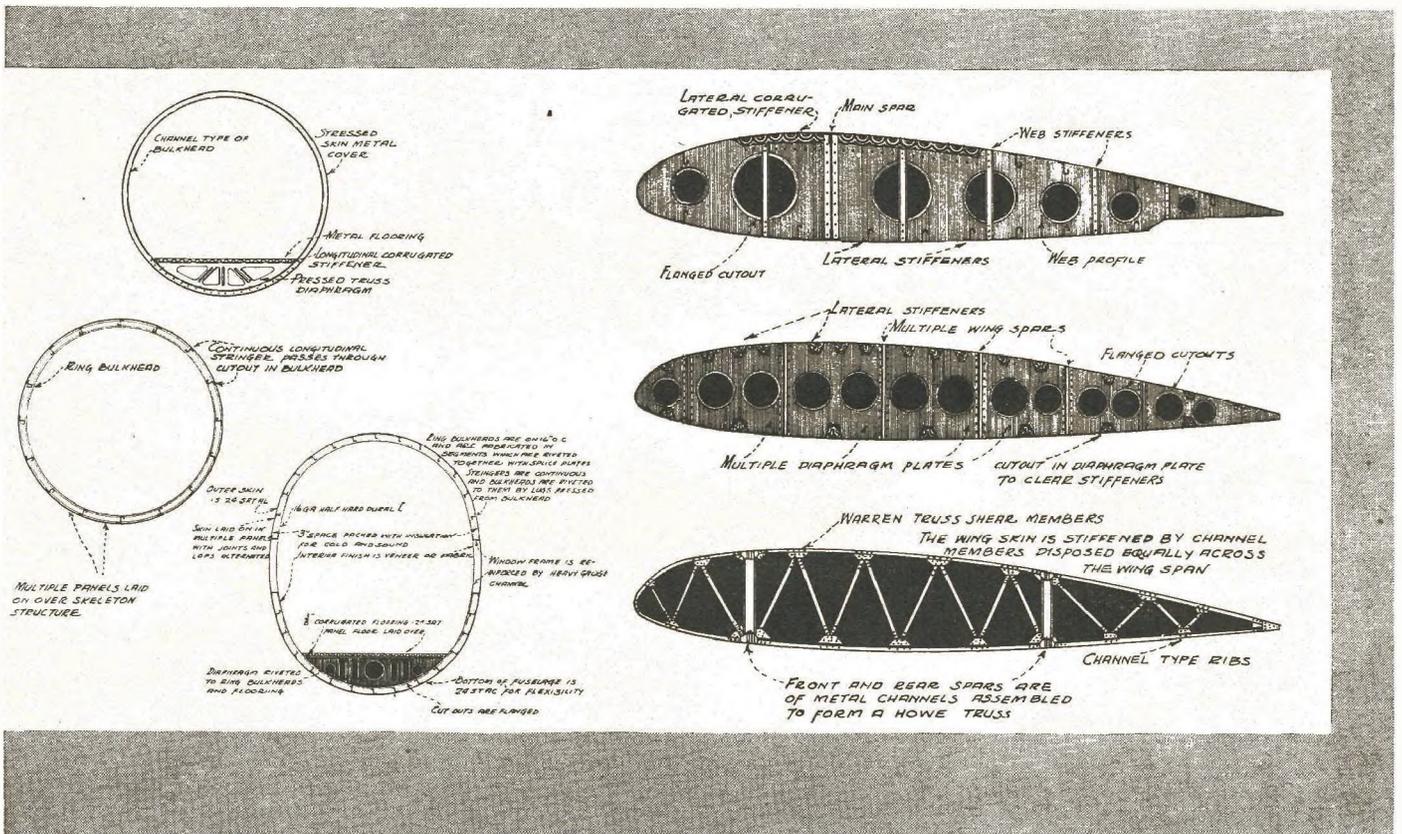
and aerodynamic loads. The weight is naturally of vital importance so that some form of reinforcing member must be used to sustain the loads that are imposed upon the shell plating, and to prevent local instability of the plate. Local instability is manifested by buckling and wrinkling of the thin skin. It is the function of the stiffener to prevent this. See Figure 1 for typical methods of stiffening the skin.

While performing the duty as a covering, the shell plating must sustain the design loads without instability in any axis. Since the plating must be of light gauge in order to conform to the weight limitations, it is logical to assume that the internal system of stiffeners or

structural element unless the skin were of such heavy gauge as to resist all forces without local instability. The weight, in this case, would be nearly prohibitive, and so the semimonocoque fuselage is the type in use at the present time.

Shell structures are referred to as stressed-skin construction, which means that each square inch of the skin carries a certain specific percent of the entire load imposed upon the structure. Duralumin aircraft can be designed for a maximum load of approximately twelve thousand pounds per square inch before local instability or secondary failure of the stiffeners is evident.

Therefore it is conceivable that the stiffness ratio of



Far left—How Ryan builds their metal fuselages. Their method features a heavy skin that carries most of the load. Left in the photo is shown the tail section of the S-C, center, the fuselage center section and, right, the cabin section still in its jig. The drawings show, left, the three basic methods of stiffening a thin-

gauge shell plating; center, reading from top to bottom, Northrop, Vultee, and Douglas fuselage construction practice; above, also top to bottom, is shown the Lockheed, Northrop, and Boeing methods of wing construction. At present, these are the three distinct types of wing fabrication adhered to in this country.

skeleton structure must be disposed so that it carries the longitudinal loads and the transverse loads in an efficient manner. Stiffeners act similar to column elements. They are riveted to the skin and tend to sustain a definite area of the thin plate from local instability on each side of the element. These secondary members may be channel, angle or any other shape consistent with good structural design.

A shell structure which has secondary stiffening is known as a semimonocoque fuselage. The resistance to bending is executed by the skin, which is strengthened by the longitudinal stringers and transverse bulkheads. Pure monocoque structures are as yet impossible as a

the individual sheet element is a function of the gauge and the stiffener combination. Both these elements are restricted in their weight. There is a certain ratio of gauge and stiffener size beyond which it is uneconomical to go. The structural analysis of such types of structures is difficult to determine by the few empirical methods in use today. Consequently the substantiation of the mathematical analysis is made through a system of static tests. The buckling and the wrinkling of the flat-plate elements are a function of the unsupported distances which exist between each stiffener combination.

All metal structures are held together by rivets. The welding of dural for the stressed-skin (Turn to page 82)

Have you been disappointed in your aviation photographs? This article will help you improve your flight and field shots of aviation subjects.

BY MORGAN MUNROE

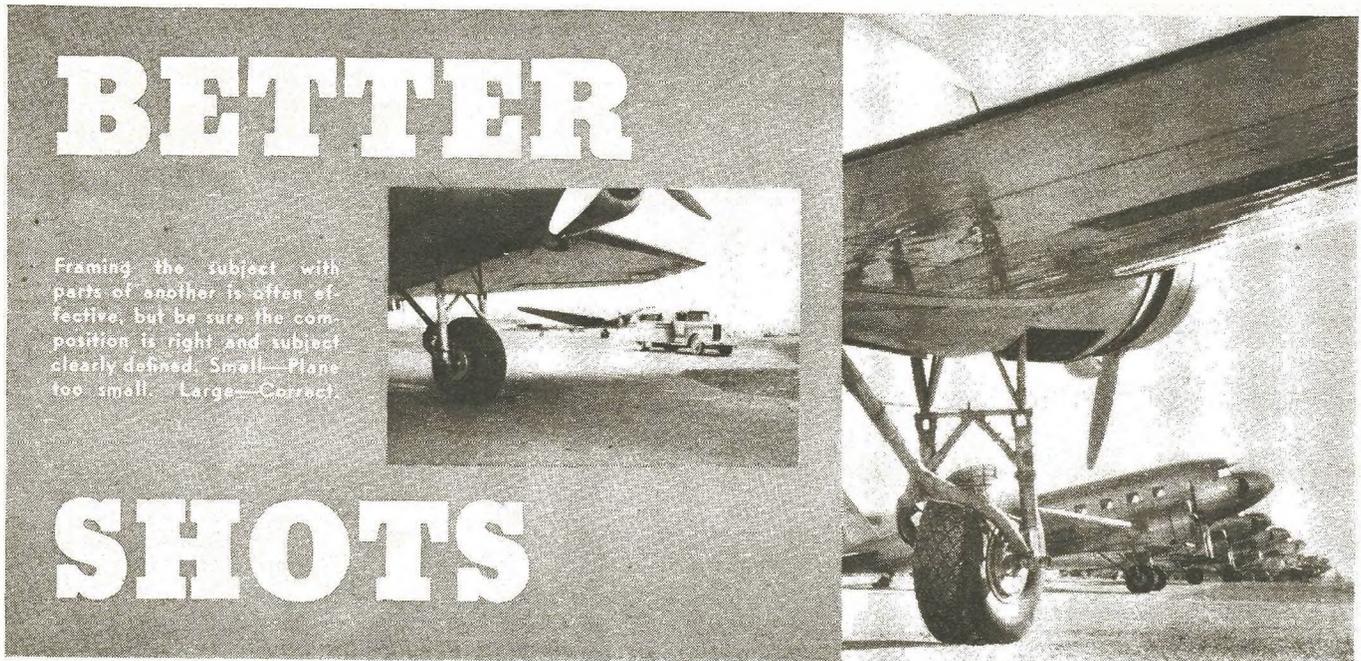
Do you often lug your camera to the airport to snap a new ship on the line, take it on a hop to get some "aerials," or out in the back yard to preserve a photographic record of your latest model for posterity, only to be disappointed and disgusted when you look at the results of your effort?

Okay, buckle your safety belts, stick with me a few minutes and I think we will come out of this photographic spin right side up—with better pictures.

But before we take off let's have a good look at aviation picture making as a hobby. Most of us have some kind of camera. It may be a dollar box or a three-hundred-dollar precision miniature—they both give good re-

tells me he would like to use more of the pictures you send him, but many of them cannot be reproduced in *Air Trails* because they weren't correctly made. Flying instructors have a phrase descriptive of what some of you do. When a student has progressed to landings he often brings the ship in perfectly, judges his glide to the foot—then spoils it all with a rotten landing. Instructors call it "running out of knowledge." The same thing happens to those bad shots of yours. You have good intentions, try hard, but "run out of knowledge" just before tripping your camera shutter!

Like everything else, there's a right and wrong way to photograph ships on the ground. If you happen to be on the spot when some speed ace drops into your local field in his newest low-wing racer, what do you do? Bang away with your camera as soon as the ship rolls to a stop



with amateur cameras

sults when properly used, which is all we're interested in. Now ask yourself these questions:

Am I using my camera, regardless of what type it is, to the limit of its possibilities? Do I get the best aviation shots I am capable of making? Am I preserving, in photographic form, the amazing history of flying being made all around me every day? Do my pictures tell the story of modern aviation, as I see it, in an individual manner?

If your answer to any of those is no, you're missing a lot of fun and profit. (We will get to the profit angle a little later on.)

All set? Gas on? Switch off? . . . *Contact!*

The first thing an aviation snaphooter should know is how to properly photograph standing planes. The Editor

and discover the plane's tiny image half hidden by a gas truck and two mechanics in the finished print?

Try it this way next time: Wait until the gas truck and mechanics are out of the way. Take a position near the ship from which you can get either a full side view (the best spot if you want to use the photo as a guide for model building later) or a three-quarter shot. Three-quarter, photographically speaking, means about twenty-five degrees to right or left of the plane's nose.

When you are in position, study the ship in your camera finder to determine what's behind it. No ship looks well against a background of signboards and telephone poles. Pick a spot where there is nothing behind the plane but sky and clear field.

If you can't get close to the ship hold your camera



Above—This shows the blurred effect resulting from resting the camera or the hands upon the window sill of the plane in flight. Photo shows lack of clouds due to nonuse of sky filter or correct film. Right—Correctly taken.

near the ground and shoot up at it and you will minimize the dwarfed appearance caused by your distance from it. This cannot be done successfully if you are near the plane, as that causes severe distortion of the image.

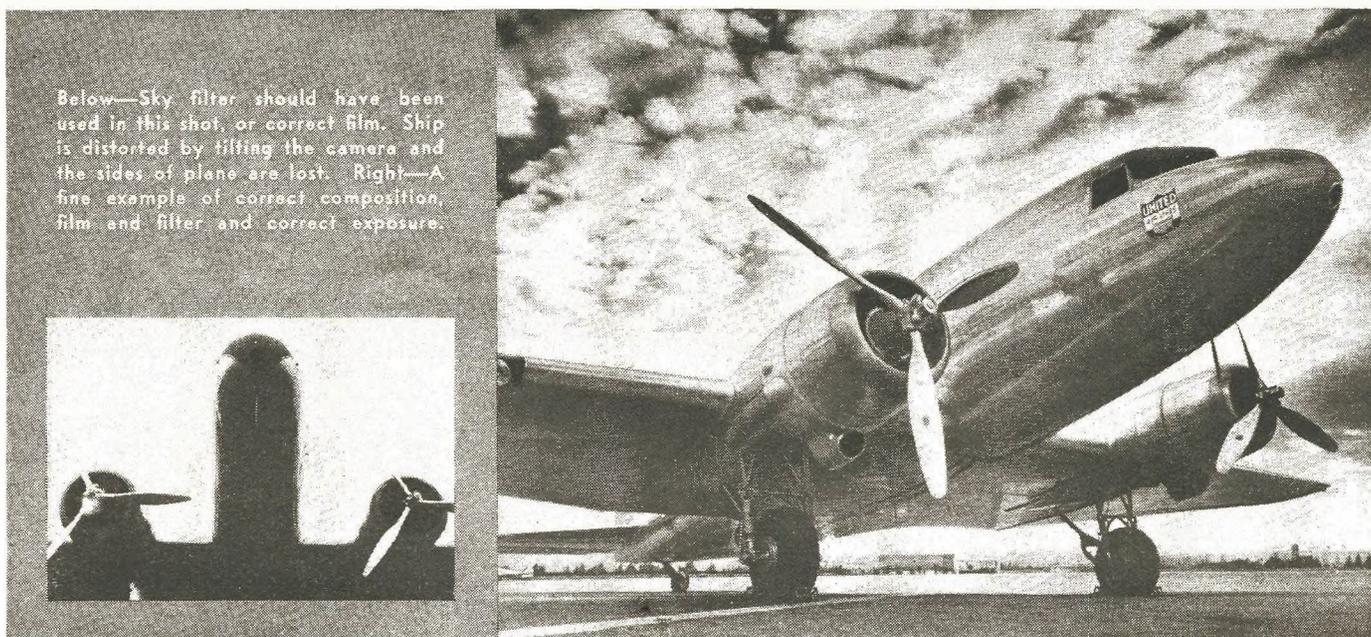
If the pilot happens to be in the cockpit when you snap your shutter, so much the better. A human figure in the right place adds interest to any picture. If he is famous you can kill two birds by getting a celebrity and his ship on the same negative.

Don't attempt shots of standing planes from the rear, unless you wish to record some particular feature of fuselage or tail assembly at close range. A ship doesn't look very impressive when its entire length is photographed from behind. Of course, if you like tricky shots of mechanics perched on engine nacelles or transports being loaded, that's different. A camera position behind the wing is often ideal for such shots, especially if the ship is outlined against cloud formations.

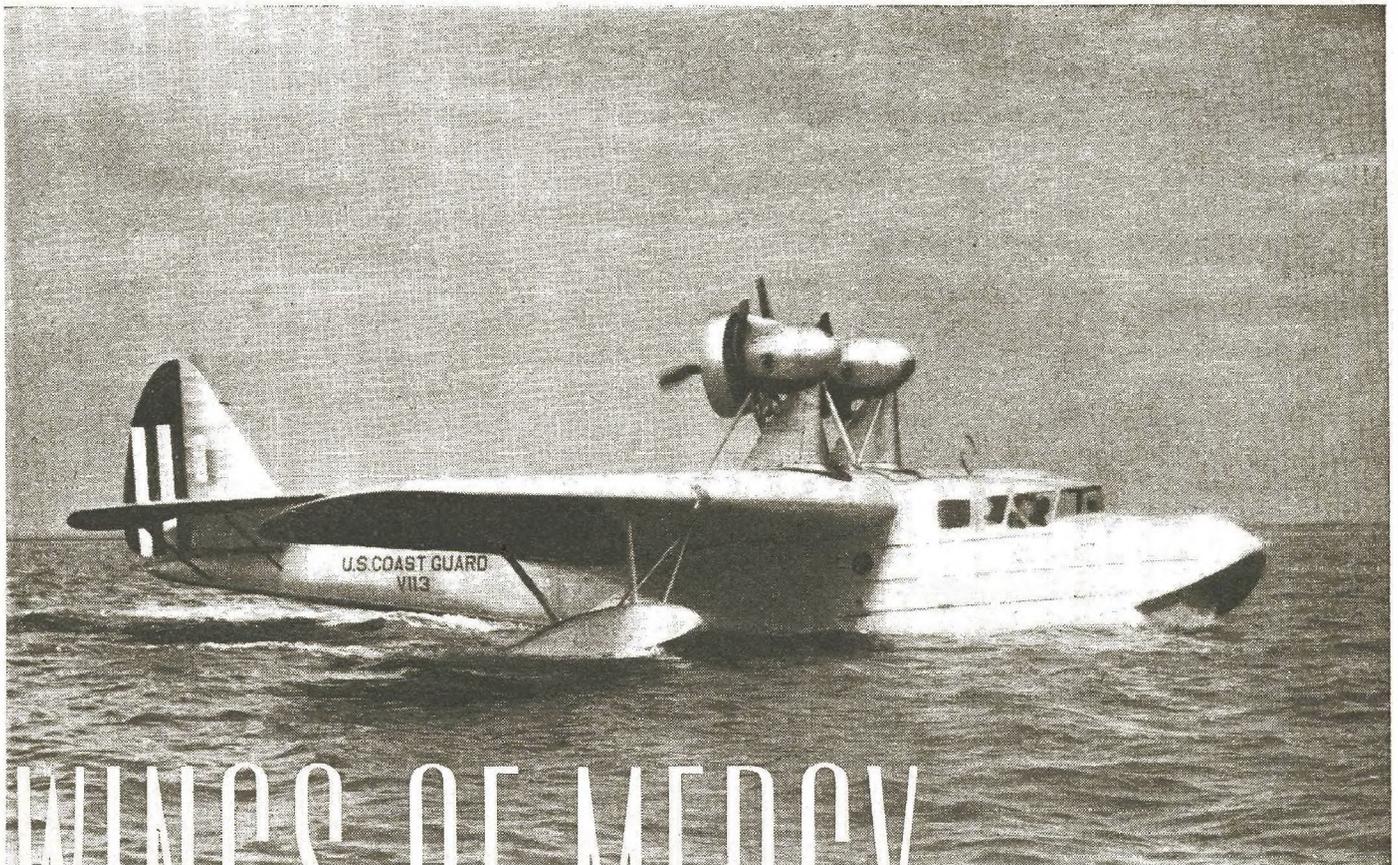
Speaking of clouds, have you often wondered why those beauties which appeared in your finder when you tripped the shutter evaporated right off the film before it was developed, leaving only bare, white sky? Often it's because they were never on the film!

There's many a slip between finder and film when shooting clouds. There are two common types of amateur film—at least we'll consider only two just now. The one seen most often on photo counters is orthochromatic, sold under such names as Verichrome, Orthochrome and Plenachrome. These "chrome" films will not record cloud formations unless a color filter is placed over the camera lens.

The second type of film, known as panchromatic, is marketed as Agfa Superpan, Eastman Super-Sensitive Pan, Finopan, Panatomic and many others. To reproduce clouds in your negatives without using filters use one of the "pan" type films. They are (*Turn to page 75*)



Below—Sky filter should have been used in this shot, or correct film. Ship is distorted by tilting the camera and the sides of plane are lost. Right—A fine example of correct composition, film and filter and correct exposure.



WINGS OF MERCY

Fair weather or foul the coast guard patrol stands ready for emergency, no motto being more justly earned than "Semper Paratus."

"Certainly, come out right away. Glad to have you with us any time."

With these cordial words of welcome still ringing in our ears, we approached the new coast guard air base located at Brooklyn's Floyd Bennett Field. As we stepped into the truck thoughtfully sent over to the airport's administration building, we had a chance to get our first view of the impressive air station about a mile away, hugging the Jamaica Bay side of the flying field. Drawing nearer to the scene, we could see the neat-looking concrete apron fronting the hangar, leading to a wide and sturdy ramp which dipped into the water nearby, for seaplane and flying-boat use.

The newspapers and magazines had been full of stories about this magnificent, new, and modern air station just recently officially opened by the United States coast guard. So it was not by mere chance that we found ourselves here, but an urge to get behind the scenes and see just how such a huge and up-to-date unit worked. The major air station in point of size and number of planes, it is now the most important station on the East coast, if not in the United States. Its strategic location

The stanch Fokker coast guard plane remains popular after long and faithful service. This ship is larger and heavier than the similar-looking but more generally known Douglas Dolphin amphibian, which accounts for its being a favorite. The two pusher engines are Pratt & Whitney 420 h.p. Wasps.

in our country's largest metropolis insures its participating in plenty of activity in the multitudinous duties that make up coast guard aviation.

This new unit has been constructed so that it will play a primary part in the large-scale peace-time works of the service.

The immense hangar houses eight aircraft of varied type, and has full living accommodations for an enlisted personnel of about fifty men and five officers. Two stories of spacious rooms in addition contain complete machine and repair shops, dining and recreation rooms, and a weather bureau and radio communications room. A pharmacy and an arsenal are also included.

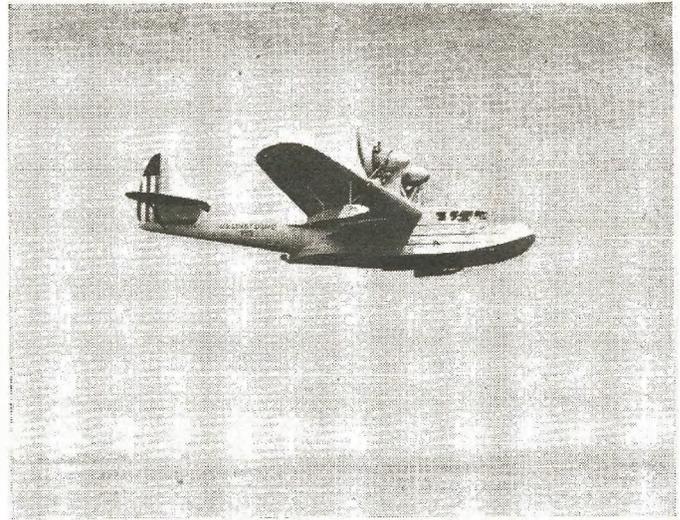
But we were to see more for ourselves. As we walked through the hangar the P. A. system woke into life to summon the crew of a Hall PH-2 to duty. Within a few moments the men had assembled and begun the job of pushing the big "flying fish" out of the hangar to prepare it for flight. Mechanics swarmed over the plane's glistening exterior, pulling off engine covers and checking the craft over thoroughly before the twin eight-hundred-and-twenty-five-horsepower motors coughed into action for the preparatory warm-up. A sturdy tractor crawled up and made a line fast to the plane as it was towed down the ramp toward the water's edge.

Before we entered the plane by means of a narrow ladder, a pleasant, brisk-looking individual walked over and introduced himself. It was the voice we had heard on the phone—that of Commander Donohue, who is in charge of the base. He turned us over to Lieutenants Miller and Harris, who were to pilot the plane. As we watched from inside the plane, the tractor scooted around to the back, fastened a heavy line to a ring in the tail section, and held fast while the craft slid easily into the water, like some gigantic duck. Then, as one man cut the fastening line, others in rubber hip boots waded out and released the beaching-gear apparatus, leaving the plane floating free. Despite its size and unstreamlined appearance, the craft lost its awkwardness, changing from some land-bound creature to a graceful denizen of the air which had come down to rest before going aloft again.

The crew of six and its two watchful passengers settle themselves as the ship breaks water and takes to the air. The lower Manhattan skyline unreefs past our starboard side as the pilot banks and points the nose toward Montauk Point and areas south and east. This is to be a routine patrol flight of perhaps four or five hours' duration.

Outbound transatlantic vessels flash by below as the radioman pounds out his first message to the home base: "V164 in the air." All coast guard aircraft report their position every fifteen minutes while in flight, so that it is a comparatively easy matter to locate a cruising plane at all times. In bad weather, or when out of sight of land, the plane's powerful radio transmitter can send out a continuous "M. O." signal on which shore range stations can take bearings and ascertain the plane's position in the air in a few moments. Nothing is ever left to chance.

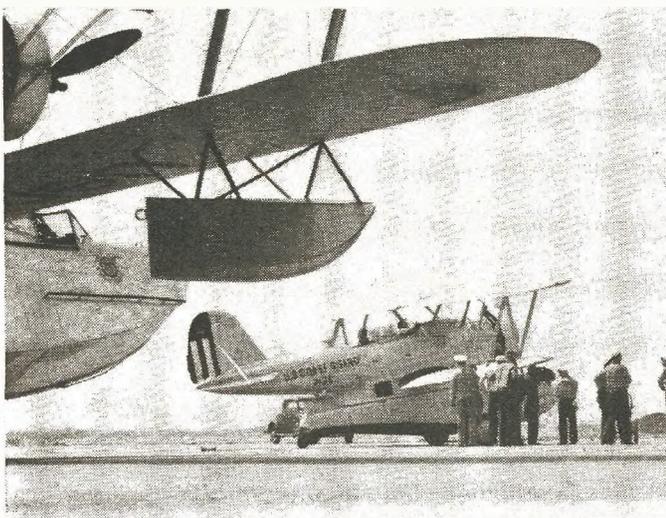
We set a course, and every once in awhile the plane swoops down low as the pilot takes a look at some plodding vessel on the remote possibility that it may be a suspicious "rummy." Not much luck—the coast guard boys have pretty well stamped out this branch of law-breaking in the last few years. Most *(Turn to page 94)*



Winging gracefully seaward, the bi-motored coast guard Fokker FLB heads outward on an emergency call. This sturdy plane is but one of six of the various types stationed at Floyd Bennett Field.



Taking off an injured seaman from a freighter at sea is ticklish business. Extreme care must be taken in landing on the rough water and in transferring the patient from steamer to airplane.



Seen from beneath the lower wing of the giant Hall-Aluminum is a Grumman JF-2 four-place amphibian. This smaller type of plane is similar to the Navy JFs, and is intended for patrolling only.



Action! The culmination of a real rescue made recently near Floyd Bennett Field, in this case a plane crash in Jamaica Bay. Greater care is taken with the patient when circumstances require.

light plane flying clubs

Have you soloed yet?

If not, why not?

For months now we have been showing you how you can learn to fly. We have encouraged the operators of the best flying schools to advertise in our pages and we have shown you how to organize a flying club and make it tick. If you haven't soloed by now, you're not trying. Whether you have or not is your lookout, and you ought to do something about it. *We're going to.*

We of Air Trails are making a new stand to prove that America wants wings. Not only that, we're going to *provide* wings for America's solo fliers!

Many of you have done a lot of talking about going solo. Many of you have written in to tell us you have gone solo. Many of you have promised us you would go solo soon. Now we're going to check up on you. We're tired of being checked up by you.

Have you gone solo yet?

Yes, we know the answers. It's tough sledding in a lot of cases. Flying training is not bought with peanuts. It takes a certain amount of money, and the money has to be put on the line. It takes a certain amount of nerve and physical stamina; but when you've done it, it's really worth it, isn't it?

That's what we think, and we're going to do something about it all. We're starting a new club and *only those who have soloed can become members.* It's called the Solo Club.

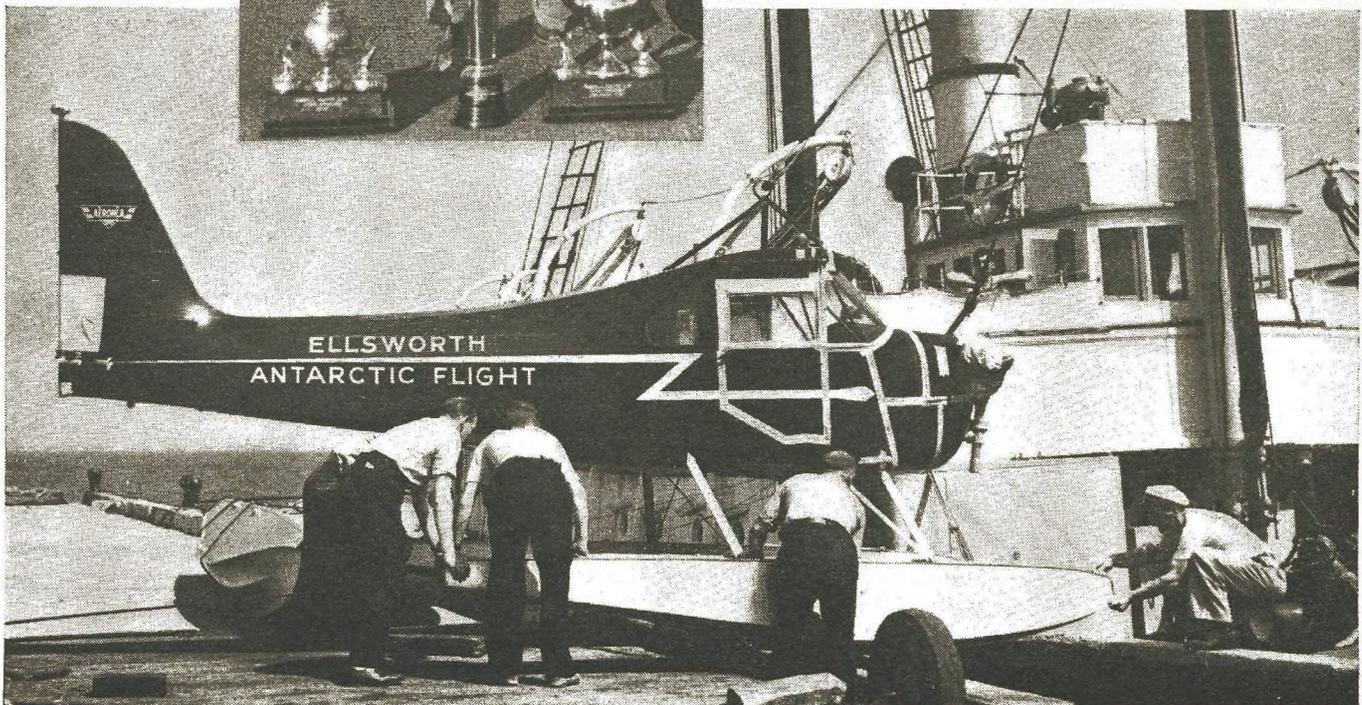
We of Air Trails have long been pondering the problem of getting people to fly. As we said before, we have done everything possible to induce you to try your wings. We have given you the details of flying clubs. We have explained costs and values. We have devoted plenty of valuable space to news and information on light plane flying clubs.

From now on, it's up to you.

Three first prizes in one light-plane meet is the feat of Mr. C. C. Brayton, of Oakland, Calif., who flew a new Aeronca "Chief."



A little bit goes a long way! Little Aeronca seaplane boards Ellsworth expedition ship, South Pole bound.



Rudy Arnold

In which Air Trails introduces an entirely new and needed means of recognizing those who have experienced the thrill of soloing.

conducted by
arch whitehouse

If you want to join the Solo Club and wear the only set of "wings" we know of outside the services that indicates that you have "alone mounted beyond the realms of earthbound mortals," you must prove you have flown alone. If you have really soloed and can show actual proof that you have flown by yourself in a power plane or glider, we'll send you a Solo Club pin, and you can wear it and tell it to the world.

The Solo Club pin? It's a beaut! Sterling silver, about half an inch wing-span. Something dignified and suitable for any lapel. It consists of a small numeral 1 from which gracefully spread your wings. The figure represents your first solo flight, and the wings are the world-wide insignia of flight or aviation. You might even interpret it as being "one with wings," as Editor Colby has so aptly put it.

So you won't solo, eh? Well, you'd better if you want to get in on the most exclusive club in the world.

In addition to the Solo Club pin, we are going to give all members a permanent life membership identification card bearing the design of the pin, a space for an identification photo, a line for the owner's signature, and a line or two explaining that the holder is a soloed pilot of aircraft.

The sterling silver lapel pin indicating your standing

in aviation and the identification card will cost you but fifty cents. This fee is to cover all expenses including the necessary clerical work the operating of such a club involves. Further details will be found in another part of the magazine. A regular solo list will be published from time to time.

One thing more. These wings are just as I have described. They carry no advertising for Air Trails.

What's it all about? Why are we of Air Trails doing this?

There are several reasons. First and foremost, we want to know how many readers of this magazine are actually flying men. We want to know how well we have succeeded in inducing our readers to take up active aviation.

Secondly, we're sincere in this effort of ours to get people to fly. We believe in the science and the industry and probably somewhere back in our minds we consider it a worthy arm of national defense. Some day we may need men who are pilots, or at least men who are air-minded and have what we term "air feel." It's just as well to have a few thousand amateur pilots around at any time.

So join up with us in this drive for active aviation. Tell your friends out at the airport what *(Turn to page 96)*

A new product of the genius of C. G. Taylor. The new de luxe Taylorcraft light plane. This model features many new refinements and improvements which place this famous light plane in the foreground as one of America's most typical contributions to sport aviation.





Wide World

Part of the great German program of national defense is glider training. Pupils of Rhinow Glider School get ready a utility glider.

GOVERNMENT SUBSIDY

In a speech recently made by the chairman of the Civil Aeronautics Authority, Edward J. Noble, he mentions the fact that, if this country wants more pilots, the government will have to do something about it other than sending a select group of men to the military flying schools for training, as the amount of pilots these schools graduate each year does not fill the growing demand for flying personnel. He points out that several European countries start the training of their pilots from childhood, beginning with the building of model airplanes, advancing to glider flying, and from there to power ships. As this department is primarily concerned with gliding, we will quote Mr. Noble's words on this subject:

"In Europe, aviation is begun in the kindergarten with the making of paper models. Germany and Italy spend hundreds of thousands of dollars training young people. France has appropriated millions of francs for educational purposes, and in England last year twenty-five thousand pounds were set aside for glider instruction. We have barely three hundred soaring pilots in this country. Germany has fifteen thousand."

We have been advocating for a long time the necessity of government subsidy for gliding and soaring. But up until recently the glider pilot was regarded by the flying fraternity as some sort of a trapeze artist, and very few took him seriously. In Europe, on the contrary, a

glider pilot is regarded as excellent material for a potential power-plane pilot. In many instances gliding experience is compulsory before entering certain branches of aviation. Handlers of German dirigibles, for example, must all be soaring pilots.

We are offering here a plan for subsidizing the American gliding movement which uses as its basis organizations already in existence, thus eliminating the creation of new ones. This plan is similar, to a certain extent, to the government subsidy plan used in England, and modified to suit our conditions. It calls for creation of a glider department in the C. A. A. and appointment of one person, a gliding and soaring pilot with executive ability, in charge of it. This man will pass on and recommend gliding organizations desiring subsidies. He will work with the Soaring Society of America, through whose hands all applications for government financial assistance will pass.

The organizations to benefit from governmental subsidies will be: 1. The Soaring Society of America, which will receive funds for the purchase of at least two sailplanes to conduct soaring expeditions for location of suitable soaring and training sites and demonstration flights. These appropriations will also cover any other expenditures connected with the promotion of the gliding and soaring movement.

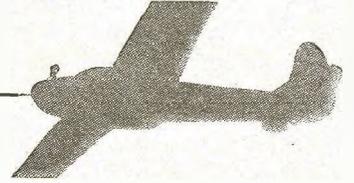
2. All established glider clubs and those about to be

formed whose program is approved by the S. S. A. These will receive funds for the purchase of gliders, equipment necessary to operate same, and for the erection of hangars and lease of land. Such clubs must operate according to Federal aeronautical laws., i. e., all flying equipment must carry Federal licenses. Instructors are to hold commercial glider pilot licenses, and at least a private power-plane pilot's certificate. All fly-

Such manuals have already been written, but have evidently been lost in the general shuffle of the reorganization of the aeronautical branch in Washington. Let's hope that these will soon be available.

We would be glad to get some comments and suggestions from our readers on the question of government subsidy for gliding, so that we may present it in future issues of this department.

—Conducted—by—Alexis—Dawydoff—



ing equipment is to be under the supervision of a licensed aircraft mechanic. All ships are to be insured. To be eligible for subsidies, each and every club must be incorporated.

3. All manufacturers and designers of gliders and sailplanes whose ships have been entered in a design competition, similar to the Warren Eaton Memorial design competition, and won a place therein. Judges to be member of the N. A. C. A., S. S. A., and the C. A. A. All ships to have their final stress analysis and application for A. T. C. finished within six months after the competition. Funds are to be available in case designers lack them.

Finally, the publication of manuals dealing entirely with construction of gliders and their operation are to be available in the same manner as the C. A. A. bulletins.

CLUB NEWS

The Southern California Soaring Association held a meet recently at Arvin, the site discovered by Hawley Bowlus. Those participating were Jay Buxton with his Transporter; Harvey Stephens with his Ross-Stephens sailplane; John Robinson and his Robin, in which earlier this year he attained an altitude of ten thousand feet; Volmer Jensen and his Silver Bird, and the Studio Glider Club, with their Briegleb BG-5. During the contest, Robinson twice exceeded five thousand feet of altitude. The best duration was three hours.

Gil Waters of the Soaring Society of North California made two flights, fifty-nine and seventy-minutes duration, during which a two-way radio communication was successfully maintained with the ground.

The newly organized Tri-State Soaring Society is operating at the Tri-State Airport, Endicott, N. Y., with the long-wing Franklin purchased from Warren Merboth. The society has twenty members.

Since completing their glider in July, members of the Red River Glider Club of Gainesville, Ga., have made over four hundred flights in it. In the same town, two men are building a Baby Albatross, and Charles Dobkins is constructing a sailplane of his own design.

Vernon Ross, brother of Harland Ross, made his "C" license over level ground. He climbed to an altitude of twenty-five hundred feet and stayed up for twenty-six minutes. He is the first man in America to obtain his "C" without previous slope-soaring experience.

The N. A. A. appointed Bob Blaine of Oak Park, Ill., as official glider observer, following the recommendation of the Soaring Society of America.

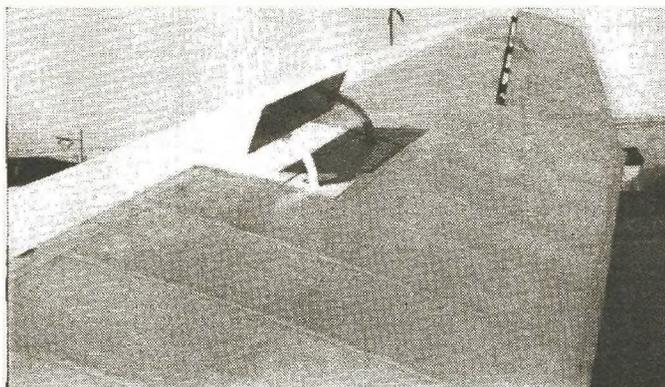
The Airhoppers Gliding and Soaring Club of New York is busy flying the Franklin at the Hicksville, L. I., field. New and bigger club headquarters were recently obtained, and the Pruefling is being recovered.

Peter Riedel, who is attached to the German embassy at Washington, D. C., took Edward J. Noble, head of the Civil Aeronautical Authority, for a flight in his two-place Kranich sailplane.

The Manhattan High School of Aviation Trades Glider Club is busy building its glider, expecting to have it ready and flying by early spring. (Turn to page 96)



A glider's-eye view of the photographer. A unique photo by Don Stevens of Kurt Sizzoms taking a photo of Eaton's Falcon.



Darn clever, these Italians. An interesting type of interceptor used on the Italian sailplane "Asiago G.P.2," in the up position.

New developments in national aviation activity

"AIR YOUTH OF AMERICA" FORMED

WINTHROP ROCKEFELLER, son of John D. Rockefeller, Jr., has announced the formation of a committee to be known as "Air Youth of America."

The committee is undertaking an extensive survey to determine what is now being done in the field of youth aeronautic education and to study the development of a program initiated by the late Frank Hawks. This survey will further the studies made by the writer following investigations of youth aviation programs in Germany, Italy, France, and Great Britain. These studies indicate that Europe has forged far ahead of our own country in such educational work in recent years. The survey will be coordinated by N. A. A.

Winthrop Rockefeller's keen interest in the field of junior aviation work was stimulated by his association with Captain Hawks, whose outstanding record in avia-

tion was matched by his deep interest in American youth.

During the past few years, model-plane building and competitions have become popular to the extent that over one million young men and women hold membership in model-airplane clubs. Most of these are established in large cities throughout the country and sponsored by vocational schools, park departments, recreation boards, newspapers and hobby shops.

Government studies of preparedness bring to light the relatively small number of reserve pilots. At present the government is seeking to remedy this deficiency through the C. C. C., the N. Y. A., and other governmental youth agencies.

The survey is designed to indicate to what extent it may be possible to further coordinate and standardize this widely scattered activity.

Committee membership is as follows: Winthrop

OFFICIAL SENIOR N.A.A. NEWS

Prepared by William R. Enyart, Sec. NAA.

A potent weapon in the scheme of national air defense are these hard-hitting Boeing YB-17s army "Flying Fortresses."



C. B. Allen, new consultant to the C. A. A.



Richard C. Gazley, Chief Planning Division, C.A.A.



Major A. B. McMullen, Chief of Airport Section.



Roger Kahn, N. A. A. Governor, New York.



G. Maxford Kessler

as viewed by the National Aeronautic Association.

Rockefeller, chairman; Major Edwin E. Aldrin, vice president of N. A. A.; Jacqueline Cochran, famous speed flier and recent winner of the Bendix cross-country trophy; William R. Enyart, secretary of the N. A. A.; Major Lester D. Gardner, Institute of Aeronautical Sciences; Grover Loening, pioneer aeronautical engineer. Ernest Gamache, former executive director of the Olympic Winter Games at Lake Placid, N. Y., is acting as director of research.

"The unprecedented amount of leisure time because of economic conditions creates a major problem for youth," said Mr. Rockefeller. "These young people between the ages of twelve and twenty-one are seeking constructive outlets for their tremendous, enthusiastic energy. The response that has been seen in many of our larger cities where model-plane building and junior aviation programs have been undertaken indicates the need for coordinating, standardizing, and endeavoring to im-

Startling to many who have assumed that private flying has been advancing in recent years along with scheduled air transport, it actually has been going backward.

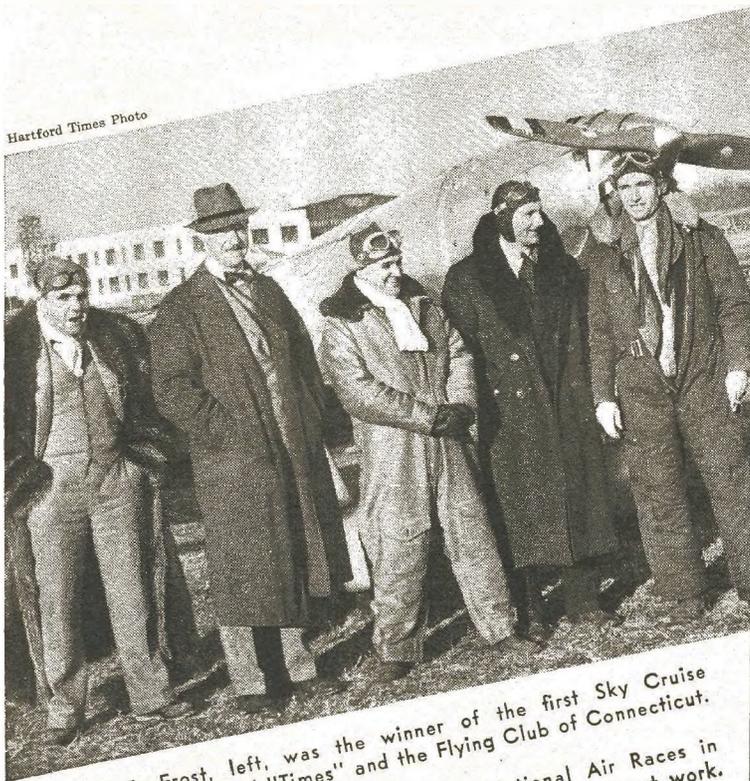
Many observers hold that unless our government wishes to depart from its traditional policy of a relatively small regular military establishment quickly expandible in time of emergency through civilian components, it must give immediate attention to the private and nonscheduled flier.

The alternative leads toward a huge un-American military air establishment, abhorrent to every peace-loving citizen, and maintained at heavy cost to every taxpayer.

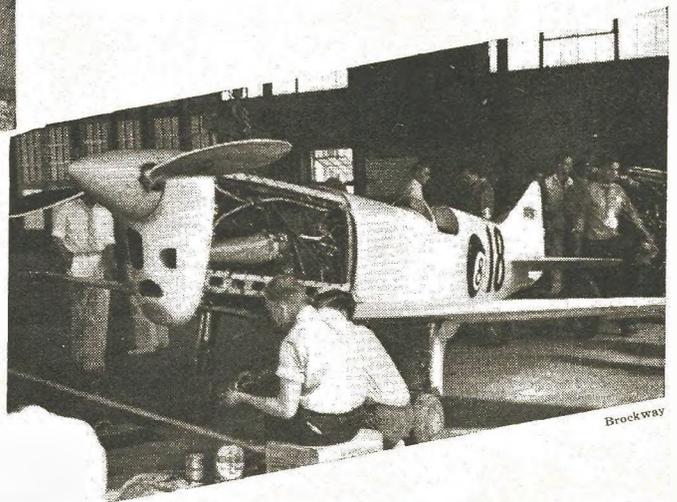
For the handwriting is on the wall and woe be it to us if we fail to heed it. Where we have been thinking smugly in terms of thousands of airplanes, the world's predatory nations have been thinking in tens of thousands. Let us realize that if we are to find a practical

American answer to the huge air fleets now under way abroad, private flying assumes a place of even greater importance as a civil aviation component to our national defense than scheduled air transport.

Submerged in the wide publicity that has attended the more than twofold expansion of scheduled air transport in the past eight years is the increasingly grave and significant fact that during this period private and nonscheduled flying have actually gone backward! In 1930, private owners and nonscheduled operators flew a total of one hundred and eight million two hundred sixty-nine thousand seven hundred and sixty miles and carried two million two hundred ninety-eight thousand three hundred and forty-one passengers, whereas in 1937 but one hundred two million nine hundred ninety-



Herrick E. Frost, left, was the winner of the first Sky Cruise sponsored by Hartford "Times" and the Flying Club of Connecticut. An informal photo taken just before the National Air Races in Cleveland catches the mechanics of the "8 Ball" racer at work.



Brockway

prove the already established work and assisting in the encouragement of similar programs in new areas."

Mr. Rockefeller pointed out that though such channels as air-youth programs may help to stimulate, we shall not only find increased interest in private and commercial flying, but a direct approach to youth's participation in a preparedness program. It is expected that the report will be completed by the end of the year.

PRIVATE FLYING AND NATIONAL DEFENSE

Growing concern within government circles and with the public regarding our national defense facilities has put the spotlight on the neglected child of private flying.

six thousand three hundred and fifty-five miles were flown and the one million five hundred thousand passengers carried. Compare this with the thirty-six million nine hundred forty-five thousand two hundred and three miles flown and the four hundred seventeen thousand five hundred and five passengers carried by scheduled air-transport companies in 1930 and the more than twofold increase by 1937 of seventy-six million nine hundred ninety-six thousand one hundred and sixty- (Turn to page 78)



Air Adventurer Charles Miller, Jr., of Gloucester, Mass.

Greetings, Air Adventurers!

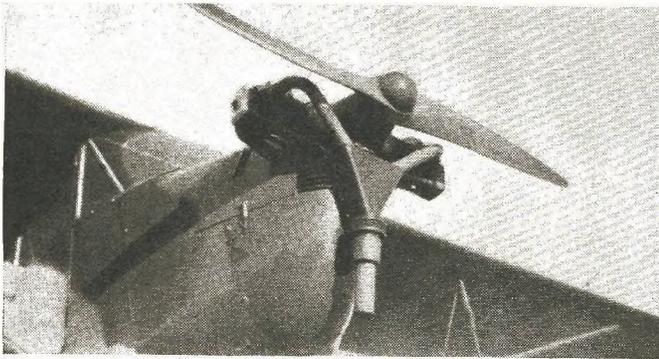
Well, we're starting off a new year with this issue, and this is as good a time as any to begin making plans for the future. It is not enough that we simply sit back, read over the magazine, and glance at the pictures. There's work ahead for willing hands, and plenty of it.

Perhaps you've noticed on another page the announcement of the Solo Club, and perhaps many of you have already set your course for a Solo Club rating. I know that many of our Air Adventurers have already ventured alone into the realm of the blue, for they have written in and told me so. Now we of Air Trails have given them the opportunity to get special recognition of the flight.

We want more Air Adventurers to go to work this year and make 1939 a banner year for flying. We have the material in this organization to feed a dozen Solo Clubs, and there is very little excuse for attempting to dodge the responsibility.



NOW IS THE TIME



This interesting shot of the nose of an Aeronca K shows the trunking of the exhaust pipes from the Aeronca engine to the triangular outlet. Picture was taken by Ture Hognell, New York.



Another photograph of the Northrop A-17A attack ship taken by Richard Myers, Allentown, Pa. Myers has an affinity for Northrops, judging from the many photos of them he sends in to us.

So far we have encouraged you to study airplane mechanics, topography, engine mechanics, photography and general observation work. Many of you already have the basic groundwork to become solo pilots. The rest is up to you, and you must remember that you are still Air Adventurers and owe a certain pledge to further the advance of aviation.

1939—solo this time!

We have given you a complete list of flying clubs, and there should be one within a reasonable distance of you. It costs money, we know, but so does every other hobby or profession, and you can't start any earlier. You can save a few dollars now and then this winter so that you can get your medical and student permit by the time the snow is off the ground, if you happen to live in parts where Jack Frost does his stuff. Once you have surmounted that financial obstacle, all you have to do is to keep salting away the pennies and the dual-instruction time will soon be taken care of. Really, there is not a great deal to it as far as effort is concerned, and if you honestly want to go solo, there's no reason in the world why you can't.

1939—solo this time!

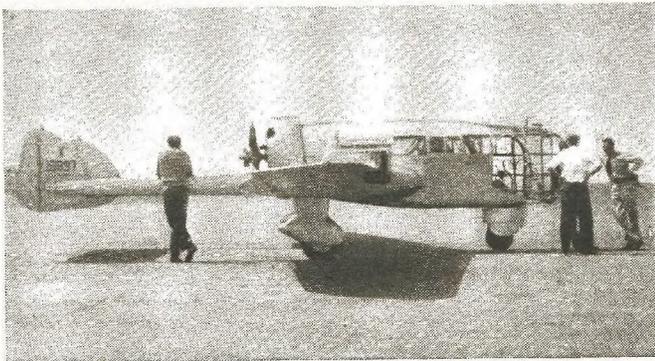
Of course there are other means by which you can step up and demand your winged numeral. You can take up gliding, and why not? We have told you all about it. Our experts who actually glide and soar themselves have shown you in words and pictures how simple and beautiful it is. If you are really interested in this

flying art, we suggest also that you contact the Soaring Society of America, 1500 Locust Street, Philadelphia, Pa., and get further information. There's plenty of work to be done for gliding, and the men who are trying to make it an integral part of aviation, and not simply a hobby, will welcome all the help we can give them.

Indeed, there is plenty of work ahead for 1939.

Another matter which we hope has not been forgotten is that of the Air Defense League, which we brought up some months ago. Every Air Adventurer in the United States should support this worthy organization to the limit.

The Air Defense League, which was established in 1930, is now in the thick of an extensive program to increase its membership and to educate the public on the needs of the United States for a more adequate air defense. This is not a plea for jingoism or the beat of a war crowd, designed to sell expensive military planes to the government. There is a definite need for sane and



Featured on our September cover was the novel Abrams Explorer, designed especially for photographic work. This particular photo was submitted by Bill Markland, who hails from McKeesport, Pa.

unbiased education on present-day requirements, regardless of politics.

1939—now is the time!

You all want to do something about this aviation business besides making models, answering questions and wearing badges. Let 1939 be the year they'll all remember. Let's see how many Air Adventurers will go solo in 1939. Let's see hundreds of Air Adventurers winning their wings either in power planes or in the snug cockpits of gliders; and let's get behind the Air Defense League and show the world that the United States can't be pushed around by bluff and bluster. You can contact the Air Defense League at Suite 310, the Bellevue Stratford Hotel in Philadelphia.

That's all for this month—but it's plenty. Go to it, Air Adventurers!

Your Flight Commander,

ALBERT J. CARLSON.

AIR ADVENTURERS NEWS

And now for the regular business at hand. Let's dig deep in the mailbag and see what the gang has been doing during the past month.

Miss Ruth Boynton, of Wilmington, Mass, has sent in a picture of her swell model of the Flying Fortress, which photo was used in an exhibition at the Wilmington post office. She is a keen member and reads our magazine from cover to cover, and makes several interesting suggestions.

Robert Hinkley of Gloucester, Mass., has a suggestion to make. He likes charts, and wants to see charts printed showing details of schools (which we have done), noted trans-oceanic flights, and carefully compiled data of that kind.

A Photographer's award goes to Donald W. Wiggins of Climax, Saskatchewan, Canada, for his shot of two swell model planes. One is a Fokker triplane and the other a modern Heinkel He.51. He uses a Univex Model A camera and Univex Ultrachrome film.

Another photographer to join the ranks is Michael C. Markovich of Scalp Level, Pa. He sends us a shot of the Boeing 247D taken at the Allegheny Airport with an Eastman Premoette Jr., using film pack and an f.4.5 lens.

Andre Beauregard of Prince George, British Columbia, has come through with a grand letter on commercial flying up his way, and he includes a neat snap of a



Canada flies more than six times as much freight as does the United States. This Fleet freight ship has a large loading hatch in floor. Picture snapped by George Howiston, Hamilton, Ont.

Norseman taking off from Prince George. Andre knows all about the schedules, routes and the equipment used up that way, and knows how to tell about it, too. Thanks, Andre.

A new airplane mechanic on our books is I. W. Keen of Dunn, N. C., who sends us a picture of a model Flea built last August and photographed with a Brownie camera using Agfa film. *(Turn to page 84)*



Actual size of your Air Adventurers pin.

(MEMBERSHIP COUPON)

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

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

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

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

Address.....

Check here if interested in model building.

(This coupon may not be used after February 15, 1939.)

WHAT'S YOUR QUESTION?

Question: Are flying licenses in Germany issued by Lufthansa or the government bureau of aeronautics? H. W. P., Flushing, N. Y.

Answer: Lufthansa is a transport company and does not issue licenses. They are issued by the German air ministry.

Question: Is it possible for a boy fifteen and a half years of age to learn to fly a plane, or is there an age limit? If one did not have enough finances to get a plane or even an interest in one, would you advise attempting to build one at home? If so, what type? R. V., East Orange, N. J.

Answer: The minimum age limit for learning to fly is sixteen years, and then you have to have the consent of your parents to do so. I would not recommend building a plane of your own at home, as it is far more difficult than it appears.

Question: I am interested in taking an airplane mechanic's course, but don't think that I will be able to go to college. Are there any schools for this that do not require a college education? Is it possible to exchange work for tuition in any of these schools? If not, what is the cost of a complete course? Where are these schools located? B. G., Madisonville, Ky.

Answer: You do not need a college education to enter any of the schools for mechanics, but I don't know of any which will exchange work for tuition. In the September issue of Air Trails there appeared a list of schools with detailed information as to courses and tuition fees. I suggest that you get this issue and contact the schools. It might be that you will find one which will be willing to exchange work for instructions.

Question: I am interested in aviation, particularly in its designing and engineering branches. I have had four years of high school and am anxious to enter a college or technical school to specialize in this field. W. H., Seaside Park, N. J.

Answer: I would recommend either the Guggenheim School of Aeronautics at New York University, University Heights, N. Y. C., or Lawrence Tech at Hoboken, N. J.

Question: Could you tell me where it would be possible to obtain three-view drawings of the latest edition of the Seversky P-35? If these plans have been printed in your magazine, could you give the date of issue and the price? J. M., Davenport, Ia.

Answer: We published three-view drawings of a Seversky in the April, 1938, issue of Air Trails. Send fifteen cents to our circulation department for it.

Question: I would appreciate information as to how I may obtain the names and drawings of all the Bill Barnes planes from the original one to the present. C. V., Chicago, Ill.

Answer: The only drawings available of the Bill Barnes planes are those that were published in issues of Air Trails as follows: the Silver Lancer, November, 1937; the Snorter, December, 1937; the Eaglet, January, 1938; and the Transport, March, 1938. If you write to our Mr. Clifford of the circulation department and inclose fifteen cents for each of the magazines he will be glad to send them to you.

Question: What are the top cruising and landing speeds of a Hawk 75 and a Consolidated PB-2A? How many cylinders and what h.p. has the Curtiss Con-

queror? What is the largest airplane in the world and to what country does it belong? Which is the fastest, a two or three-bladed propeller? J. H. C., Alexandria, La.

Answer: The Hawk 75 has a top speed of 273 m.p.h., cruising of 234, and lands at 68 m.p.h. I haven't any information regarding the Consolidated PB-2A, as it is on the army confidential list. I think its top speed is slightly over 200 m.p.h. The Curtiss Conqueror is a V-12 liquid-cooled engine developing 630 h.p. The largest airplane in the world is our Boeing 314 flying boat. It has a wingspread of 152 feet. There is no difference in speed between the two or three-bladed prop; the difference is in the power of thrust.

Question: Could you give me any information about the old Barling bomber? Recently I have seen tabs on an airplane's elevator. What are they used for? W. B., Regina, Can.

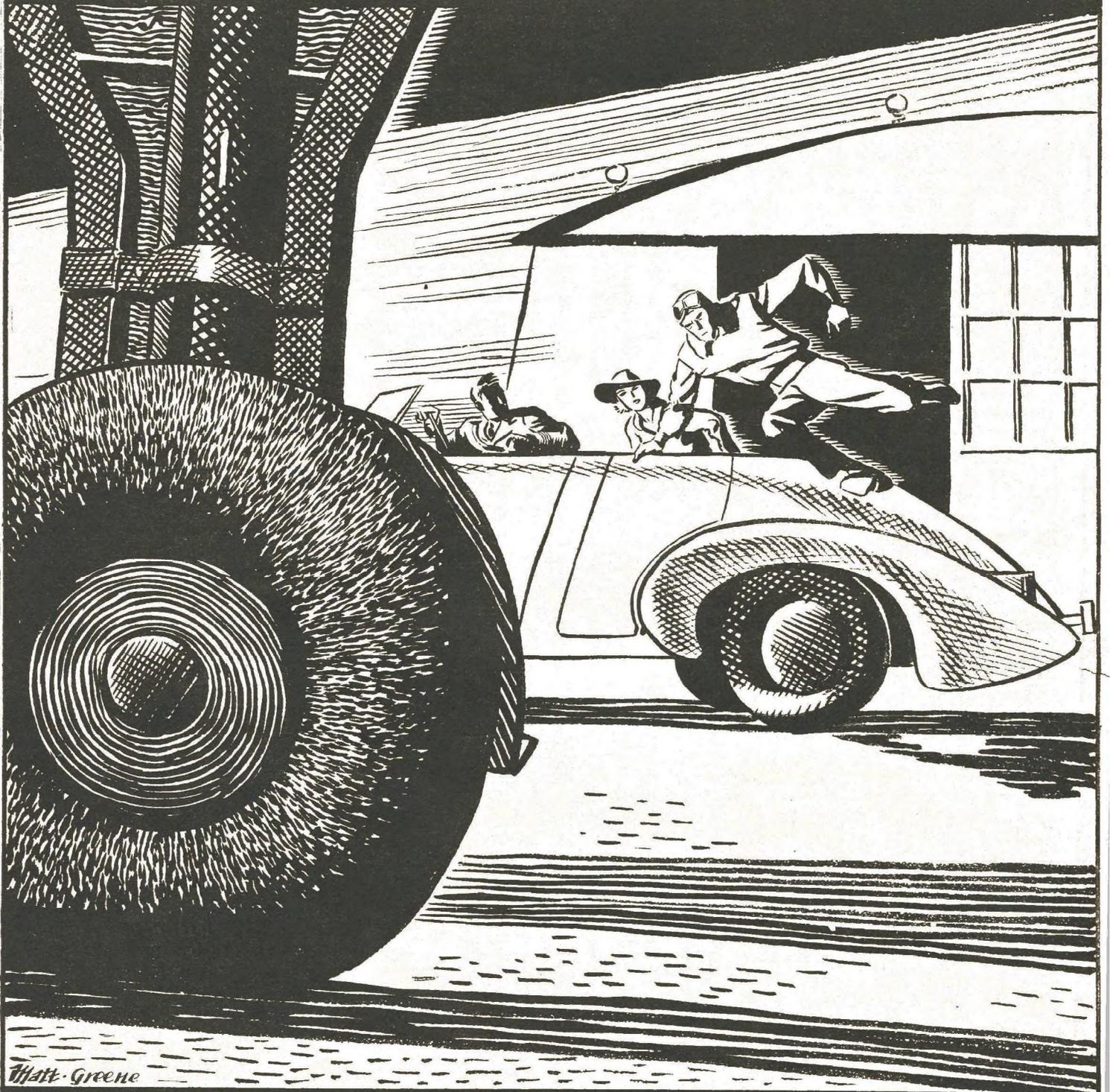
Answer: I have very little information on the Barling bomber beyond that it had six Liberty engines, four tractors and two pushers. The tabs on an elevator are used instead of an adjustable stabilizer for the purpose of trimming the plane in flight.

Question: Whom can I write to to get some information about the Payne Knight Snuffy? D. M. S., Grand Forks, N. D.

Answer: I am afraid that you are slightly mixed up. The Snuffy is one airplane and the Payne Knight is another. The Snuffy was built on special order for a sportsman pilot and no information on it is available. The Payne Knight Twister, which is slightly similar in looks, is built by the Payne Aircraft Co., Joliet, Ill. (Turn to page 97)

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.

A COMPLETE BILL BARNES AIR NOVEL



Matt Greene

THE MAGNIFICENT GESTURE

BY GEORGE L. EATON

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

BILL BARNES' powerful body was clearly silhouetted against the path of moonlight that danced like a stream of gold across the Ligurian Sea at Cannes. He was dressed only in his pajamas and had turned off the light in his hotel room to gaze down on the twinkling lights which were a part of that phantasmagoria known as the French Riviera.

Yet he did not see those twinkling lights. He could see only the mental picture which that British master of counter-espionage, Eden Aird, had drawn for him a few days before. Aird's warning that his life and the lives of his men would be in jeopardy until they got back to Barnes Field, Long Island, still beat in his ears.

That he, Bill, had been of certain assistance to Aird in helping forestall the outbreak of a general European war, was the only satisfaction he had at the moment. He was thankful that on the morrow the big, low-wing, cantilever monoplane he called the Charger, and the three scarlet-and-black-and-yellow amphibians of his men would be ready and fit to take the long hop across the Atlantic, away from this potential powder keg.

Only a few hours before, after Bill and his men had finished tuning their ships on the little airport between Cannes and Grasse, Bill had told the four that were left of his famous combat squadron that he wanted to have a talk with them in his hotel room.

I. Kinter Hassfurther, Bill's right arm and chief of staff and known to aviation circles throughout the world as Shorty, was the first to put in an appearance. The usual grin on his good-natured, Pennsylvania-Dutch face disappeared when he saw Bill's dour expression.

"What's in the kettle?" he asked casually.

"Wait until the rest of 'em get here," Bill had snapped.

A few minutes later the broad-shouldered, carrot-thatched Eric (the Red) Gleason, the brown-eyed Bostonian, Beverly Bates, and the youngest and last of the little squadron, Sandy Sanders, entered the room.

"You going to give us all a bonus?" the freckled-faced, irrepressible Sandy wanted to know.

"Pipe down!" Bill's eyes roved over their puzzled faces, and before his mind's eye flitted a picture of those two stalwarts, Cy Hawkins and Mort Hen-

deron, both of whom had been killed in combat in Bill's service.

"I'm fed up!" he had snapped at them. "What did we come over here for? Ostensibly to deliver a valuable string of pearls to a Greek millionaire's daughter. Well, it turned into something different. Why is it that everything we touch turns to violent death and murder?"

"Gosh, Bill," young Sandy broke in, "we didn't know the pearls were going to be switched to run in a string that contained secret plans and maps and things. We—"

"All right," Bill said quietly. "I didn't call you here to argue with you. I want to tell you what I am going to

can't stand it any longer. I want the world to think of us as an exponent of peace-time aviation instead of an instructor of warfare!"

"Maybe we ought to take up gliding and soaring," Sandy said with a grin.

"None of your facetiousness!" Bill barked. "You wouldn't be so flippant if you had heard the bombardment plans on London and Paris and Berlin, Aird told me about. They were too horrible to visualize."

"I'm all for it, Bill," Shorty said. "I'm sick and tired of dodging bullets. The only question is whether or not we can live down the reputation we have established as a fighting unit and make people think of us in terms of aviation progress."

"Exactly," Bill had said. "That's what we've got to do. I don't want to go into a long discussion about the thing now. I only asked you to come here so that I could start you thinking about it. Give it some thought tomorrow when we're hopping across the Atlantic, if you have time. When we get back we'll all go into a huddle and decide what we're going to do."

"Maybe we could all go in the movies," Sandy said.

"Shut up. Now all of you get out of here and get some sleep. We take off at six o'clock sharp in the morning."

They filed out of his room in silence except for Sandy, who was still young and unwise enough to retain that desire for the excitement of war which is the heritage of youth.

"We could mark out handball courts in the hangars back on Barnes Field and have a lot of fun," he scoffed.

Bill was thinking now, as he gazed out into the moonlight, that the whole world had come to think of aviation in terms of war. The efficient daily flights of the big passenger lines, for instance, received scant attention unless some mishap befell them.

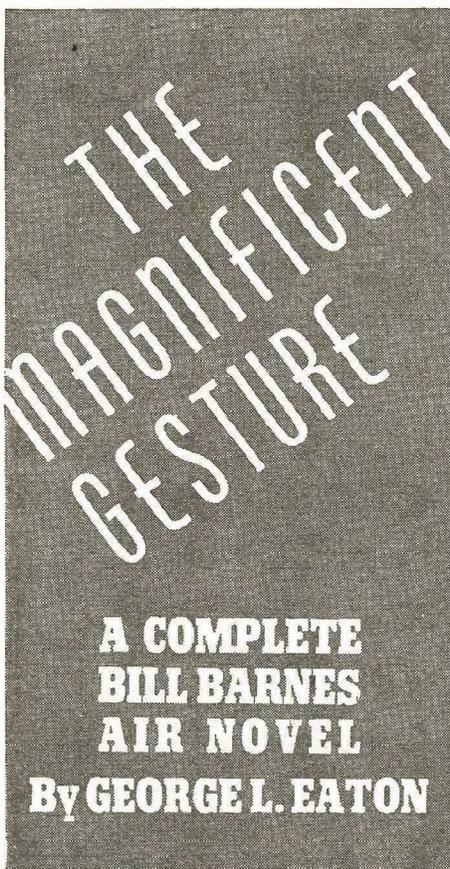
And then, suddenly, his heart seemed to stop beating and climb up into his throat to choke him. For a moment, a split fraction of a second, he didn't know what had caused it. Then he was aware of another presence in the room besides himself. He had heard no sound, yet he could feel the presence of another person.

Using all the will power at his command, he slowly withdrew his gaze from the window and turned around. He stood gazing into the blackness of the room trying to penetrate it while his hand slid toward the light that was on the table beside him. He cursed inwardly for not having locked his door and for having left his automatic pistol across the room. Aird, the Englishman, had warned him to be careful, and now he was going to pay for not heeding the warning.

do." He sat down on the edge of a table and drummed his fingers nervously on the top.

"If we hadn't found out those pearls had been switched Europe would now be at war," he went on. "We would have been instrumental in bringing it about. I'm thoroughly tired of this business we're in. Everything we touch is smeared with blood. We started this business to be an aid to aviation, not a detriment. Every time anybody wants a bit of dirty work done they come to us. We have built up a reputation as the greatest small fighting unit in the world. But that isn't what I want. I want peace and I hate the sound of the word war."

"We're constantly engaged in a little war all our own. The world thinks of us only as a combat organization. I



For an instant he debated whether or not to throw himself on the floor away from the path of moonlight that made him a perfect target. Then he pushed the button on the side of the lamp nearby and braced himself. Bill squared his shoulders to meet whatever danger threatened him.

As the bright light flooded the room he saw a man standing just inside the little hallway leading into the room. His snap-brim hat was pulled down over his eyes and in his right hand was a small but deadly-looking automatic whose muzzle was pointed directly at the middle button of Bill's pajama top.

II—MESSAGE

BILL'S eyes fastened on the blue-black barrel of the little automatic in the man's hand as the other glided with the agility of a cat out into the center of the room. He waited, speechless, for fire to jut from the mouth of the gun.

Then, his fear turned to astonishment as the man stopped six feet away from him, swept his hat from his head, clicked his heels together and bowed.

"You don't recognize me, Barnes?" he said in precise Oxford English. As Bill watched him in fascination a smile flashed across his lips and some dim memory stirred in Bill's mind and was immediately gone.

"Who are you?" he snapped. "What do you want?"

"I want you, Barnes," the man said, and then he did a most astonishing thing. He reversed the pistol he held in his hand and extended the butt toward Bill. "You may have it now if you wish," he said.

"Who the hell are you?" Bill said again.

"You do not remember me?" the other asked, a smile twisting his swarthy face again. "I am Colonel Ricardo, equerry to his majesty, Prince Michel of Maxembourg. I am hurt that you do not remember me."

"Ricardo!" Bill Barnes shouted, and the tone of his voice brought a rollicking laugh to the lips of the swarthy man as they wrung each other's hands.

"You will please pardon the way I have come," Ricardo said. "It was important that no one see me."

But Bill was not listening. He was thinking about the time when he had gone, with his men, to the aid of the ruler of Maxembourg, a little principality in the center of Europe. He had gone at the pleading request of Rene Roebing, an American heiress who had since become the wife of Prince Michel and now sat beside him on the throne of Maxembourg.

He was remembering how Ricardo, Michel's equerry and best friend, had fought by his side to defeat the premier,

Max Jarquin, and the minister of defense, General Huberto, so that Michel might keep them from seizing control of the country. He was remembering the brilliance and the daring courage of this man Ricardo who stood before him now.

"You were always in uniform when I saw you before," Bill said, and he had a vision of Ricardo's right hand flashing across his breast to draw the rapier that hung at his side from its scabbard. He remembered how Ricardo had leaped straight at six automatics, a shout of defiance on his lips, to run his rapier through the midriff of General Huberto. Six guns had spoken as one as Ricardo

Ricardo smiled as he teetered on the tips of his toes. "All of the governments of Europe know you are here, Barnes, and half of them know why. I am here because Prince Michel wishes to see you at Madura. He has made it very urgent. But he does not wish the big powers to know that you will visit him. That is why I had to come un-
seen."

"Michel wishes to see me? Why?"
"That," Ricardo said politely, "I cannot tell you. His excellency has become a bit, ah, eccentric recently. He did not confide in me."

Bill's keen eyes searched the impass-



Bill's right fist sped forward with the speed of light to the guard's chin.

bounded down a hallway to escape. He had spoiled their aim by pushing one man against the rest as they began to shoot. He had disappeared around a corner with his laughter floating back to Bill's ears.

"You will please pardon the way I have come stealing into your room like a thief," Ricardo said again. "But these are tense times in Europe. Maxembourg is in a key position, in the nerve center of turmoil, and we are being watched as closely as the big powers."

"Which doesn't explain why you're here," Bill said. "But let that go. I am glad to see you, Ricardo. I had thought of flying to Madura to see his excellency and the princess, but I have been warned to get out of Europe fast. How did you know that I was here?"

sive mask that was Ricardo's face. He knew what a wrench to Ricardo's loyalty toward his prince it had been to even use such a mild term of criticism. He knew that in Ricardo's eyes Prince Michel could not be wrong.

"I don't see how I can do it, Ricardo," Bill said after a moment of worried thought. "I don't feel that I should expose my men to the danger."

"He doesn't want to see your men. He wants to see only you. If we can use your Charger we can be in Madura in two hours. He will give us an audience immediately."

"I have already given orders that we take off for the States at six o'clock in the morning. It isn't safe for us to stay here."

"You can be back here by six o'clock,"

Ricardo said. "You can leave word for your men to stand by their ships until you return."

Bill Barnes paced the length of the room and back while he fought with himself. Here it was again, he thought. Someone wanted him to pull their chestnuts out of the fire again. It was trouble, or Ricardo would not be so mysterious about it. Suddenly, he came to a halt and spoke so quickly that Ricardo's eyes flew wide in amazement.

"No!" he said. "I can't do it, Ricardo. Please convey my regrets to the prince. Tell him I'm through with intrigue—"

"Wait, Bill!" Ricardo said. The smile was gone from his lips now and some of his fierce pride had gone with it. "I can't tell you any more than I have told you, but I entreat you to come with me. It may be the turning point. Talking to you may bring the prince back—back to sanity. He—" Ricardo stopped speaking and slipped a hand into an inside coat pocket to pull out a wallet. From the wallet he extracted a small white envelope and extended it toward Bill.

"I had not intended to use this unless it became necessary," he said quietly. "Prince Michel does not know that I brought it with me. It may change your mind."

Bill took the envelope from Ricardo's hand and turned it over as though he was loath to open it. Then he dug a forefinger into the flap. There was a single sheet of scented paper inside. He moved over to the light and read:

Dear Bill:
Please come. I need you.
Rene.

That was all.

Bill turned the note over and stared at the back while a vision of the girl who had been Rene Rocbling flashed through his mind. He remembered that harrowing flight across the Atlantic with her in the after cockpit of the Lancer, when she had persuaded him to go to the aid of Prince Michel. He remembered the desperate courage that was in her deep blue eyes as she pleaded with him to go to the rescue of the man she loved and was going to marry. And he remembered the trembling joy that had been in her soft, sweet voice when she and Michel had been reunited.

"Well?" Ricardo's voice broke into his thoughts.

Bill looked at the watch strapped to his wrist and then reached for the telephone. He asked for and got Shorty Hassfurth on the wire.

"I'm sorry to wake you up," he said, "but it's important. Colonel Ricardo—Maxembourg, remember him?—is here. We're leaving in a half hour for Madura."

"You're what?" the startled Shorty shouted.

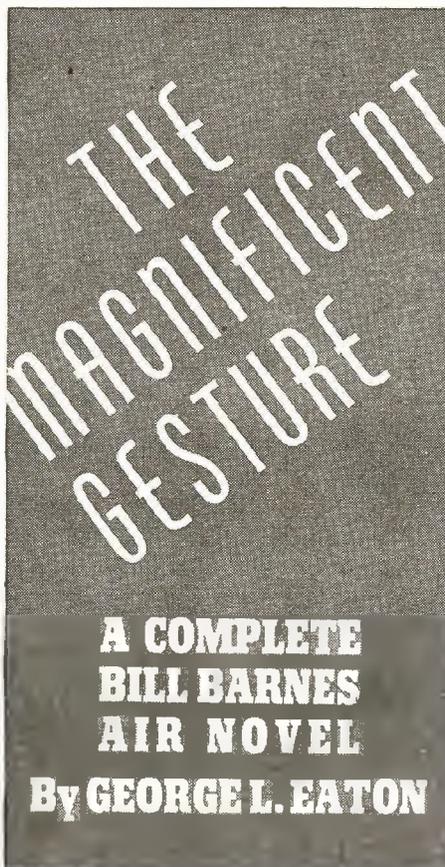
"Stand by your ships at six in the morning," Bill went on. "I believe I'll be back in time. If I'm not I'll make contact with you on the radio. Do you get it?"

"What the hell is it all about, Bill?" the astonished Shorty asked.

"I don't know," Bill snapped, "but be ready to hop at six."

III—VANISHED FRIEND

THE head mechanic and a half-dozen sleepy-eyed assistants were making a quick check on the stainless steel monster Bill called the Charger when he and Ricardo



appeared at the airport twenty minutes later.

The two single-blade, automatic-pitch propellers with their black de-icing spinners seemed to stare back at Bill as his angry eyes flashed over the big ship. From the tip of the 23mm. Madsen auto-cannon that projected from the nose of the fuselage to the rubber trimming tabs on her double rudder fins, the Charger was a thing of sleek, streamlined beauty and tremendous power.

As the mechanic gunned the twin "pancaked" power plants that were completely inclosed within the thickness of the wings and the thirty-six hundred horses roared to life. Bill shouted to Ricardo: "Get into the navigator's seat in the forward cockpit!"

Following Ricardo into the forward cockpit, he dropped into the parachute

chair that was the pilot's seat. His eyes ran over his two main instrument panels and the .50-caliber Brownings mounted on each side of him. He released his wheel brakes and blasted the big ship around into the wind and fed her soup. The twin Diesels welled into a mighty roar as the gleaming monster sped down the runway into the wind. Crouching a little over the wheel, he took the Charger into the air with the precision for which he was justly famous.

A yellow and green light flashed on his instrument panel as the main landing wheels and the nose wheel slid up into the belly and the big ship became a low-wing, cantilever monoplane.

At ten thousand feet he leveled off and pulled open his chart drawer. In five minutes he had plotted his course and laid the nose of the Charger on the little city of Madura in the heart of Maxembourg. His tachometer registered twenty-five hundred r.p.m. as the air-speed indicator on his panel climbed to three hundred and fifty miles an hour.

Only once during the first hour and a half while the big ship bored through the night air did Bill speak to Ricardo over the interplane telephone.

"You're sure you can't give me some more information before we arrive?" he asked.

"There is nothing more I can tell you, Bill," Ricardo said. "Believe me, I would like to, but I—I can't."

"You think it wouldn't be ethics," Bill said to himself. "You blindly follow the man you call your ruler without asking why or when. Hooey!"

Twenty minutes later Bill asked Ricardo to help him make contact with the government airport at Madura.

"They say everything is all clear," Ricardo reported.

"Tell them to give you the ceiling and the speed and direction of the wind," Bill ordered. Then, "Right," he said after Ricardo had translated the Madura operator's reply. "I think I can see the beacons now."

Beneath them, at the bottom of a natural saucer, spread out the dim, dark outlines of the small city. Far away in every direction lights blinked in the farmhouses and barns in the valley around the city.

As they dropped down to a thousand feet the city itself began to take form. Wide boulevards that were dotted with lights led from the outskirts to the main plaza in front of the turreted castle that had been the home of the princes of Maxembourg for generations. From south of the great courtyard powerful beacons stabbed the sky to greet them, and the white glare of floodlights made the field as light as day.

Bill circled down into the wind, cut his gun and eased the big ship down on a runway, fishtailing a little to reduce

his speed. He rolled up to the apron, locked his brakes and killed his engines.

"Please ask 'em to keep her warmed up out here on the apron," Bill said to Ricardo as they slid out on the concrete. "I'm going to keep that six o'clock date if I can get away from here on time."

"Right," Ricardo said. "You'll start for the States without any sleep?"

"Young Sandy will be in the Charger with me," Bill said. "He can take the controls while I sleep."

They climbed into a long low limousine that was waiting with a chauffeur at the wheel, and were whisked down the side of the field toward the great towering chateau at the other end.

The high-gabled houses with their lace-capped heads and Gothic windows that lined the streets were dark and silent. Far off in the hills they could see the glow of shepherds' fires, and down the valley the moon danced across slowly drifting clouds.

Then they were being ushered into the paneled, high-ceilinged hallway of the chateau that had been the palace of the rulers of Maxembourg for ten centuries. Through Bill's mind marched a kaleidoscopic picture of men in doublets and linked armor, and perfumed, high-bosomed women strolling along the ancient hallways.

A door was thrown open in front of them, and light streamed out of a mammoth room at the end of which fire leaped high in a great stone fireplace. Blinking in the bright light, Bill saw the form of a man moving down the room toward them, whom he dimly recognized as the man he had known as the dashing young ruler of Maxembourg.

"Mr. Barnes, sire," he heard Ricardo say, and then the man stood before him with outstretched hand. He was dressed in a brightly colored colonel's uniform of one of his own regiments, and across his chest were pinned a dozen decorations and medals.

Bill was aware that Prince Michel's hair had turned almost completely white, and that his gaunt, lined face was the face of a man of fifty years instead of thirty-five. A shiver crept up Bill's spine as he felt the cold clamminess of the other's hand, and saw the half-mad, frightened expression in his eyes.

"I thought you would come at my summons, Barnes," the prince said.

Bill remembered how, when last they parted, he had been "Bill" to the ruler of Maxembourg and Prince Michel had been "Mike" to him. The stiff formality with which the prince greeted him now caused him to glance uneasily at Ricardo, and what he saw in Ricardo's face astonished him even more.

Ricardo's expression was both a command and a warning. With an effort Bill choked back the words that sprang

to his lips, said instead, "We came as fast as we could, sir."

"Sit down, Barnes," Michel said peremptorily. "I suppose Ricardo has given you a brief outline of what I wish you to do?"

"There was little time, your excellency," Ricardo interposed. "I thought you could do it better than I."

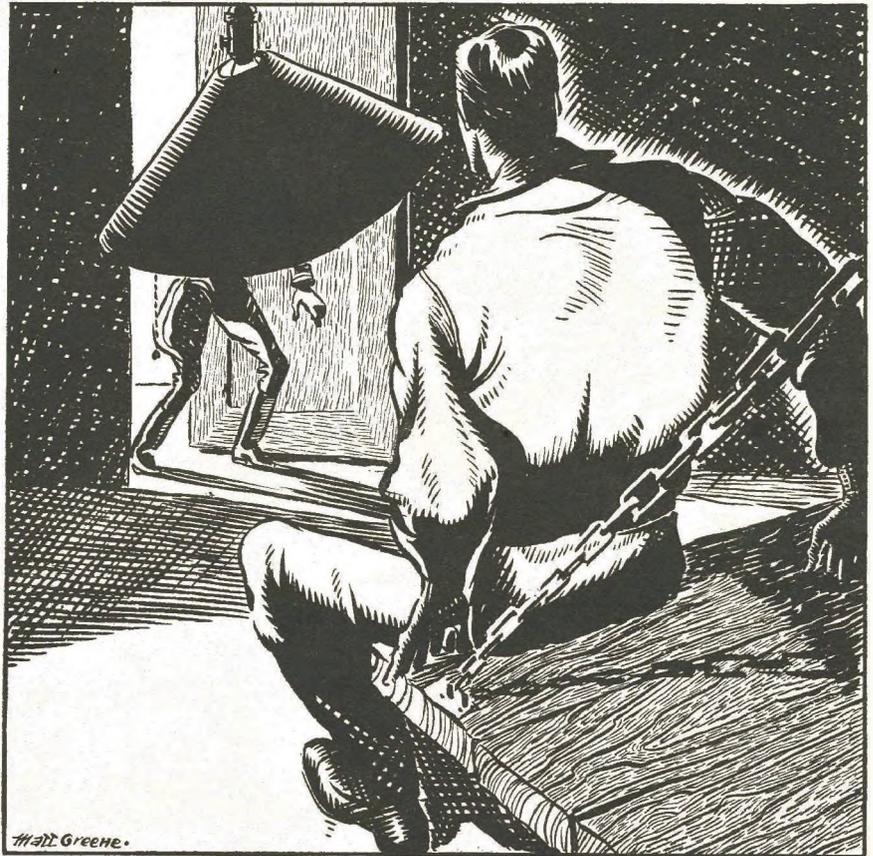
Michel's eyes raised in cold dissatisfaction to stare at him as Ricardo's face became suffused with color. Through Bill's mind flashed the thought that no one is as lonesome as a king. Ricardo and the prince had been like brothers when Bill had left them. Now there

leaned forward in his chair. "Her majesty, Princess Rene?" Bill Barnes asked. "Is she still in love with Maxembourg?"

Prince Michel's eyes darted to Bill's face to rest there long and searchingly. The palms of Bill's hands grew moist under his venomous stare.

"Princess Rene is in England," Michel said slowly. "We have been afraid that Maxembourg might become a battlefield."

Bill's gaze shifted quickly away from Prince Michel to fasten on Ricardo, and what he saw in Ricardo's eyes now was sheer terror.



He saw the big door of the cell swinging inward, the figure of Ricardo entering—

was a cold hostility between them that crackled like the great logs in the fireplace.

Suddenly, Bill was angry at himself for having listened to Ricardo's pleas. This was none of his affair! At the same time he wanted to reach out with his two hands and shake the man who sat across from him until the medals went spinning from his chest. He wanted to break down the frigid barrier that was as tangible as a wall of ice between them. He searched his mind for something to say that would break the tense silence, bring back the Mike he had known.

Then a vision of Rene Roebing, the prince's consort, floated before his eyes, and he believed he had found the subject. His face lighted in a smile as he

IV—WEIRD DREAM

THE seconds ticked away endlessly as Bill tried to fathom the strange conduct of these two men. Which of them was lying? Was the girl who had been Rene Roebing here or was she in England? What strange thing, he asked himself, was taking place here under his very eyes?

Then Bill was aware that Michel was speaking again. His voice had risen now and was high and sharp. "The time has arrived, Barnes," he said. "You will recall that we talked of you developing an adequate air force for Maxembourg. I didn't have the money or the resources before. But now I have them." He leaned forward in his chair

toward Bill and lowered his voice to a whisper. "I can get unlimited credit from a great power that has been left out of the European pact."

Bill stared into Michel's wildly gleaming eyes with a feeling of revulsion.

"You will help me to build the greatest air force the world has ever seen, Barnes," Michel went on. "The powers in the pact are going to begin a disarmament program within a few months. Of that I have actual knowledge. As they disarm we will arm. This other power will furnish me with endless pilots and planes. We will concentrate them all here until the hour comes to strike.

"Then, the four powers that have held Maxembourg helpless for centuries will be helpless themselves. We can strike and destroy their capitals and bring them to their knees in forty-eight hours. And little Maxembourg will rule Europe. I will accomplish what Napoleon and others have tried without success."

Bill's mouth was dry as Michel waited for him to speak. He wet his lips with his tongue as he tried to think of some soothing reply to the madman who sat before him. He knew that to try to argue with him would be useless, and might be more than a little dangerous.

"What will their bombers be doing while you are destroying their capitals?" he finally asked.

"We have been experimenting to take care of them," Michel said. "We have developed a light, inexpensive single-seater that is a flying bomb. We have learned that a pilot can bail out of it safely when it is traveling at nearly three hundred miles an hour. They will be our defense. We can annihilate all of their bombers with our rammers. The pilots will fly them head-on into their bombers, bailing out before they make contact. The rammers will detonate when they make contact. They will be so heavily loaded with explosives that they will blow any ship in the world into a million pieces."

"But you can't land an army on their soil even though you have ten thousand transports," Bill said. "You can't get through their ground defenses."

"We will destroy them behind their own lines," Michel said. "We will bring them to their knees by destroying their sources of supply and their lines of communication and transport. We will wipe their civilian populations off the map if necessary."

Bill could feel his anger rising again and he tried desperately to control it. "It's not a very pretty picture you paint," he said.

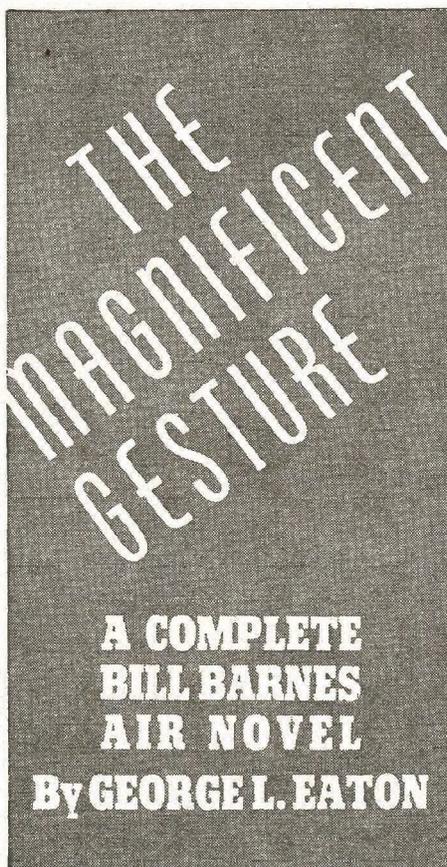
"Pretty?" Michel snarled. "What is pretty about man's first instinct—the instinct to survive at all costs? We, too, must survive."

"But you're talking of conquest," Bill said.

"I have told you my plans," the prince said. "I am offering you a high place on my staff. You will accept or you will reject my request. It is my will that will determine what is right and wrong. It will be your will to carry out my orders. You will have a high place in the sun, Barnes, if you follow where I lead."

Bill Barnes knew what he must do. He must get out of there before he said things that would endanger his life. He got to his feet and stood looking down at the prince with contemptuous eyes.

"I appreciate the honor you have offered me," he said with biting sarcasm, "but I don't care for any part of it."



The world is sick of war and so am I. That, sir, is my answer."

"You," Michel said, his narrowed eyes gleaming, "have destroyed countless men in the air. You have lived on death and destruction since the time you first formed your squadron. That is why I chose you for the post. Because you have been a ruthless fighter and will not admit defeat."

"That's a lie!" Bill said hotly. "I have never fired a shot at any human being unless I was first attacked. I have tried in my own way to protect the interests of honest men and women. I—I have tried to protect them from fanatics and madmen like you. If it weren't for men of your caliber the world might be a half-decent place to live in."

Even before he had finished speaking

Bill knew what was going to happen. Out of the corner of his eye he saw Ricardo moving toward him, and he braced himself as he saw the prince coming out of his chair.

He saw the dagger that was in Michel's hand as he lunged at him. His fist was back to smash into Michel's face when Ricardo crashed into him and sent him reeling across the room. He knew that Ricardo carried an automatic pistol in his pocket, and he measured the distance to the window above his head as he tried to catch his balance.

Then, he saw that Ricardo had closed with the prince and had caught the wrist that held the dagger between both of his own, and was bending it up and back behind him. He started to close in to help Ricardo when the dagger clattered to the floor and Ricardo spoke.

"Keep away, Bill," he said. "I'll handle it."

He saw the prince's face turn to a mottled purple and saw him fighting desperately with himself to retain some semblance of reason. The man was trembling.

"Easy, sire," Ricardo said to him as a nurse might speak to a child. He moved over beside him and helped him back into his chair. The other's hands were shaking as though with palsy.

While Bill watched him struggle back to half-normalcy he thought of Rene Roebing and the horrible fate that had overtaken her. It was all he could do to restrain from pinching himself to make sure that he had not dreamed this horrible little drama.

He was brought back to the peril of his own position an instant later when the prince raised his venomous eyes and fastened them on him. There was the hatred of hurt pride in his beady stare.

"Call the guard and put him in irons," Michel snapped at Ricardo. "Tomorrow we'll give him a chance to change his mind."

"But, sire—" Ricardo began.

"Call the guard!" the prince snarled. "Tomorrow we'll give him a taste of some of the things the subjects of Maxembourg have had to stand from the powers that surround us. We'll teach him what torture can do for an unwilling mind."

"Do you realize what you are doing?" Bill asked as calmly as he could.

"Do you realize that you were caught trying to steal military secrets on the soil of Maxembourg?" the prince replied. "And that you landed on our soil with an armed combat plane?"

Bill looked at him long and steadily while he heard Ricardo move to the door and issue an order to the guard posted outside. An instant later six green-clad guards with heavy automatics strapped to their hips stalked into the room. They (Turn to page 86)

Model Making

GUEST EDITORIAL

By BEN E. SHERESHAW

Noted gas model designer and engine manufacturer.

1938, one of the greatest years in model aviation, is just about to pass. We have definitely established throughout the world and driven home the meaning of "Yankee ingenuity." American youth leads the world today for outstanding achievement in model aviation. We look ahead and try to contemplate what 1939 has in store for us. If we look back to a short while, and review our rapid, painstaking progress, it is but a simple matter to foretell the future. In but a relatively short period, the model aircraft industry has grown from a pastime of a small group to an industry catering to tens of thousands of consumers with an investment of several million dollars. One model motor company alone is turning out engines at a rate of two hundred daily.

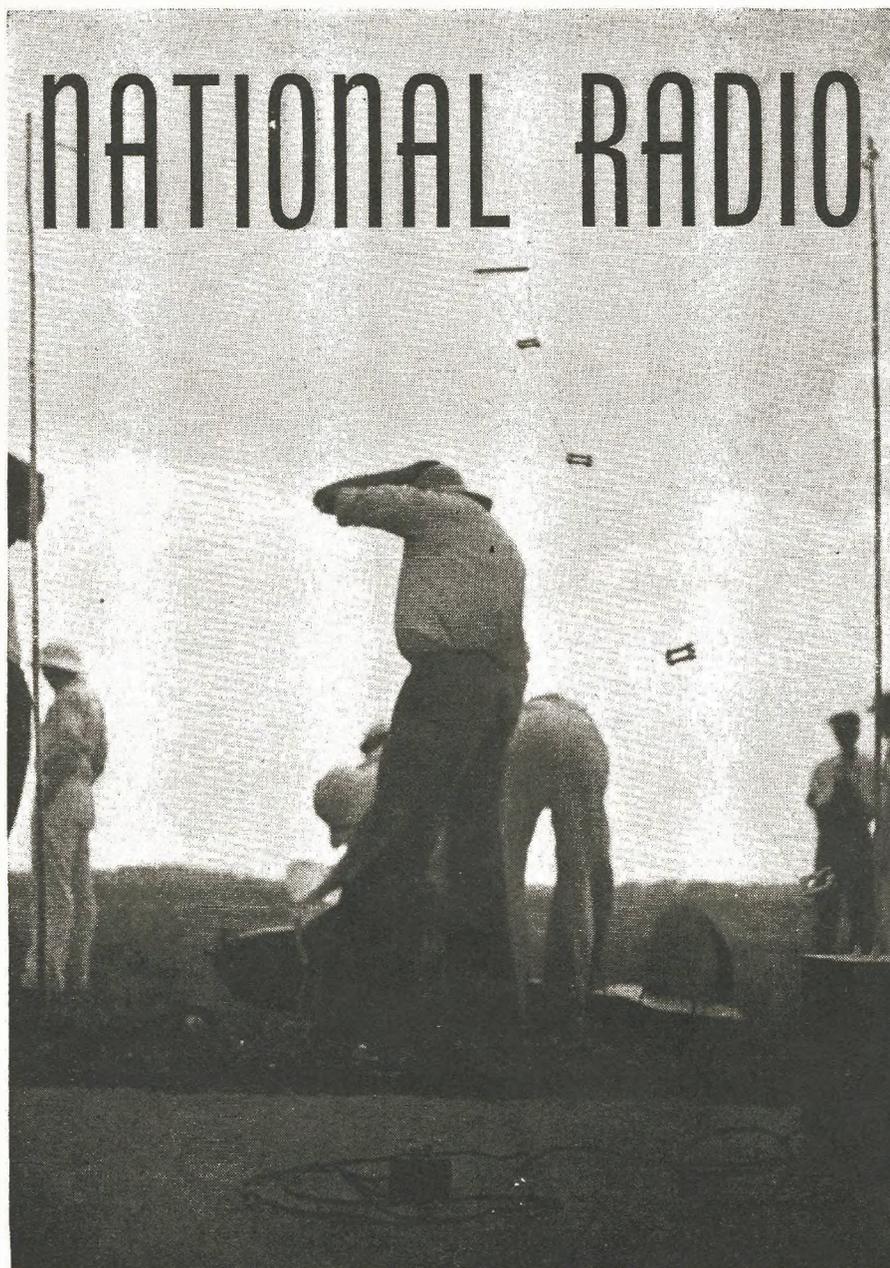
Model designs have rapidly improved from the old type box-car construction to clean and efficient designs, capable of climbing almost a thousand feet per minute, and remaining aloft forty to fifty minutes on a thirty-second motor run.

Radio control of gas-powered models, and remaining aloft forty to fifty minutes on a thirty-second motor run. It does not require much effort on our part to visualize what new fields of conquest are in store for us the reality for many builders. And I may venture to say that within a year, construction sets for transmitters and receivers for the control of model aircraft will be on the market. What legislation would have to be worked out pertaining to amateur licenses can be tackled, old ones must be settled, such as: 1. Gas model insurance. 2. A separate event by Mr. Effinger, limiting the power loading of models to five pounds per cubic inch of motor displacement. 3. Adaptation of models to five efficient flying events besides endurance. 4. The creation of solutions for our future needs are contemplated.

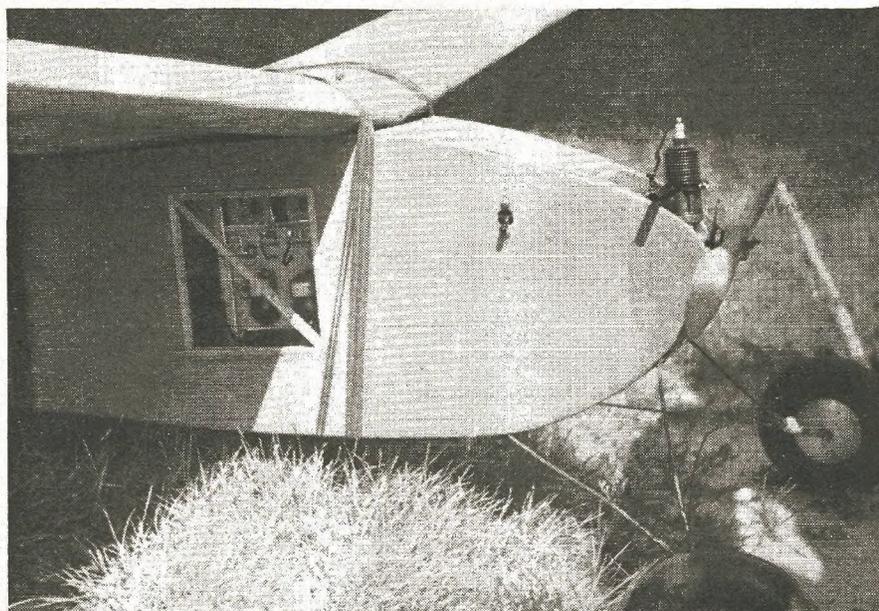
Yes! 1938 was an eventful year, with the Wakefield Trophy here, the swing to rubber-powered models, small-bore engines, great strides in model designs, and with greater values in kits, motors, and model accessories. Watch 1939! I know the American modelist will make this a still greater year.

9 MODEL BUILDING ITEMS

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Preparing for radio-controlled gas event at the 1938 National Contest held in Detroit.



An interesting close-up of the winning ship, showing the transparent inspection panel.

NATIONAL RADIO CONTROL

by
**WALTER
GOOD**

This radio control unit was awarded first prize at the 1938 National Meet in Detroit. It was built around the idea that an r. c. unit should be kept as simple as possible. Over three years were spent in its development. It was made to be easily adaptable to almost any gas job. The complete control weighs about 1.4 pounds with the heavy (10-ounce) 45-volt battery. The weight with the 2-ounce B battery is only 1 pound.

Radio amateurs sometimes have difficulty duplicating the items of equipment used in r. c. models. Rissi Brothers, Inc., radio stores in Grand Rapids and Detroit have agreed to supply all the necessary radio items in kit form for \$5.50. This kit includes all the material except balsa and cement. The parts are all standard and can be obtained at the following places: Rissi Brothers, Inc., 443 S. Division, Grand Rapids, Mich., or 5027-31 Hamilton Ave., Detroit, Mich.; Allied Radio Corp., 833 W. Jackson Blvd., Chicago, Ill.; Wholesale Radio Service Co., Inc., 901-911 W. Jackson Blvd., Chicago, Ill.; Burnstein-Applebee Co., 1012 McGeo St., Kansas City, Mo. All of these companies put out free catalogues on request.

This control is suitable for any gas model with a wing area of about 10 square feet. Our ship has a total weight of slightly less than 8 pounds for a wing loading of 12.8 ounces per square foot. We firmly believe in the idea of building and *flying* the gas job *before* radio installation. The logical procedure is to determine the C. G. of the model, test-fly it, and then mount the radio unit at that point. In this way you're sure the model will perform even when the control is not working.

WINNER

A simple, proven system; easy to duplicate and not too expensive.

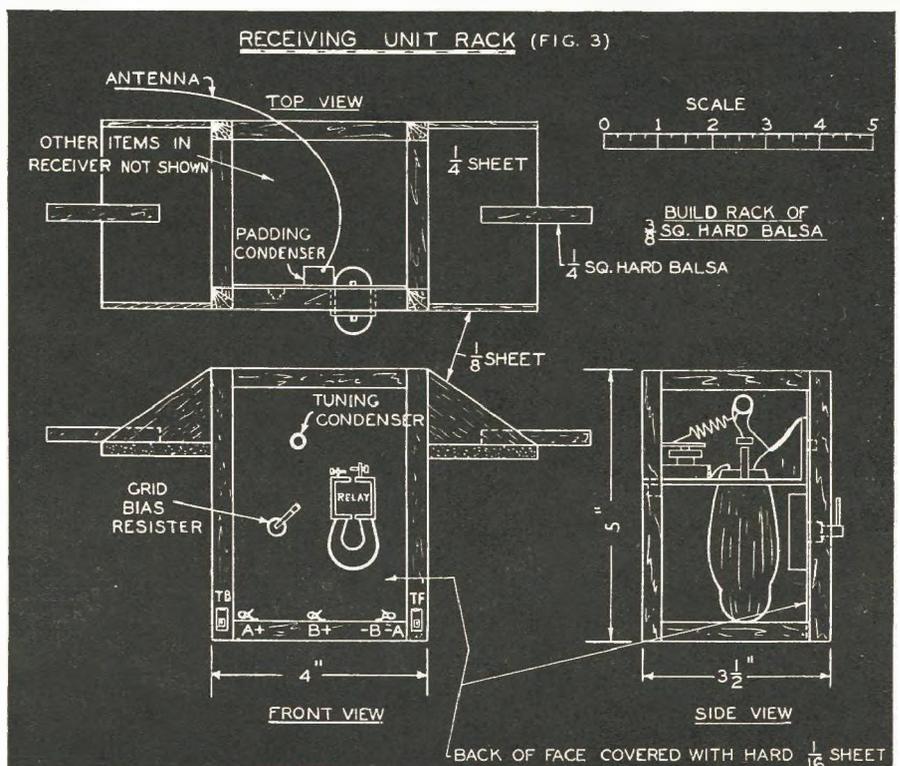
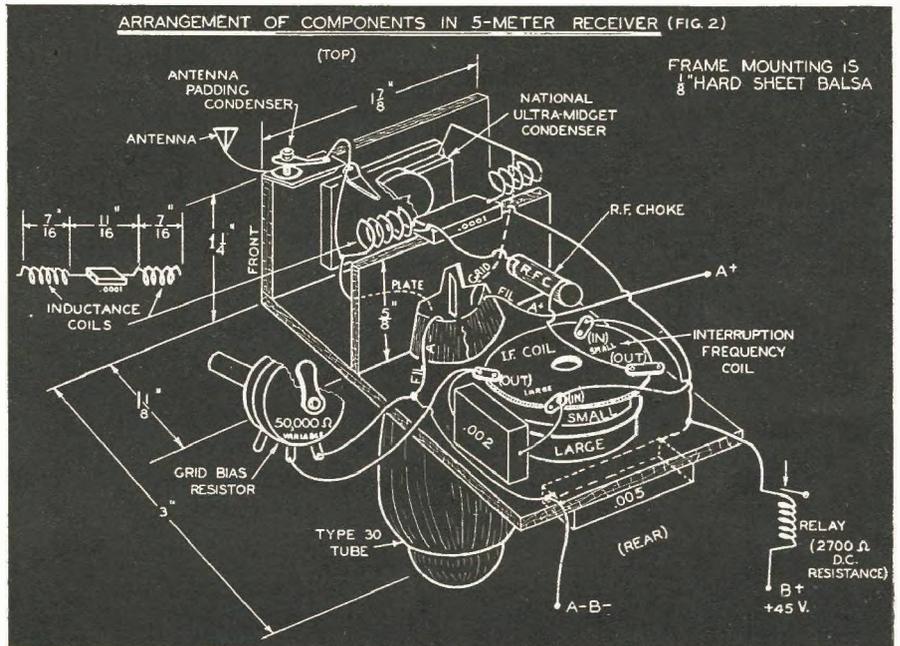
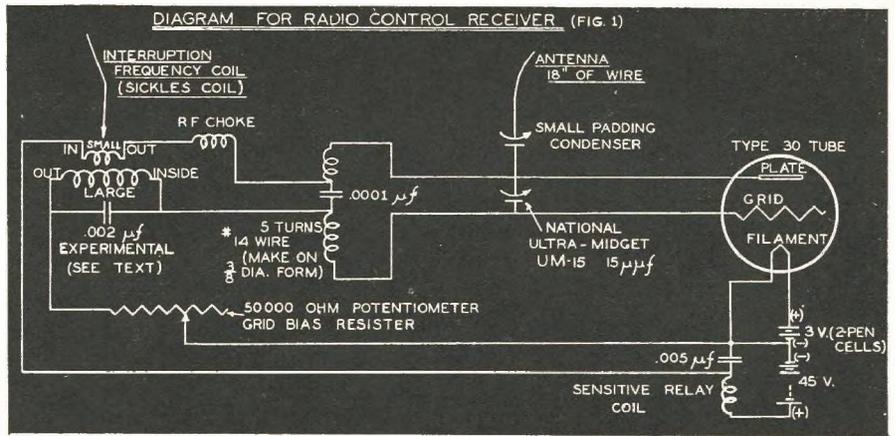
RECEIVER

The most important detail of this unit is that it uses only *one* tube which is a standard Type 30 available at any radio store. The circuit is a standard superregenerative circuit working on 5 meters at a high degree of efficiency. The receiver has the advantage of long life and *not* being critical to plate voltage. Our two receivers have been in use for well over a year with no signs of wear!

Build the receiver in a unit by itself. After satisfactory adjustment it can be mounted in a balsa frame or rack (described in the article) inside the fuselage. With this high-frequency work the arrangement of the parts is important. Follow the sketches and photos closely.

Receiver base is $\frac{1}{8}$ " sheet balsa (Fig. 2). The tube is mounted inverted through a hole in the balsa base. The base of the tube is removed by soaking in hot water for ten minutes, unsoldering the wires at the tip of the prongs and working the base loose. Looking into the bottom of the tube the two inside wires will be found to be the filament wires which go to the back of the receiver. The plate and grid wires should also be identified and marked for convenient future reference. The National Ultra-Midget variable condenser may be cemented on the back of the front piece of the balsa frame after chipping away some of the white isolantite (insulation) to reduce weight. The shaft is sawed off flush with the nut on the front.

The interruption frequency coil is cemented near the back of the receiver. Small bolts come with the coil and can be used if light weight is not the most important consideration.



Wind two inductance coils of #14 enameled wire on a $\frac{3}{8}$ " diameter form. Each consists of five turns wound in the same direction. The length of each coil will be about $\frac{7}{16}$ " and spaced $\frac{11}{16}$ " apart with a .0001 μ fixed condenser soldered between them. Enough wire ($1\frac{1}{2}$ ") should remain on the end of each coil to make connection to the two terminals of the variable condenser. This wire may have to be bent down a trifle to reach the wires from the tube.

A radio frequency choke (R. F. C.) is made by winding #32 silk-covered wire on a $\frac{5}{16}$ " diameter form to a length of $\frac{3}{4}$ ". The form is a small tube of several layers of writing paper and cement.

The Sickles coil (IF coil) consists of two coils. The words "in" and "out" on the diagram (Fig. 2) refer to the inside and outside wires on each coil. The hook-up holds true for a Sickles coil in which the windings are both in the same direction. If they should be in the opposite directions it is merely necessary to reverse the connections on *one* of the coils.

In hooking up the receiver, remember that the wire which comes on the condensers should be of ample length. Probably some of it will have to be cut off. A prime requisite in this type receiver is to make all connections as *short* as possible. The grid bias variable resistor is connected in with enough wire to allow it to come around in front of the tube. Allow it to hang loose at present. It is mounted firmly when the unit is placed in balsa rack.

In an ordinary receiver this resistor would be a fixed one, but we have found that by making this variable we can easily adjust the receiver to an optimum operating point. Without this *variable* resistance it would be almost impossible to make the receiver give the proper results. It is very important!

The antenna is an 18" piece of wire attached to a small padding condenser which in turn is connected to the plate side of the variable condenser.

TUNING THE RECEIVER

We are striving to get the very best plate-current change possible. It is worth while to put extra time on a 1-tube receiver rather than build haphazardly a 3-or 4-tube set with no better results. This 1-tube set gives just as good or better plate-current change as those with extra tubes.

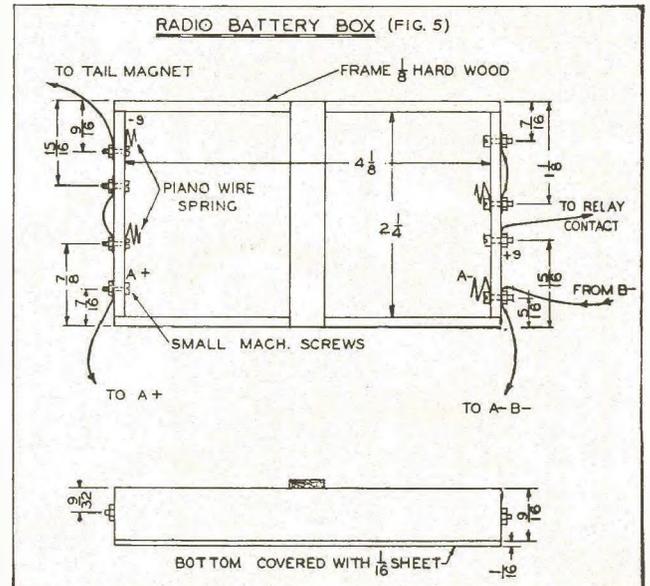
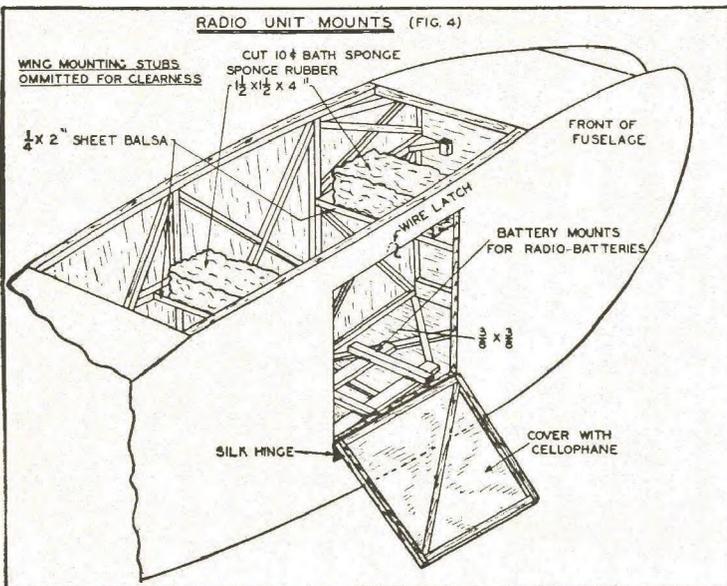
Hook up the batteries to the receiver. Two penlite cells are used for filament when flying. For testing use two regular flashlight cells (in series to give 3 volts). The batteries and battery box from your gas job will do nicely. Hook up the filament first. In this way you make sure the 45 volts are not sent through the filament, which would burn it out and ruin the tube.

A regular 45-volt battery is used for testing. For flying there are several choices: W3OFL Burgess weighing 10 ounces; 11-ounce General 45-volt battery; or the 2-ounce Eveready 45 volt. The longer-life heavier battery seems advisable if the extra weight can be handled.

Connect the 45-volt batteries in series with earphones and a milliammeter (5 or 10 milliamper scale). Earphones should be the same resistance as the resistance of the relay, which will be about 2700 ohms (direct current resistance). This is rather a standard value for earphones. Later the meter and the earphones will be replaced by the sensitive relay.

With the hook-up complete, there should be a "rushing" hissing noise in the earphones. This is with the grid bias resistor set at full value. This hissing noise is the characteristic background noise found in the superregenerative receivers. When a signal comes in, the background noise is cut out. With the grid-bias at 50,000 ohms the meter should read 1 or 2 mils. Slowly decrease the grid bias resistor. The rushing noise will become louder and louder and the meter will slowly increase. At about 3 or 4 mils the noise will "peak" and disappear and the meter should increase rapidly up to 5 or 6 mils where further decrease of the grid bias will just slowly increase the meter and no noise will be heard. The idea here is to make the meter give a fairly fast rise from 3 to 5 mils. This rapid rise depends upon the quench frequency of the circuit, which is determined by the condenser across the large coil of the interruption frequency coil. It may be necessary to experiment with different values of this condenser. The value stated is .002 μ and if any change is made it will probably have to be increased. One of my receivers uses .002, the other .005 μ .

It is just a matter of trying different values differing .001 at a time or maybe .0005 μ until the meter gives a fast rise and the noise "peaks" rather sharply in the

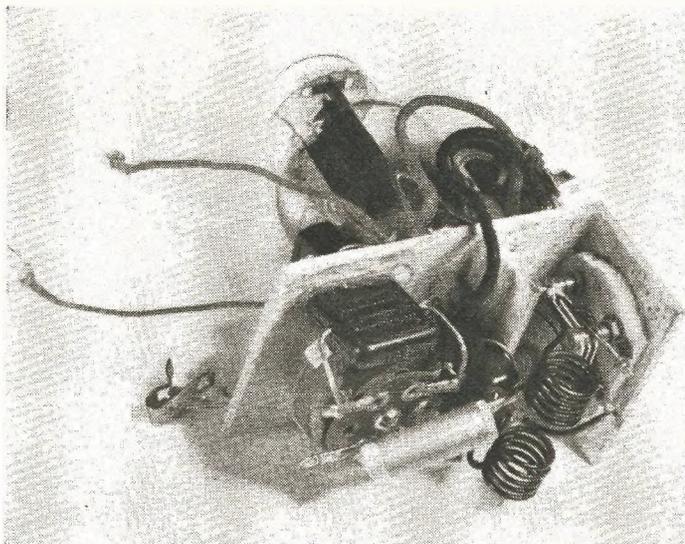
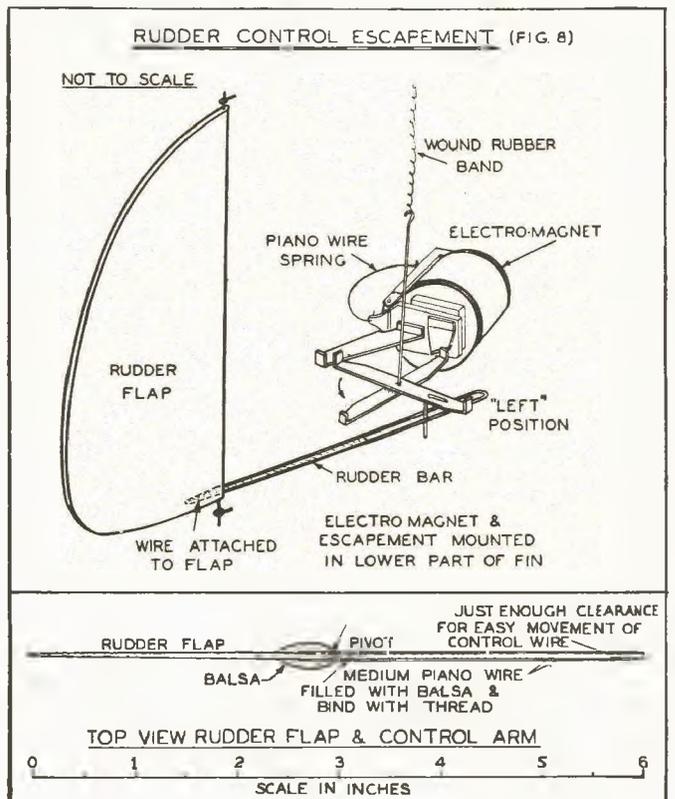
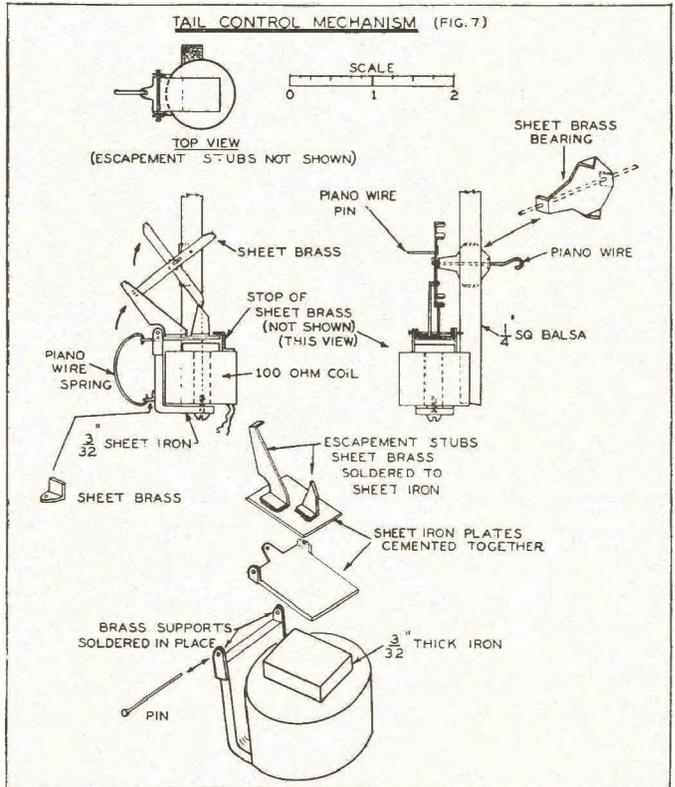
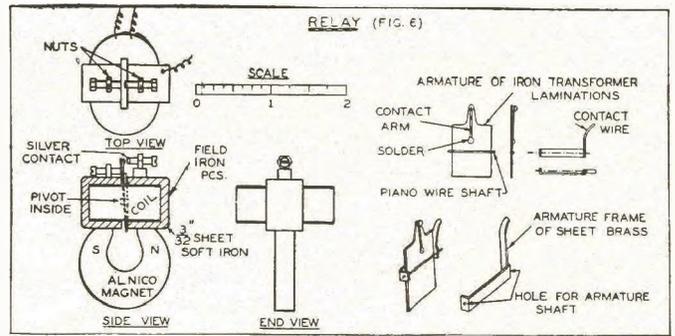


earphones and quits. This may be checked by tuning the receiver to the transmitter. This is done by leaving the transmitter on and tuning the receiver condenser with an insulated tuning bar (We used an insulated aligning tool.) The shaft is sawed off the condenser right at the nut. When the transmitter is tuned in, the background noise disappears completely and the meter also drops. Slowly change the grid resistor and turn the transmitter off and on. It will be noticed that while the transmitter is off the noise will be heard and the plate current will be at some value depending on the setting of the grid bias. When the transmitter is turned on the noise stops (although a little hum may be heard from the transmitter, it will be distinctly different) and the meter *drops* slightly in value. It is this drop in current that is going to work the relay.

The idea is to make this current drop as much as possible when the transmitter is turned on. This drop will be about .3 mil for high-resistance settings of the grid bias, but as the grid bias approaches the place where the noise peaks it will be found that the change increases and the grid bias should be adjusted until the best change can be obtained. This change will be about 2 mils—from 5 mils (transmitter off) to 3 mils (transmitter on).

When close (10 feet) to the transmitter, changes of 3 mils have been found, but at operating distances (up to a mile) the change will be about 1.5 to 2 mils. If the change is found to be there, but too critical to adjust on the grid bias, that means the condenser (the one we varied) is too great and should be made a little smaller. Or it may also be remedied by increasing the plate-circuit resistance (relay coil) a little (maybe 100 ohms). You see we have a way of making the receiver very sensitive, but must not overdo it or it will become too critical and tricky to operate. After you are getting a good change and want still better you might try changing the plate-circuit resistance one way or the other, although the recommended value for the relay coil is 2700 ohms. (Any value from 2600 to 2900 should work.)

So far all the testing has been done close up to the transmitter, so place the whole affair on a board and carry it away from the transmitter. Have someone turn the transmitter off and on while you do this. Now is the time to tune the antenna padding condenser (it is



The receiver, minus mounting case, shows clearly the details of its assembly. This photograph will clarify details of the drawing.

not critical close up). When a hundred yards or so away tune the paddler so that the meter will drop to the lowest value when the transmitter is on. Once set, this probably won't have to be touched again.

Summarizing what adjustments have been made to the receiver:
 1. Build receiver using variable grid bias resistor. 2. Experiment (if necessary) with condenser across I. F. coil for best results. 3. Experiment—only if necessary—with resistance in plate circuit (relay coil resistance). 4. Tune antenna padding condenser.

On the flying field we adjust only the main condenser and the grid bias. The receiver stays in tune remarkably well and probably the tuning condenser will need only occasional adjustment. The grid bias is the old standby for critical adjustment and is used more than any other on the field. This should probably be checked after every few hours of operation to take care of the slowly changing battery voltage.

The receiver complete with the grid bias resistor weighs $3\frac{1}{2}$ ounces.

The theory of superregeneration is not well understood by even the experts, so we'll offer no explanation. This receiver needs absolutely no shielding to protect it from ignition interference. It is a property of this type of circuit.

RELAY

A good sensitive relay is one of the keystones to a practical radio control. Commercial relays until recently have been both heavy and expensive. We've experimented with about a dozen different relays during the past three years, always keeping in mind the limitations of the model builder.

A relay must have the following characteristics: 1. Lightweight; 2. Be unaffected by vibration; 3. Work in any position; 4. Contacts must not stick; 5. Have good sensitivity; 6. Low cost.

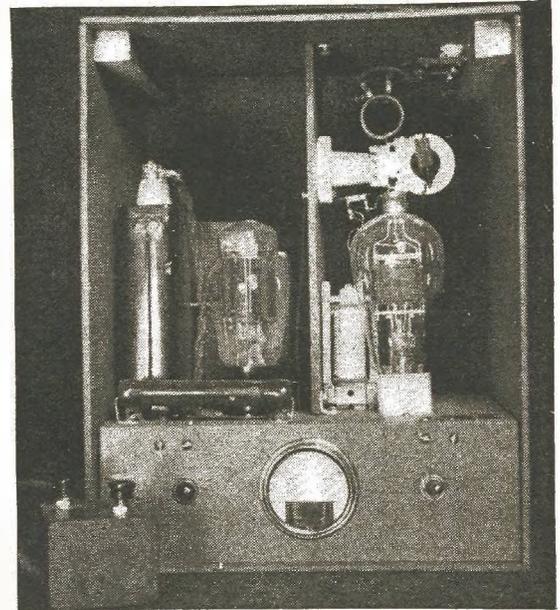
The one to be described fills these requirements. Its weight is $2\frac{1}{2}$ ounces.

The relay is the polarized type and contains a permanent magnet. The armature is balanced so vibration and position have little effect on it. Also, there is a "snap action" in its movement which along with good contacts gives nonstickable results. It has no springs (as does the usual type), which is another aid against vibration interference. This relay is "matched" to the circuit for best results. The cost is about fifty cents, even considering the ten-cent piece cut up for silver contacts.

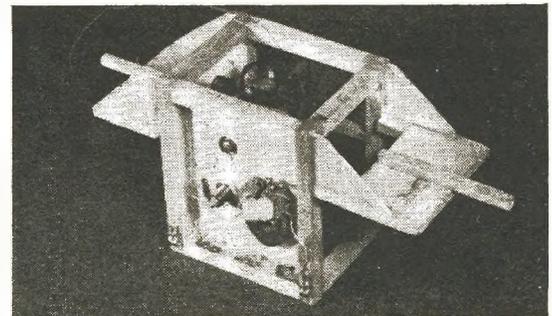
The relay coil form is made of thin cardboard. #40 wire from old earphone coils or a Ford spark coil secondary is wound on the form. Use a hand drill mounted horizontal in a vise for winding. The direct current resistance should be 2700 ohms. Vary this

figure in case your receiver has been found to work better with more or less resistance. Solder short lengths of regular wire to both ends of the #40 for lead wires. Wrap and cement a piece of writing paper around the finished windings.

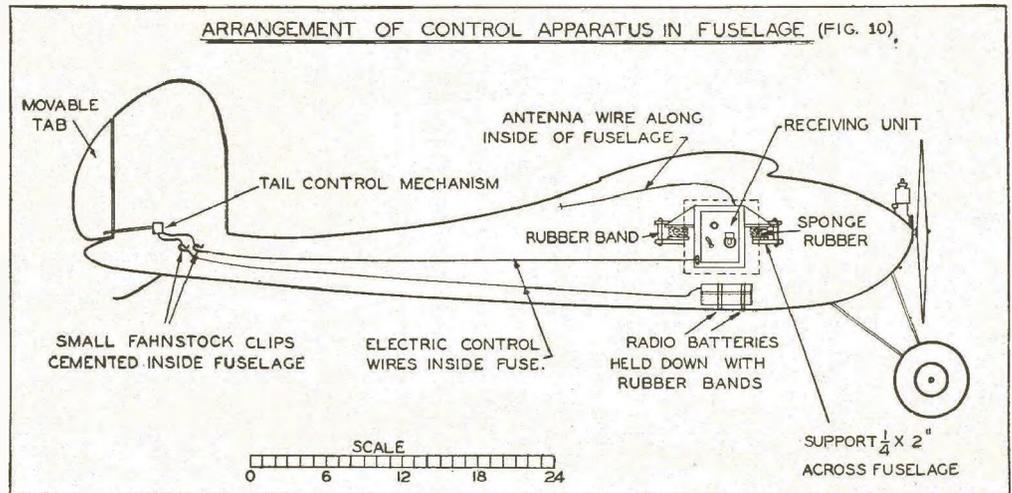
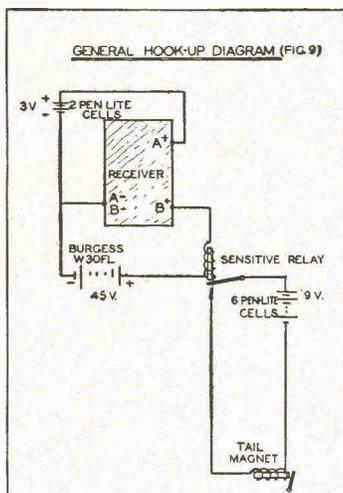
The field iron pieces are made of $\frac{3}{32}$ " sheet soft iron bent into a U shape. The contact screw supports are nuts soldered to the field pieces. Any small screws and nuts will work.

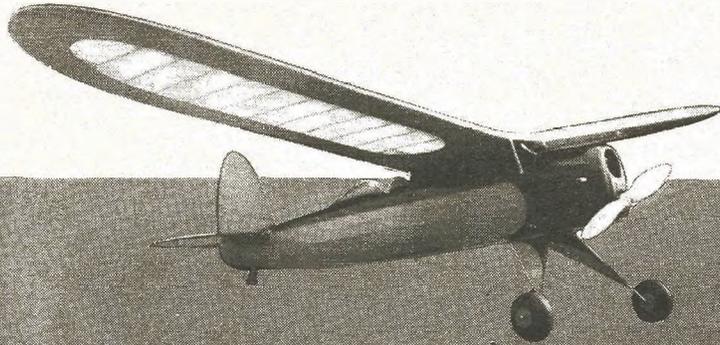


The transmitter, showing control buttons. The top photograph on page 50 shows it in right, foreground.



The receiver, ready for installation. The method of mounting it in the fuselage is compact and simple.





A modified California Champ built by John Sniegowski, Warsaw, Wis. Cyclone engine; wing span 69".

model

New developments in model building; new ships, designs and ideas. Contests and coming events: Send in your news notes and photographs.

SCRIPPS-HOWARD NATIONAL AIR RACES. The annual Junior Aviator Meet, held in Akron, O., during September, was the meeting place of more than 400 contestants from 15 States and 67 cities. Bill Ward came all the way from Balboa, Panama Canal Zone. Walter Good of Kalamazoo set up a new gas model record of 24:04. He was flying his Brown-powered model "Guff." Good won a week's trip to Hollywood via United Air Lines. It was interesting to learn that Harlan Gurney, the pilot of the United airliner on Good's trip West, was an ex-modeler whose interest in aviation can be traced to building models as a boy.

Winners of the meet:

Junior Fuselage—1. Robert Pfeiffer, Cleveland, 3:37; 2. William Kalman, Akron, 3:15.
Senior Fuselage—1. Anthony Kazlouskas, Akron, 22:56; 2. Ted Just, Pittsburgh, 15:27.
Open Fuselage—1. Mike Karlak, Cleveland, 11:36; 2. Arthur Eck, Johnstown, Pa., 11:05.
Speed Race—Three-cornered tie of 60.02 m.p.h. between Jerry Kolb, Cleveland; Edward Smith, Pittsburgh; Richard Korda, Cleveland.
Junior Stick—1. Don Kowalick, Rockford, Ill., 4:21; 2. Edwin Istvan, Cleveland, 3:00.
Senior Stick—1. Edward Smith, Washington, Pa., 11:57; 2. Edward Naudsius, Detroit, 9:25.
Open Stick—1. Len Becker, Lakewood, O., 6:19; 2. Leo Bailey, Akron, 5:09.
Senior Gas—1. Jack Deitz, Cincinnati, 16:48; 2. Robert Hoffmeyer, Akron, 4:12.
Open Gas—1. Walter Good, Kalamazoo, 24:04; 2. Carl Goldberg, Chicago, 8:15.
Original Design—1. Tasso Pappas, Akron, helicopter; 2. Ray Campbell, Cleveland, Wing extension.

Exhibition Scale—1. Peter Zaleski, Cleveland, Boeing P-26A; 2. Max Sokol, Hamtramck, Mich., Stinson Reliant.
Flying Scale—1. Richard Korda, Cleveland; 2. Toful Petraitis, Akron.

STANDARDIZED MARKING SHEET. Mr. K. G. Simpson, principal of the Riverview School, Verdun, Quebec, Canada, sends out a request for a standardized marking sheet for judging solid and flying scale model contests. He writes: "These contests, while held to encourage the hobby, are managed in a most amateurish fashion. One feature which allows for considerable improvement is the marking and grading of entries. I am most interested to know more finished and accurate methods of marking these, such as might be used by long-established leagues. Can you assist me in this matter so that I may prepare a standard detailed mark sheet, and thus achieve uniformity in judging?"

Scale modelers are urged to send in their ideas for working out a standardized marking sheet that will aid all contestants.

NEW YORK STATE FAIR MODEL AIRPLANE MEET. Held on September 4th at Syracuse Airport and sponsored by the Syracuse Model Airplane Club, this meet was highly successful. Winners were:

Gas Model Event—1. Roger Desbrosses, N. Y. C., 3:10.8; 2. Larry Low, N. Y. C., 2:11.8; 3. Kale Harden, Binghamton, 1:31.
Stick Event (Senior)—1. Robert Dillman, Syracuse, 2:00; 2. Kale Harden, Binghamton, 1:51; 3. Martin Dotsko, Binghamton, 1:27.3.

1. Just to prove that champions are like the rest of us, Chester Lanzo holds his broken gas job.

2. Taking out the bugs. Vern Anthony and a fellow club member concentrate on a balky engine.

3. Pete Dillon, veteran gas modeler, and his latest design. The plan form of wing is interesting.

4. The Flying Snyder's of Modelcraft. Mr. and Mrs. make a point of entering all major contests.



1



2

matters



The Inspirer, by Howard Adams. Ship was seen at the Nationals. Design was Francis Tlush's. Plans appeared in the Oct. and Nov., 1937, issues.

Cabin Event (Senior)—1. Clement Buell, Binghamton, 2:05.6; 2. Raymond Darling, Utica, 1:55.2.
Stick Event (Junior)—1. Donald Pratt, Bainbridge, 1:17; 2. Patsy Fiumano, Syracuse, 1:07.
Cabin Event (Junior)—1. Patsy Fiumano, Syracuse, 1:22; 2. Edward Izzo, Syracuse, :40.
Exhibition Scale Contest (Senior)—1. Max Sokol, Hamtramck, Mich., Stinson Reliant 2. Chas. B. Hawley, Syracuse, Seversky P-35.
Exhibition Scale Contest (Junior)—1. William H. Lacey, Syracuse, Seversky P-35; 2. Jack Daugard, Syracuse, Super-Ace.

The Senior high point winner was Kale Harden; Junior high point winner, Patsy Fiumano.

A 27-m.p.h. wind made flying difficult. Five thousand spectators turned out to watch the events. The entries were even greater than the State Fair Meet of 1937. There were 64 stick models, 69 gas models, 68 cabin models, 16 scale models.

The meet was under the direction of Harry C. Copeland.

ATLANTA AERO ENGINEERS. Meet held at Atlanta, Ga., on September 5th. Results were as follows:

Construction Event (Senior)—1. Jack Brittain, Atlanta; 2. Connie Cariness, Atlanta; 3. Jim Lovett, Atlanta.
Flying Event (Senior)—1. Jack Brittain, Atlanta; 2. Albon Cowles, Atlanta; 3. E. C. Wasman, Jacksonville, Fla.
Construction Event (Junior)—1. Ralph Blanchard, Atlanta; 2. Weyman Gibson, Atlanta; 3. Robert Hogsed, Gainsville, Ga.
Flying Event (Junior)—1. Robert Hogsed, Gainsville, Ga.; 2. Robert Davis, Austell, Ga.; 3. Roy Stripling, Atlanta.

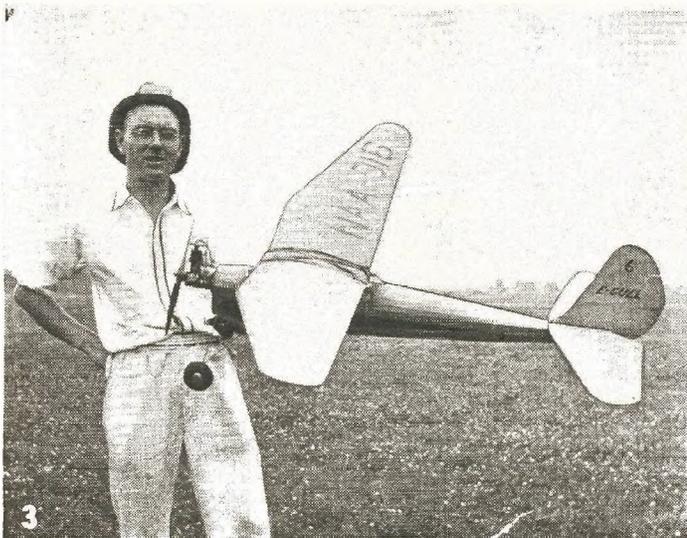
J. K. Coppage is director of the A. A. E., one of the first N. A. A. gas model chapters in the South—having obtained their charter in December, 1937. This meet will be an annual event and in all probability will be held early in the summer in 1939.

GAS BUGS ANNUAL MODEL CONTEST. Held at Machesney Airport, Rockford, Ill., on September 11th, with the following results:

Open Event—1. Alvin Anderson, Chicago, 3:02.3; 2. Ed Conefes, Chicago, 2:27.3.
Wing Area Over 300 Sq. In.—1. Kenneth Lane, Milwaukee, 2:14; 2. Vladimir Vana, Chicago, 1:47.
Wing Area Under 300 Sq. In.—1. Ed Schunk, Milwaukee, 1:55; 2. Melvin Yates, Joliet, Ill., 1:40.6.

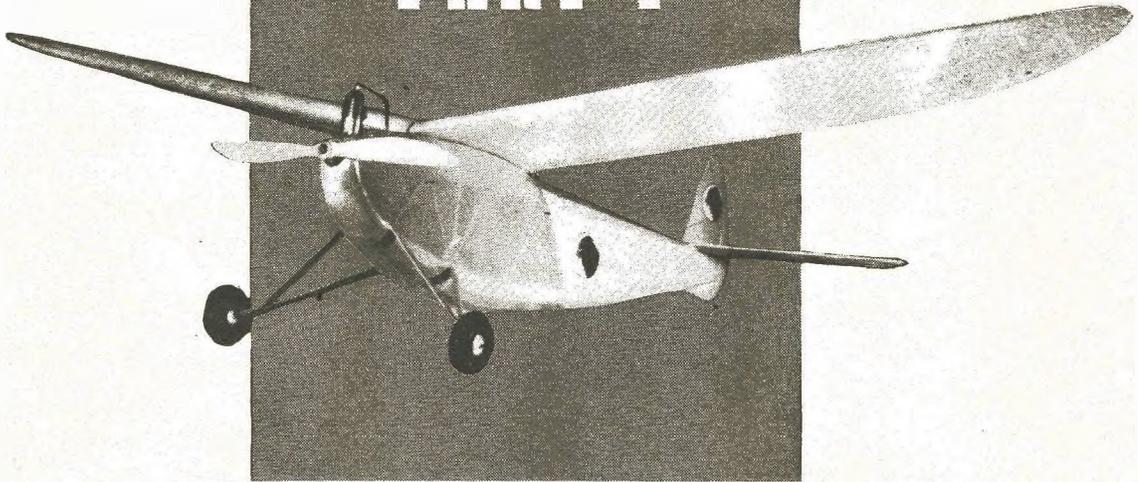
Best flight was made by Bob Schade of Rockford, Ill., with 1:54.3.

(Turn to page 89)



THE LACKEY ZENITH

PART I



The Zenith, winner of the Senior Gas Model Event at the 1938 Nationals, was designed primarily as a contest model. The flight which made the first place was not the result of an overabundance of good luck, but represented the culmination of many months of labor, physical, oral, and mental on the part of William Lackey and Ed Manthy, designers and builders of the model.

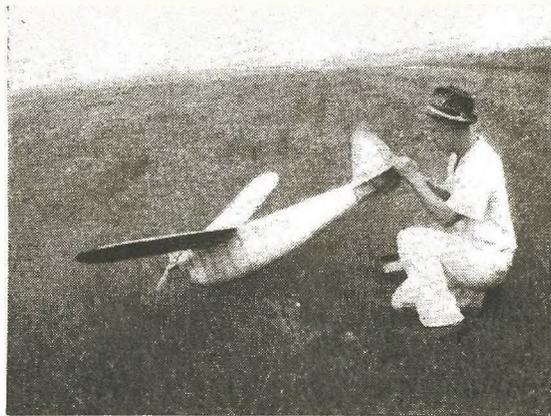
The ship was an outgrowth of a "test" model from which its two outstanding characteristics, durability and efficiency, were incorporated. On this test model, wing and tail sections were changed, structure was hashed and rehashed, and the wing position was varied from high wing to semiflush. Better performance was obtained with the wing in the latter position.

The original ship ran all the gantlets of model planes and survived them all. On some of its flights, numbering well over one hundred, it has picked for landing spots trees, telephone wires, and a lake. It also has had its share of ditches, plowed ground, haystacks, and shrubbery, all of which the model has accepted as a matter of course. Between times it has made consistently good flights, turning them in in the ratio of gliding time to time under power of eight to one, without the help of thermals. It has in its contest life to date never placed below third.

In building this ship, follow the instructions carefully. This model, when completed, should give you many hours of flying pleasure.

by **BILL LACKEY**
and **ED MANTHY**

A national champion, winner of the senior gas event.



The Zenith combines streamlining with simplicity.

CONSTRUCTION

The longerons are $\frac{3}{16}$ " square balsa, and should be straight, straight-grained, and hard. Uprights and diagonals are of the same material, except the two pieces of $\frac{3}{16}$ " x $\frac{1}{2}$ " base at the nose. Pin temporarily, to the top longeron, a strip of pine (about $\frac{1}{2}$ " in thickness by 4' in length) to keep it in a straight line while forming the sides. The sides are constructed by turning one over upon completion and building the other on it, using wax paper between them to prevent their sticking together when cementing the uprights in place.

Before joining the two sides together, form the landing gear of $\frac{1}{8}$ " music wire. If desired, the front strut may be made of $\frac{3}{32}$ " wire, as most of the shock in landing is taken care of by the rear strut. Bind the front strut to a $\frac{3}{16}$ x 1 x $2\frac{15}{16}$ " piece of bass with two layers of linen thread, and the rear strut to a piece of bass $\frac{3}{16}$ x 1 x $3\frac{5}{8}$ " with three layers of linen thread for about a quarter inch at the ends of the bass piece. Cover the bindings with several coats of thin cement.

Draw a straight line a little longer than the fuselage on the wax-paper-covered working surface. Place the two sides, top down, on either side of this line. When cutting the cross pieces, make two at a time, and on one of them mark the exact center. Starting at the widest part of the fuselage, cement in the cross pieces, with those marked, centered on the straight line. Rubber bands may be used to hold the framework together while the

cement is drying. Check the sides with a square to see that they are at right angles to the working surface. Cement in the remaining cross pieces, with the landing-gear assembly taking the place of balsa pieces at those positions. The landing-gear joints at the wheels may be bound with tinned wire and soldered.

All right-angle joints in the fuselage should be pinned with steel, rather than brass, pins about 1" in length. Use two or three pins in the bass pieces at the nose and landing gear. The firewall of 3/8" three-ply hard plywood may now be securely cemented in place.

Carefully cut out all the bottom formers and cement them in their proper places perpendicularly to the stringers. Of course, the stringers have not been put on yet, so just estimate the perpendicularity. All seven stringers are 1/8 x 3/16" medium balsa, and are spaced evenly around the formers. Cement the center stringer in place first, starting at BF-11. Two of the stringers may be ended at BF-9, and two more at BF-10.

The sub-rudder is made of 3/16" hard balsa. Plank both sides of it with 1/16" sheet at cross grain, and sand to shape after cementing them in place. The fillets on either side of the sub-rudder back of BF-11 are built up from very soft 1/4" balsa sheet, and are also sanded to shape when in place.

The fuselage may now be turned over, and the top formers should be cut out and cemented into place. There are five stringers from F-6 to F-11 (top); seven on bottom. Cement the center stringer, which extends from F-7 to F-11A, in place first, and then add the two stringers which pass along the wing mount on either side from

F-7 to the firewall. Plank the top of the fuselage above the top longeron from former F-1 to F-6 with 1/8" sheet balsa, leaving an opening in which to install the timer. Additional bearing surface for the wing is formed by cementing balsa sheet on both sides of F-3 at the top and cutting to shape when dry. Do the same with F-6 on the forward side only.

The wing and stabilizer hooks are made of 5/64" drill rod, and are cemented into place. The wing hooks go through the fuselage and project 1/2" on either side of it. The front stabilizer hook projects only 3/8" on each side. The rear stabilizer hook is driven into a 1/16" hole carefully drilled into the sub-rudder parallel to the top longerons.

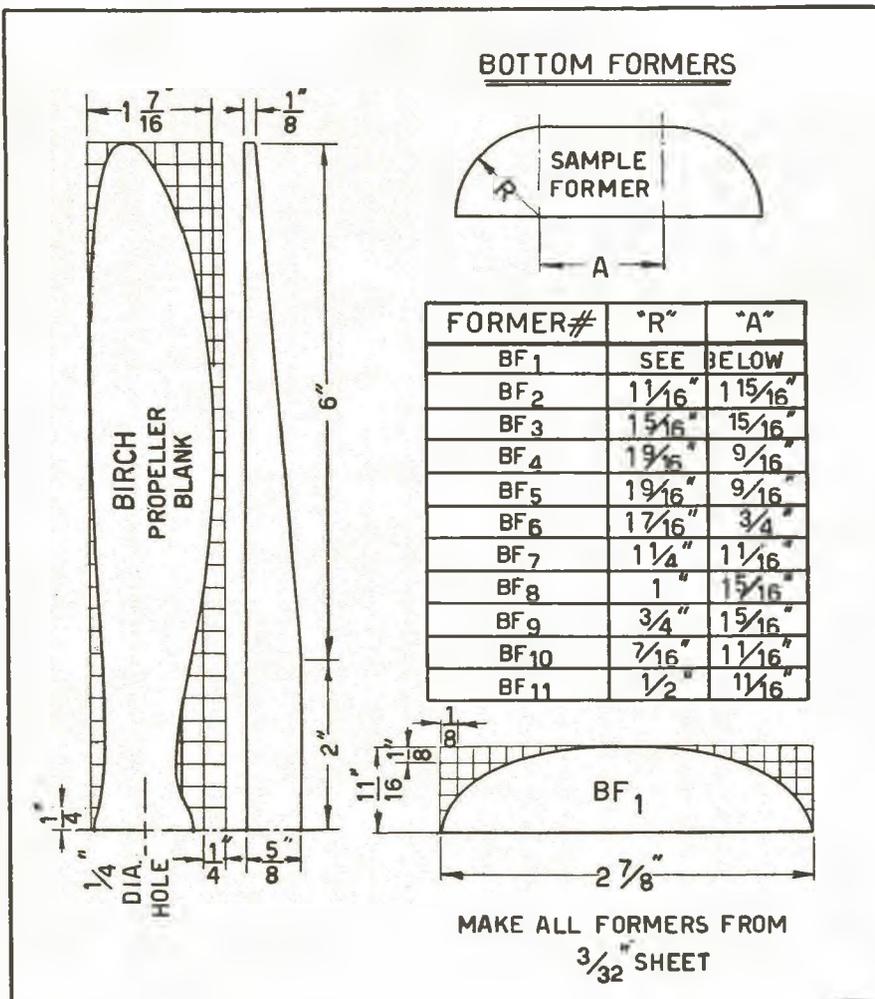
The coil, condenser, and battery box may be mounted in any desired manner, with enough separation so that high-tension leakage does not occur. In the original model the coil and condenser were bound with linen thread to pieces of hard balsa, which was cemented crosswise to the fuselage diagonals and longerons. The battery box should not be permanently fastened until the test flights have been made.

The motor mount is made of 1/16 x 3/8" half-hard brass, and is a very efficient type of mount. Should the prop stop in an upright position and catch on the ground in landing, the mount will bend enough to save the prop and the lugs on the motor. It can easily be straightened, and while zero thrust is best, a variation of from 2° positive to 10° negative thrust will make little difference in performance.

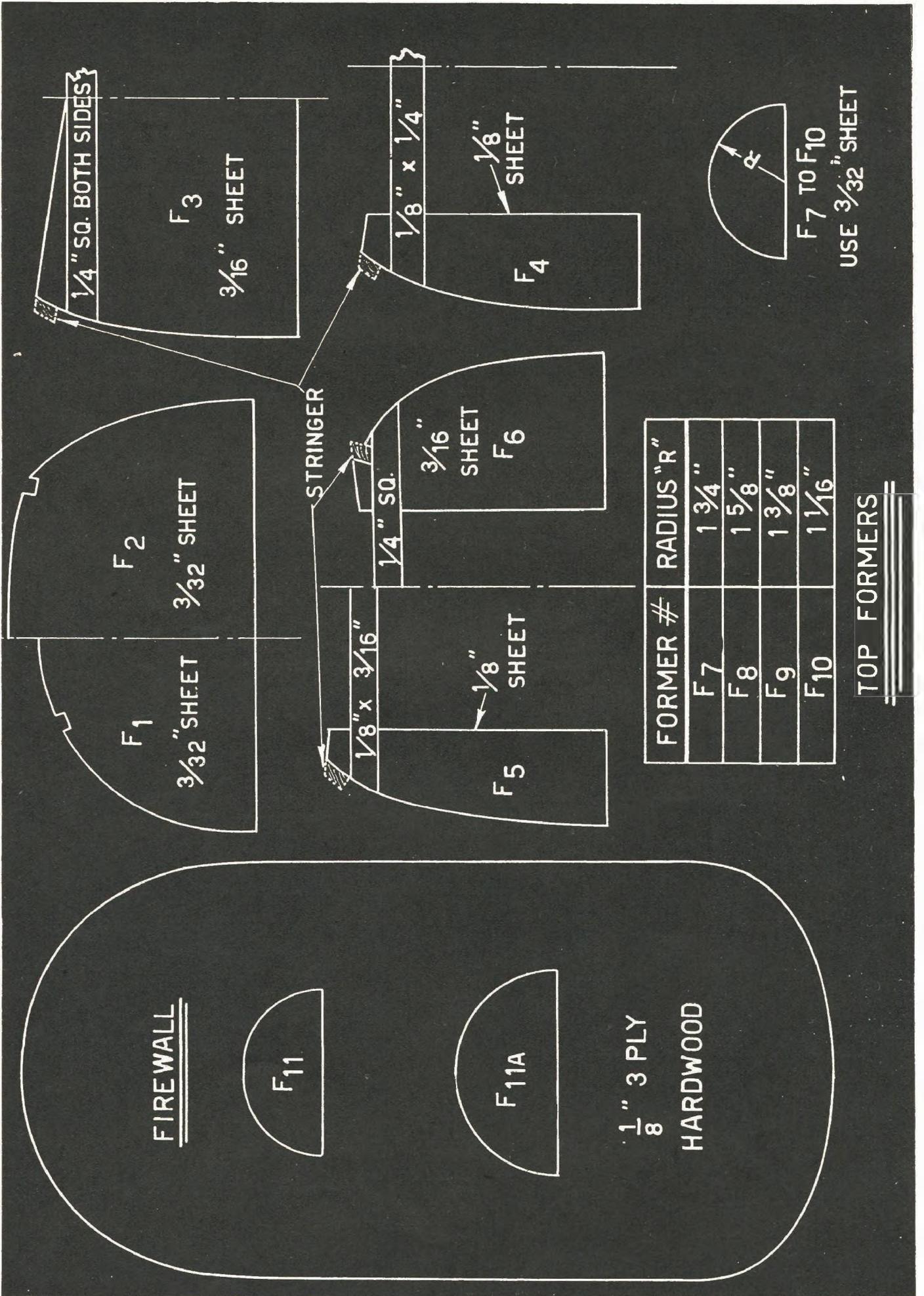
The brass is cut to length (see diagram for sizes), drilled and bent, and fastened to the firewall with 1/8" diameter brass bolts. The holes for these bolts should be drilled a trifle small, and as accurately as possible. Make sure the holes pass through the upper brass cross piece, and the lower holes pass through the piece of brass, threads and all, to which the front landing-gear strut is bound. Install the mount with the nuts on the inside of the fuselage, and after placing the ground wire under one of them, cement them well. The mount may then be removed if necessary without disturbing the nuts.

Complete the wiring, using standard wire with good insulation. To forestall ignition failure within the fuselage, solder all joints and connections. The spark-plug wire is brought out through the planking at the left side so as to be out of the way when adjusting the motor. The timer wire is led through a small hole in the center of the firewall, low enough to clear the gas tank. To facilitate the removal of the motor, this wire is not soldered to the motor points. Instead, solder a two-inch length of standard wire to the points and make the connection with a twist joint.

Cover the fuselage with a good grade of bamboo paper. The top and bottom may be cov- (Turn to page 88)



FORMER#	*R*	*A*
BF 1	SEE BELOW	
BF 2	1 1/16"	1 15/16"
BF 3	1 5/16"	1 5/16"
BF 4	1 9/16"	9/16"
BF 5	1 9/16"	9/16"
BF 6	1 7/16"	3/4"
BF 7	1 1/4"	1 1/16"
BF 8	1"	1 5/16"
BF 9	3/4"	1 5/16"
BF 10	7/16"	1 1/16"
BF 11	1/2"	1 1/16"



REAL indoor flying scale models are rare birds. The scale model usually palmed off as an indoor model is heavy enough to fly outdoors in a stiff gale.

The Heath Midwing makes a particularly good indoor scale model as it is very simple in design and construction. It has no fancy doodads, such as a more intricate airplane would have, and which, when left off, would make it look incomplete. Yet, when built, it looks very much like a real airplane.

Our model has a tissue-covered fuselage and microfilm-covered surfaces. The film, however, is not the ordinary kind, but is of a solid color. How to make it will be described later.

FUSELAGE

Make a full-size drawing of the fuselage sides and build them up of $\frac{1}{16}$ " square balsa and cement the bulkheads in place. After the cement has dried, cut away enough of bulkheads 1, 2, and 3, and the cross braces, so that the rubber can get freely from the propeller to the rear hook.

Carve the nose block out of very light balsa, leaving a thin shell approximately $\frac{1}{16}$ " all around. The plug, which is an aid to winding and changing the rubber, should be cut out next. After the nose block is finished, cement it to the fuselage framework and then cement the three upper and two lower $\frac{1}{20}$ " square stringers in place. Draw the cockpit section full size, make one out of heavy white paper, and cement it in place. Make the rear hook as shown in the drawing, and cement it also in place. Now cover the fuselage with superfine tissue by coating the longerons and cross braces with banana oil or microfilm solution, and laying the tissue over the

wet surface. Make sure that there are no wrinkles in the tissue, and then trim the excess off. Spray the tissue with water to tighten it.

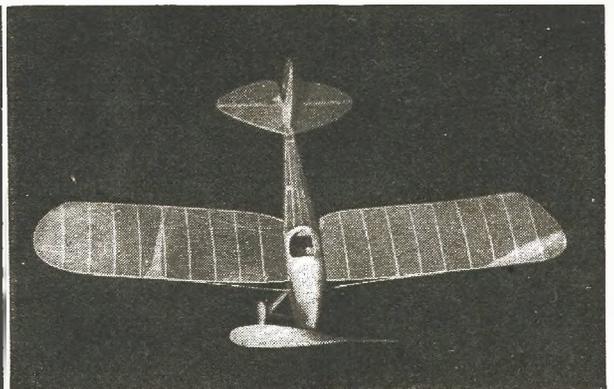
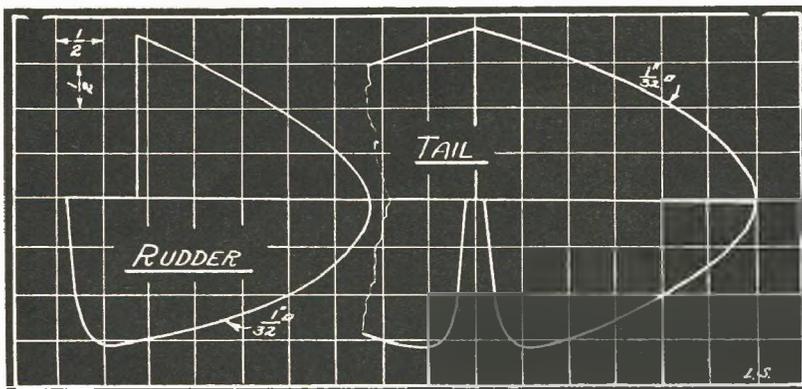
The main landing-gear struts are made by streamlining $\frac{1}{16}$ " balsa sheet, $\frac{3}{16}$ " wide and $1\frac{7}{8}$ " long. The auxiliary struts are $\frac{1}{32}$ " square strips of bamboo. Cement the wire axles in place, slip the streamlined wheels made of sheet balsa $\frac{3}{4}$ " thick and $1\frac{1}{8}$ " in diameter, on them, and put a dot of cement on the ends of the axles to prevent the wheels from coming off. The fuselage is finished by cementing the bamboo tail skid in place.

WING

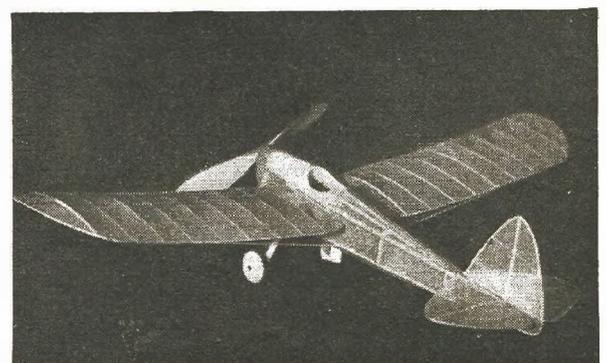
The wing is single surfaced and of light construction. On the real plane it is braced with "N" struts, but on the original model only two struts were used. The wing, as mentioned above, is covered with a semi-opaque-colored microfilm.

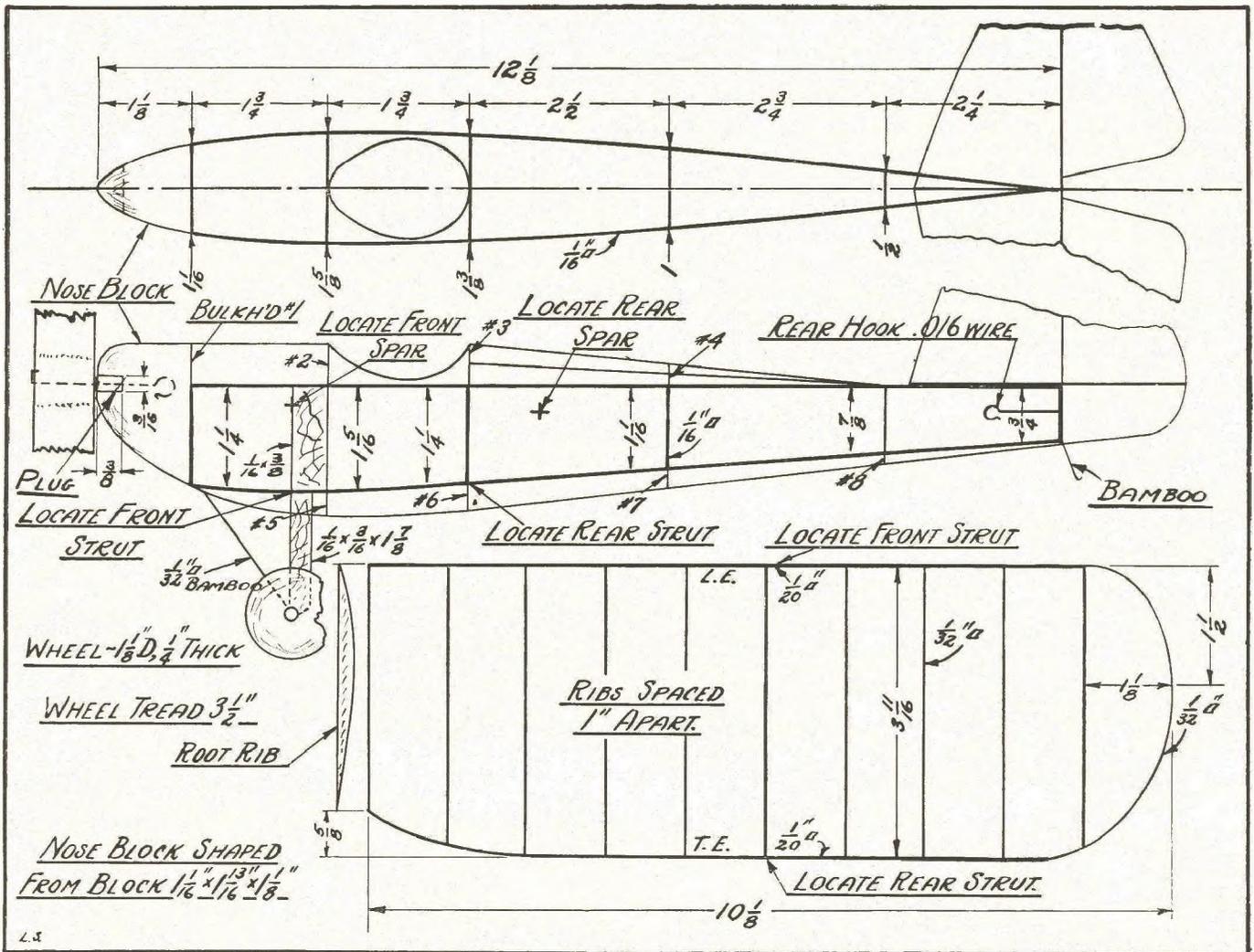
In constructing this model it is first necessary to make a template of the ribs from stiff cardboard. Cut out the twenty ribs by the usual procedure from $\frac{1}{32}$ " sheet balsa by slicing along the edge of the template, and then sliding the template down $\frac{1}{32}$ ", but parallel to the first cut, and slicing again. The spars are $\frac{1}{20}$ " square and are pinned to the full-size drawing of the wing. The tips are made by bending $\frac{1}{32}$ " square strips of soft balsa around the cardboard template, and should be cemented to the spars. Insert and cement the ribs, making sure to cut a third of any excess length from the front and two thirds from the rear. The microfilm is made by mixing well a half ounce of good colored dope and a half ounce of microfilm solution and pouring it on the water in the usual manner. (Turn to page 73)

H E A T H M I D W I N G



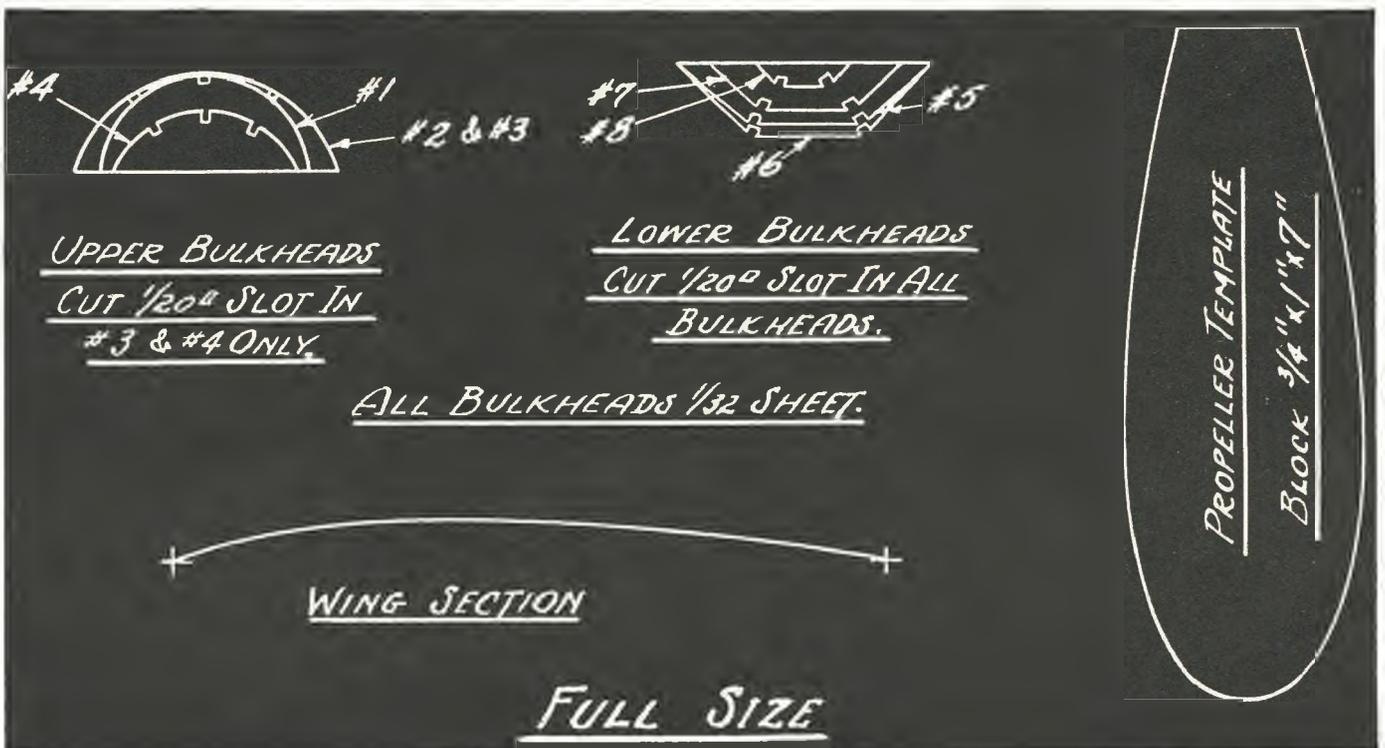
Much pleasure can be derived from an indoor flying scale model. The Heath Midwing proved itself an excellent flier, stable and reliable. The two characteristic poses—right—show the pertinent assembly details and the opaqueness of the microfilm-covered wing and tail. Fuselage is covered with superfine. This ship is capable of nearly four minutes' duration.

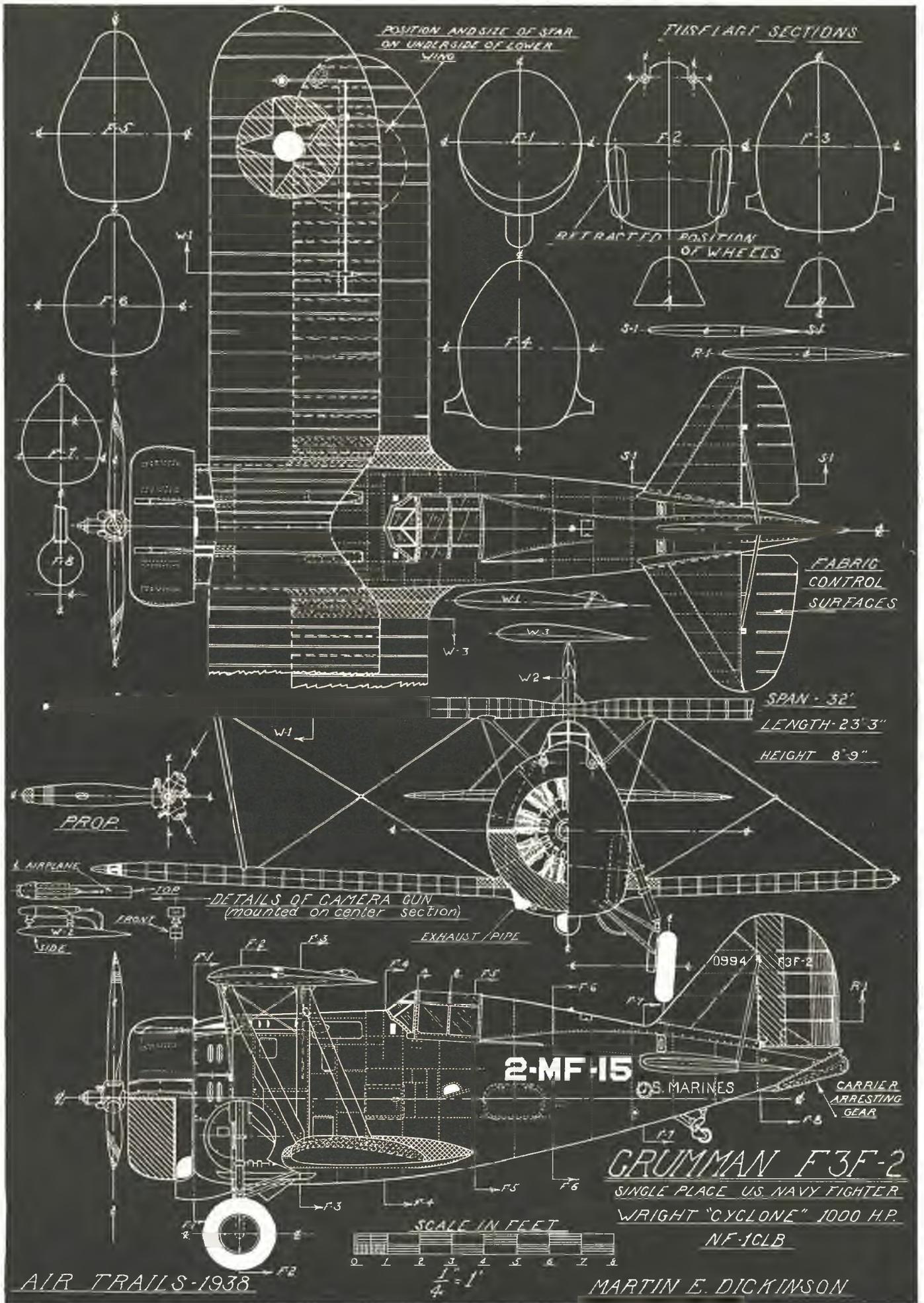




A novel construction feature in the form of an indoor flying scale model.

by **LAWRENCE SMITHLINE**





SELF-STARTER FOR RUBBER-POWERED MODELS

A unique and realistic little gadget for the remote control launching of any rubber-powered job.

By LOUIS GARAMI

REALISM creates and sustains interest in model building. The greater the similarity of a model to a real plane, both in flight and on the ground, the greater the satisfaction of the builder with his brain child.

Once in the air, a stable model is always thrilling to watch. What would be probably the most graphic phase of the model's flight, the take-off, loses its spectacular qualities because of the proximity of the launcher.

Much fun can be had from launching a model without a push. A device to permit remote control would greatly enhance the real-plane qualities of a model. The ideal, of course, would be some gadget that would suspend propeller rotation for a few seconds, and then, just as is the case with the prototype, release the motor gradually at first, letting it steadily gain speed until the ship rode forward tail-high for the take-off.

Complicated requirements generally result in a device that is even more "screwy" than the idea. Such is not the case with this self-starter mechanism. Its theory is practical, and its method of operation proved fool-proof. An added asset is the ability to take adjustment for shortening or lengthening the "idle" seconds before the propeller spins into life.

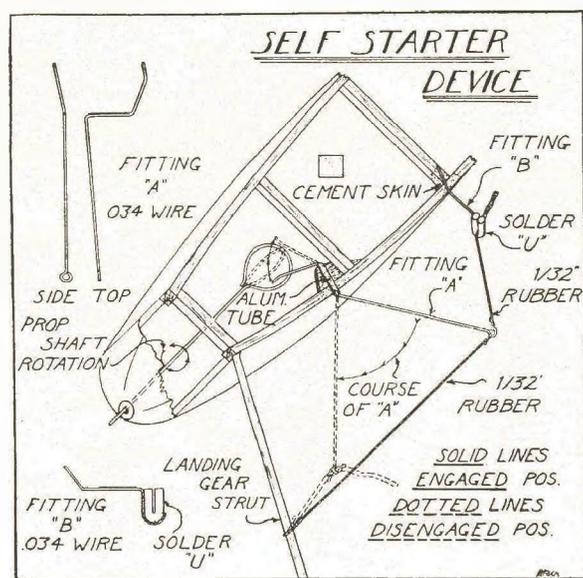
This little gadget will add that realistic touch to the performance of any flying model. It is really a self-starting device, since it does delay the start of the fully wound model from five to forty seconds. Just "jazz up" your model, adjust for a short or long delay, and place her on the tarmac. First the prop will make a very slow quarter turn, and then . . . *Whee-e-e-e!* Away she goes, all by herself!

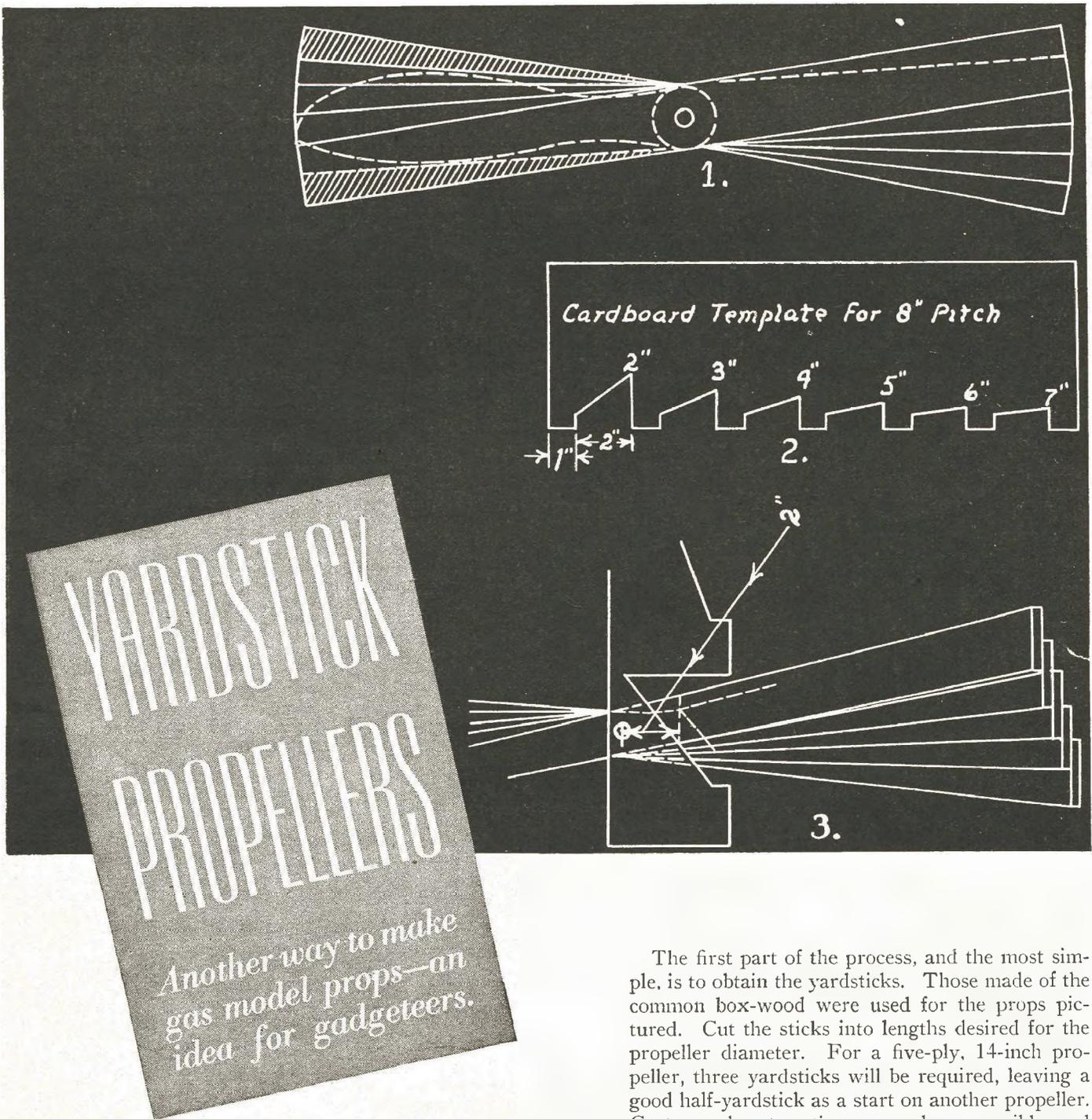
Besides being simple, it can be adapted to any model providing the principle upon which it works is well understood.

When the motor is wound, the rubber develops an anti-clockwise force. A piano wire leaning against the prop shaft keeps the motor from revolving, and at the same time transmits this force to the outside of the plane. This wire runs through a bearing which is anchored to a longeron, or other strong part. While the rubber torque is lifting the interfering wire, the straight part of the wire (outside the plane) has a greatly reduced pressure because of its longer leverage.

The end of the wire is formed into a hook. The two short lengths of rubber attached here do the timing. In action the rear one is pulled into the U-shaped solder, which is bent so that it pinches the rubber slightly to reduce the speed of its slipping through. The length of this rubber can be determined only by trial. It should terminate just before the wire moves clear of the prop shaft. In this crucial moment the front rubber helps to snap the wire away from the whirling prop shaft. By using a short end-part of the rear rubber for action, a short delay is accomplished, while the full length will produce a long one.

I had the pleasure of demonstrating this self-starter to the Air Trails model staff. Their interest in its realism and fool-proof action led to the presentation of this article. The simplicity of the gadget and ease of construction add materially to the pleasure of applying it to any or all models. Any comments, suggestions, or criticisms would be appreciated.





By M. O. HOLMES

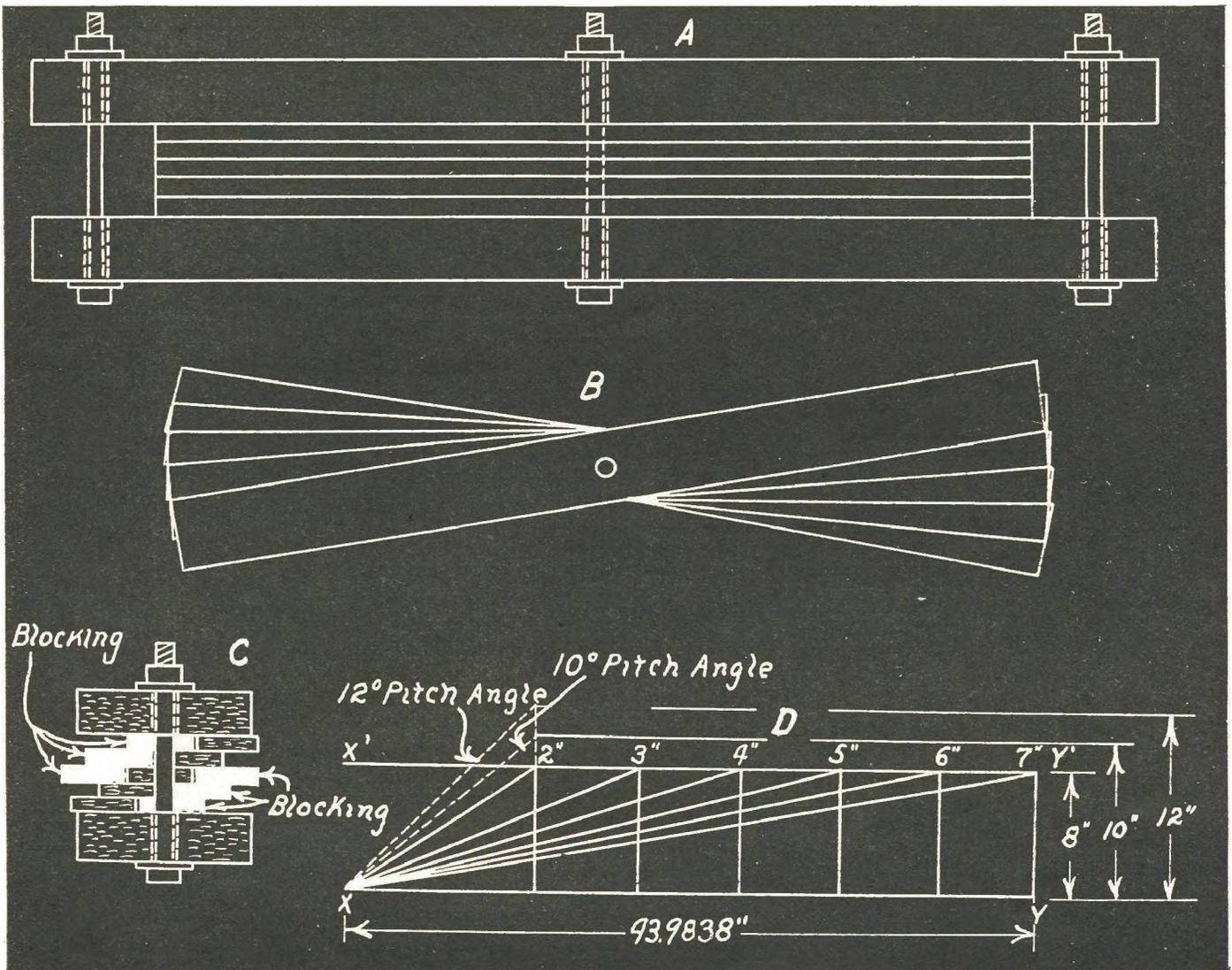
The fact has been stated by many that the propeller is the part of the gas model job that comes to grief the most often. This being the case, it's a matter of economy and much added creative pleasure to make your own propellers. These are easily made, and you can experiment to your heart's desire on various lengths, pitches and shapes.

When a pal, a gas model fan, suggested an extra prop or two for the trying-out process of a new model which had been recently completed, an assortment of yardsticks, glue, clamps, sharpened knives and cardboard for templates was assembled.

The first part of the process, and the most simple, is to obtain the yardsticks. Those made of the common box-wood were used for the props pictured. Cut the sticks into lengths desired for the propeller diameter. For a five-ply, 14-inch propeller, three yardsticks will be required, leaving a good half-yardstick as a start on another propeller. Center each cut section as nearly as possible, and drive through each, one at a time, to aid in getting the shaft hole at right angles to the blades, a small nail, not too large to endanger splitting the wood.

Next comes the clamp, with which to press the layers together while the glue is setting. Two hard-wood pieces, $2\frac{1}{2}$ inches wide by 1 inch thick and about 18 inches long, were used to make the press, or clamp. A hole was drilled an inch in and on center from each end of both pieces, $\frac{3}{8}$ inch in diameter, to accommodate easily the bolts used. $\frac{1}{4}$ inch in diameter and $3\frac{1}{2}$ inches long. The exact center of these pieces was likewise drilled, exactly vertical, with a $\frac{1}{4}$ -inch drill.

Now, each section of the propeller is drilled with the $\frac{1}{4}$ -inch drill, using the nail holes as guide. This will make a tight fit for the center bolt. Powdered glue was obtained, though prepared glue will probably serve as



well. Place one section of the yardstick over the center bolt on the bottom half of the clamp, and coat with glue, adding one section at a time, being sure the glue is well spread between the surfaces by gently working each layer on the one next beneath. When all five layers are glued, spread fan-wise the ends of the sections, each section allowing half of the one beneath to show at the end. See illustration (B). Put on the top half of the clamp, setting up the center bolt only.

With the short waste pieces left from each yardstick, cut sections about an inch long, and place under the ends of the layers for blocking, otherwise the propeller will tip at each end, and besides being twisted, will not glue together properly. See illustration (C). Tighten the end bolts and set away to dry.

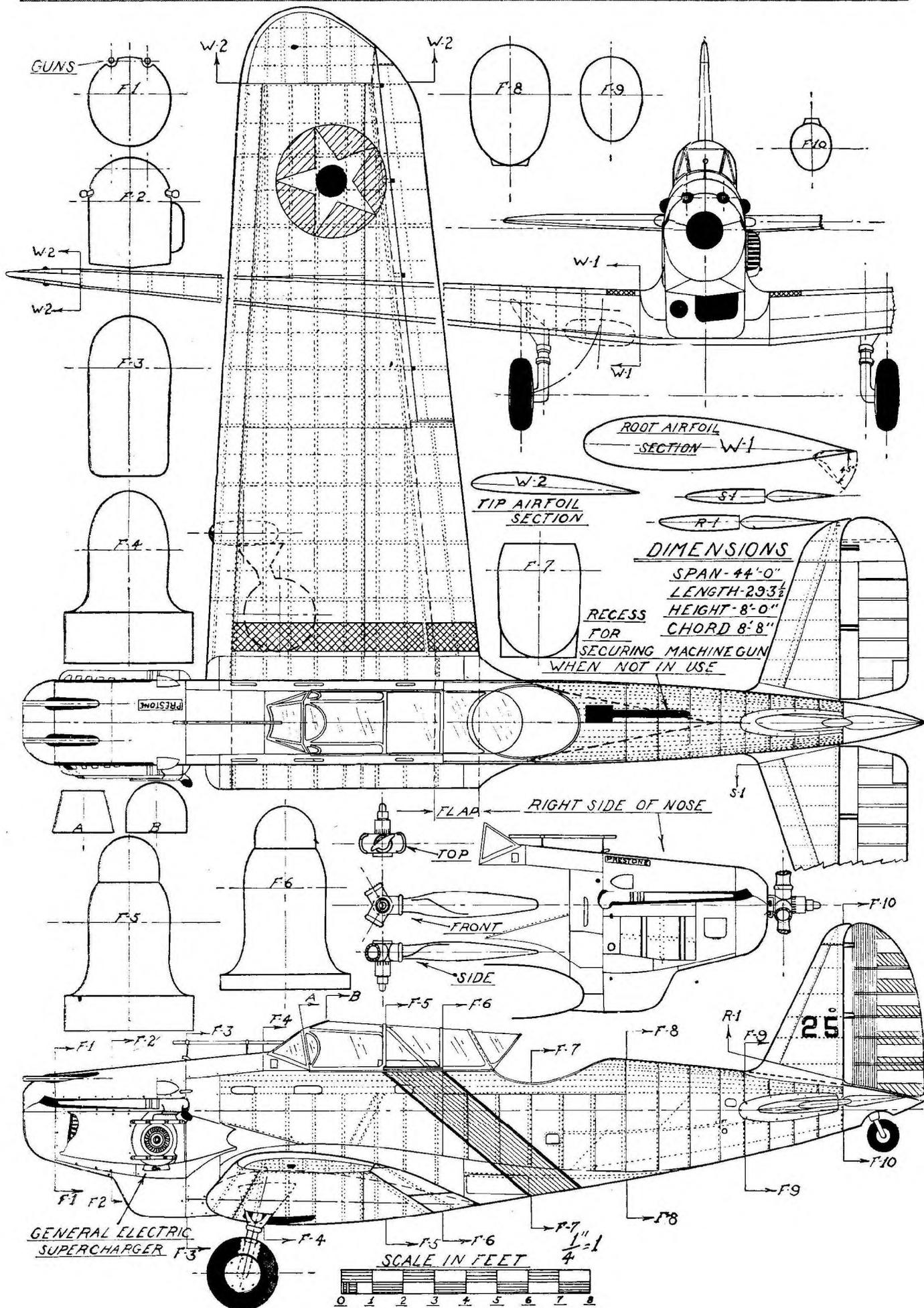
With the propeller blank out of the way, for the time being, now is the time to make the template for the proper pitch. The pitch is the distance the propeller will screw through the air in one revolution, supposing the air to be solid. Now to figure out the pitch angle. The propeller will be accurate if template measurements are taken along the blade at inch intervals, beginning at two inches from the hub, or shaft hole.

Starting with the first angle at 7 inches from the hub, the diameter of the circle the spinning propeller will make

is 14 inches. Multiplying this by Pi (3.1416) to get the circumference, we have 43.9834. Using this as a base-line upon which to erect a triangle, we find it much more convenient to convert to a smaller scale. Dividing by 4 gives us 11, an amount or line length more easily put on paper. See line x-y in illustration (D). Next, we draw another line parallel to this one, a distance above it according to the pitch you have decided to use for your propeller. Let's use an 8-inch pitch, just for example. This will give an 8-inch line, which, when reduced to our scale, puts the second line, x'-y', 2 inches above. A 10-inch pitch, when reduced to scale, would have put x'-y' 2½ inches above x-y, and a 12-inch pitch, 3 inches. Connect the two parallel lines with a vertical line y-y' at the right-hand end. Now connect y' with x by a straight line y'-x. This line gives the angle for the blade pitch 7 inches from the propeller hub. To get the angle at 6 inches, use our formula $2xR \times \text{Pi}$, which will be $2 \times 6 \times 3.1416$, or 37.7000. Dividing this by 4 to get back to our scale, we have 9.425 inches, continuing, as before, to point x on our first line. Using the formula, do the same for 5, 4, 3 and 2 inches from the hub.

Marking these angles on a cardboard, and cutting out, will produce the template for a 14-inch propeller, with an 8-inch pitch. See illustration (2). (Turn to page 97)

CONSOLIDATED PB 2A · · U. S. ARMY BIPLACE PURSUIT



FAREWELL TO BALLOON RACING

(Continued from page 19)

the wild Ozarks below less than did I, for he had been fortunate enough to escape with his life when such a sky dervish wrecked eleven of fourteen racing balloons near Pittsburgh two short years before.

If we could elude the line squall and hold on for another hour or two, the stuff might flatten out, contracting as the sun moved westward. In case of such good fortune we might float on for another twenty-four hours with the only discomfort being minor hunger and thirst by reason of having jettisoned our food and water. We could but try.

Then came a sudden warning of new danger. We had tied off the appendix of our balloon, which actually is the safety valve, to conserve every foot of hydrogen remaining. Noise of a sudden surging and straining in the bag above made us aware of our plight. The gas was expanding, the bag bulging swiftly as the internal pressure rose. That it did not burst its seams was due to quick action in yanking away the appendix tie-off. Like the famed whale of Cap'n Sims of New Bedford legend, the resentful balloon burped and belched furiously through its appendix for long seconds before we could breathe easily.

And then, as we relaxed from our fright, a perverse Fate took a hand in the race. Actually, I believe, we had both dozed off simultaneously. An icy cloud column struck us. I came back to consciousness at 8,000 feet, awakened by a sensation of what I recall as a rabbit punch at the base of my brain, the result of rapid change in pressure. My head ached painfully. "Eareck" was having the same experience as we emerged below the cloud ceiling in breathless descent remindful of an airplane power dive. Above our heads the once-taut bag flapped its lower half like a tent with stakes uprooted by a gale. But reassurance came as we saw the lower half blown up into the upper half, spreading itself to form a perfect parachute. The action braked the rapidity of our descent, otherwise it would have forced all hands to parachutes.

But we were not yet safe. At 4,000 feet downward movement was suddenly arrested, and we found ourselves being drawn across the sky at right angles to our former course. A triumphant roar told us what was happening. There, only a mile away, the line squall stalking us believed it had found its prey. In action like a whirlpool, it was sucking us into its coppery green maw, lightning glinting like golden threads in its spreading center. No, thanks! Together we reached for the valve rope, hanging on des-

perately. Dropping swiftly once more we escaped the pull. And by the grace of the special god of balloon racers, a clearing opened in the thick Ozark forest beneath, letting us strike earth with no more violence than to leave me with a displaced knee cartilage, and distributing minor abrasions and contusions impartially between Eareck and myself.

That was the last great national balloon race in this country. Its fourteen entries equaled the high point of post-war balloon racing here. It's a costly sport—each inflation representing \$700 for hydrogen alone, and of course there is no salvage. The depression and successive airship disasters resulted in dwindling interest in all lighter-than-air activities. For two years now no national balloon race has been held, and last year not a single American entry represented this country in the James Gordon Bennett international classic.

Yet America has provided the grandest balloon racing pilots in the world. Against the crack bubble skippers of all nations, American pilots have won more than a third of all the international balloon races ever held from the very first one in 1906. From 1926 until 1933 American pilots won every James Gordon Bennett race. Moreover, invariably American balloonists finished for place or show in all races held here or abroad.

Yet perhaps it is best that balloon racing be washed out. Certainly its high toll in lives lost and serious injuries aptly earned its descriptive phrase as "the most deadly air sport of all." Personally I have mourned many dear and intimate friends who perished in post-war balloon racing. There were Roth and Null of the navy, forced down in Lake Erie as they sought to stretch their distance to the Canadian shores without sufficient ballast, and were drowned. That same year Shoptaw and Olmstead of the army were killed by lightning during the James Gordon Bennett race which started from Brussels, Belgium. (Three other pilots in this race lost their lives as the result of a line squall.) Balloon racers, too, were two other departed army friends, Hawthorne Gray, who lost his life pioneering investigation of the stratosphere by free balloon, and young Neeley, who, with Meisinger, government meteorologist, after repeatedly taking off into squall formations to chart the unknown perils lurking therein, finally was killed by an angry storm god. These and many others died for a sport we all loved.

However, thanks be, there are still several figures from balloon-racing days left in the land of the living. There is,

for instance, Colonel Bill Kepner, remembered as pilot of the thrilling stratosphere hop when his giant bag tore itself to pieces coming down from twelve miles up. Together with my later companion, Eareckson, "Kep" won both the 1928 national and the James Gordon Bennett international of the same year. The latter event was won by the closest finish in racing history.

After two days and nights aloft the winners traveled 460 miles from Detroit to a Virginia town near the North Carolina border. A German team actually landed in the Tar-heel State, but farther to the west, and after experts had measured the distance, allowing for curvature of the earth's surface, the foreign contenders were found to have traveled only 459.4 miles, a margin of victory for Kep and Eareck of six tenths of a mile. The victors had earned their place. Without oxygen equipment, they had ballooned at 27,000 feet. Eareck had passed out cold for want of oxygen and Kep, gritting his teeth for physical strength and mental force to overcome his swimming consciousness, cracked the valve in time to get them down into safe air.

Out in St. Louis is aged but active old Cap Honeywell, winner of three national races and runner-up in some internationals. Ralph Upson, famed airship designer, winner of three nationals and the 1913 James Gordon Bennett, is also still with us, carrying on his scientific research.

On the bridge of a cruiser now, protecting American rights in war-torn China, is that salty veteran of stratosphere flying and balloon racing, Lieutenant-commander Tex Settle of the navy.

Tex piloted the famous early stratosphere hop from Chicago during the World's Fair, when his million-cubic-foot bag came down among a herd of switch engines in the railroad yards. After that mishap he took up a passenger in the salvaged equipment to above 60,000 feet, traveling from Akron to a point not far from the Atlantic Ocean. He later confided to me that stratosphere flying was a bore compared to balloon racing. Tex won two national races, one establishing an American distance and duration record—fifty-one hours drifting from Pittsburgh to Prince Edward Island, Canada. Bushnell was his aid. A few years later the same pair won the James Gordon Bennett starting from Basle, Switzerland, outpiloting the best balloon skippers of the world and landing only five miles from the Russian border in Poland. But that was not the race that lingers in the mind of Tex.

The Gordon Bennett starting from St. Louis in 1929 took place in skies crowded with lazy, wandering thunderstorms. Without oxygen equipment,

Tex and Bush stayed twelve hours above 20,000 feet, weak from lack of air and constantly nauseated by a particularly malodorous gas belching into their faces from the appendix. Not since he was on destroyer service out of Queenstown during the World War had Tex been so nauseated. He told me they even lost garters and shoestrings.

But the champion American pilot of all is Ward T. van Orman. He won four national races, three James Gordon Bennetts (four if one cares to count a highly technical disqualification), and rarely did he fail to place second when not finishing first.

Because his racing adventures illuminate the skill and courage which go into the making of a crack balloon racer, they are worth summarizing in brief detail.

In the tragic James Gordon Bennett race starting from Brussels in 1923. Van Orman's craft was swept into a raging thunderstorm. After riding the vortex of that crazy squall westward throughout the night, he found himself far over the Atlantic the next morning, with Usbant Light, on the French coast, sixty miles away, the last landfall. Van had figured on getting into a northerly trend out at sea which would carry him toward Ireland, or the British mainland. The wind failed to keep its date. The water-soaked balloon was forced to the waves. Then, like cavalry dashing up at the last moment in a melodrama, a pall of smoke appeared on the horizon. It was the steamship *Vaterland*. Espying the distressed balloon, the German skipper maneuvered into position so that Van, by discarding all removable weight as ballast, was able to accomplish a perfect landing on the hurricane deck. . . . He had traveled the greatest distance, but was disqualified for not ending his race on land.

Three years later at Antwerp, Van once more defied the elements at their worst, with rain cascading down and treetops shrouded in thick fog and clouds. Blinded by rain and black nimbus, he rode the howling gale northward through the night. "Couldn't see a thing when it got light," he told me later. "The stuff was right down to the sea. I figured we were over the Baltic and I wasn't sure we had enough ballast if we had to go to Finland to find land. The weather map indicated a due east wind. It was pretty high up, so we dug out our oxygen masks and went up after it."

Climbing out of the low-pressure area into the rarefied atmosphere four miles above, Van and his aid, Morton, found the air current they sought. Their rain-soaked clothing stiffening in the bitter cold, they rode the breeze westward for hours. Before midday they landed on the Swedish coast at Solvesburg, 535

miles from Antwerp. That was Van's first international victory.

In the 1928 national, Van's balloon was one of the fourteen whirled into the black heart of the vicious line squall which caused such havoc. Spinning like a top amid hail, rain and blinding snow squalls, while thunder roared deafeningly, the balloon refused to respond to valve or ballast. With all human control mocked by the inversion of currents from horizontal to vertical plane, the bag was whisked almost three miles skyward, barely missing collision with other balloons being tossed about in the contracting vortex. Through the squall's ceiling bags shot like peas from a blowgun, then, caught in the downdraft outside, were smacked to earth. Lightning struck Van's bag before it hit, killing Morton. In the crash Van was thrown clear, but both legs were broken and he lay unconscious for hours, unable to call or move before searchers found him in the rain-soaked field.

Van spent months in the hospital, yet the following year—still on crutches—he climbed into his basket to take off again. That was a snowy, blustery race in bitter cold. One racer, Hill, was forced down in the lonely Adirondacks by the weight of snow on his balloon, and spent two days getting out to civilization, footsore and hungry. Van, however, placed in the race. . . . Still using crutches, he won the James Gordon Bennett of that year, and again the next.

His last notable adventure attended the 1933 James Gordon Bennett which started from Chicago in early September. Through the night and all the following day he and his aid had battled squalls and storms, across the Great Lakes and far into northern Ontario. It was now growing dark, but somewhere in the wilderness another railroad line was indicated on the map. They would go on despite a shortage of ballast and cold air condensing their hydrogen. Not a habitation was in sight as a squall enveloped them. Once more lightning glinted about the bag, and from 8,000 feet a vertical current grabbed them, smacking them earthward with the speed of an express elevator. They were not killed only because a tree broke the force of impact. Yet the tree, twenty inches in diameter, snapped off at its trunk like a match stick, throwing the cumbersome equipment into another tree where the velocity wrapped bag and basket as a top-string is wound.

Stunned by the violence, their heads in pain from the sudden descent, Van and his aid, Trotter, spent the night in the basket in the treetop while the elements raged. The following morning, after carefully salvaging their barograph despite its broken face, they built a camp. There they remained for two

days, hoping airplanes would locate them. Then, eating the last of their canned food, they started battling their way through the underbrush, weak and suffering ptomaine. When things looked blackest they came upon a high-tension line. Knowing that a break in the line would attract a repair crew, they severed it. To be brief, it was nine days from their forced descent before they were rescued.

An airplane pilot, famed for his daring, sat one night with a group of us balloon racers who were recounting our varied adventures in the race of the preceding year. It had been a nasty one, starting in the inevitable squalls and with cold and rain persistent throughout. That year I had escaped narrowly from the center of Lake Oneida in a cloudburst. At length the heavier-than-air pilot spoke up as though a great light had suddenly dawned on him.

"I know why you do it," he said. "Balloon racers are like the small boy hitting his head with a hammer. Someone asked him why and he said, 'It feels so good when you stop.'"

The airplane pilot just didn't understand. There's skill in the sport of sailing the breezes. It requires a fine knowledge of meteorology to interpret a weather map. There is a fascinating gambling element present. There is the lure of the unknown in how far you will go and where you will land. Invariably there is a laugh and an anecdote in the people you meet upon landing in remote country.

For instance, I've been berated by an angry farm wife in the Adirondacks for distracting attention from herself in a moment of triumph. She had just discovered a three-legged chicken among a new-hatched flock, and because her neighbors were more interested in the sudden visitors from the sky than her freak chick, she blamed *me*. I had done it on purpose, she said. I've landed in the backyard of a Virginia farmer just in time to be invited in at the carving of a fine Smithfield ham dinner with yams. In the wilds of the Ozarks I have been given, in benighted innocence, water to drink from the well and family dipper of a backwoodsman whose children all were down with typhoid fever. But that wasn't a laugh.

And, may I say it, balloon racing takes more than a little intestinal fortitude to ride a basket through somewhat-may conditions until one's last bit of ballast is gone.

Most of us who have enjoyed this sport are now in our forties and fifties. When, as, and if balloon racing ever is revived, there is the consolation that we leave behind a worthy American tradition to the youngsters who will take off in the sky paths we have blazed.

MAKE WAY FOR AN APPRENTICE

(Continued from page 23)

graduations on the dials of those machines, without our supplying false ones. Kennedy?" His tone suggested casual amusement.

Mickey was stung by this implication of ignorance. Eagerly he replied: "On one of the dials of that hydraulic honing machine, the graduations for each one ten-thousandth inch of work surface movement are one full inch apart, and by vernier adjustments its setting can be controlled within millionths of an inch, although the machine will not hold to millionths accuracy in operation."

"But how large an error will the machine make in ordinary production?" Bangor asked with studied carelessness.

"Well, the Swede says its grossest ordinary error on a two-inch diameter could be thought of like an error of less than two inches in measuring the distance from New York to Chicago."

Bangor looked very interested.

"But of course," Mickey hedged a bit, "the Swede may have been handing me a—"

"No, the machine is as accurate as that," Bangor interrupted. "But who is this Swede?"

"Olson, here. The fellow who works alongside o' me." Mickey enthused with friendship, his suspicions forgotten. "And although that guy is dumb most of the time, you ought to hear him go to town when he talks about the day when he will set those machines up. Boy, he dreams of getting his wrenches on those babies!"

Bangor's face was set in deep lines of worry. "Hm-m-m, could that be it?" he mused aloud. "A kid filled with curiosity, trying his wrenches on the machines, thinking he can just turn the dials back as he found them and everything will be all right? It sounds fantastic! But something screwy is going on around here!"

"Sir?" said Mickey in surprise.

Bangor's voice crisped with decision. "Kennedy, you had a high-school reputation for alertness. It made a great quarterback of you. And your night-school record confirms it. Now listen closely." And Bangor told him how someone was putting the finest grinders out of adjustment, someone who knew grinders. And how it was holding up army and navy orders for airplanes, how the best detectives had failed to catch the culprit.

"Kennedy," he continued, "that white powder you asked me about was my own attempt to find fingerprints. And there are none. That man is either very smart, or very stupid to outsmart us all like this. But here is a chance. He will not be expecting a kid like you to

be watching for him. You might get him for us. Will you try it?"

Mickey trembled with excitement. "Mr. Bangor, I think I have a clue. My wrenches. You bawled me out about them. I had them in order. Someone has been using them—"

"Then chucking them back too hurriedly to be neat," the manager said quickly. "Yes, but who—and when? And why your wrenches? Here, let me see one!" Bending over the tool drawer, Bangor raised his voice: "Kennedy, you haven't these wrenches arranged yet!" Surreptitiously he looked at one through his magnifying glass. "Look how those handles are getting nicked!" he yelled. Then he whispered: "No fingerprints, not even your own. The oil on the steel would show them plainly. That checks. Your wrenches are being used."

Mickey's heart was heavy with the old suspicion of the Swede. Yes, he thought, it all checked. "Mr. Bangor, I know who—" he started reluctantly, then determined to make sure first. "I mean, Mr. Bangor, I think I can catch the mug. Give me a pass to come back early this noontime—so I can arrange my wrenches on my own time. And when you find a guy who stinks, grab him. I mean, he'll—"

Just then the Swede came back. Without another word, Bangor turned and walked on.

"What took you so long, Swede?" Mickey was making talk to keep things looking natural.

"That multistation full automatic ring grinder they are setting up. It chucks with torque motors. And it checks up and does its own inspecting as it goes, for size, roundness, smoothness of finish, taper, bell mouth and squareness. It grinds outside, inside, both ends and two oil grooves without the piece ever leaving the machine, then automatically ejects the finished work. It even dresses its own wheels. Gosh, but I'd like to tune that baby up just once!"

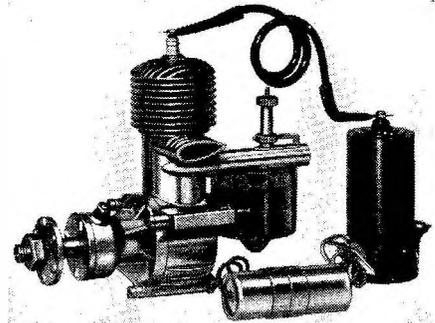
"You dumb squarehead!" Mickey exploded. "Stop that phonograph record from playing in your conk. You are worse than—"

"Mick, I don't know what's eatin' you. But you talk to me like that again and I sock you in the jaw." Swede put his file down and turned to face Mickey.

The noon whistle blew. They filed out, Swede in the lead. There would be a fist fight, Mickey knew, and then they both would be fired. Well, better that than to see the Swede arrested. And the fight would be fun.

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washroom quickly and getting the longest possible nooning, crowded between them. Mickey saw Swede dodge behind a guard, and return to the factory. Back to the plant, at a forbidden time, and without a pass! Well, that settled it.

Mickey collected the readmittance pass which Bangor had left for him at the factory gate. He left his lunch in his locker, and, going directly to a drug store, bought a fifty-cent atomizer and a bottle of cheap but very strong perfume. Returning to the plant, he used the pass and was admitted. The rooms were so empty he felt like walking on tiptoe. He had the sensation of hidden eyes watching him. They were, of course—Bangor had mentioned detectives. But were saboteurs watching, too?

He opened his wrench drawer. He expected wrenches to be missing, but none were. If not at noontime, he wondered, when did Swede get at the machines?

Pushing the drawer half closed, he reached under the bench apron and piled the wrenches as high as he could in the back of the drawer. Then he fixed the bulb of the atomizer so that opening the drawer would squeeze it between the piled wrenches and the bench apron. He aimed the atomizer nozzle straight forward, and with his finger bent it a little upward, then hid all but the very tip beneath a wiping rag. Carefully shutting the drawer, he went to his locker and gulped down his lunch.

The whistle blew, ending the noon rest. Mickey came back to his bench. Swede was already there, working in stony silence. He ignored Mickey.

Work went on for an hour. The machines were all in action now, their crews crowding them to recover some of the lost schedule. Mickey was thinking. The more he thought, the less he liked what he had to do.

Swede left for the washroom. Mickey followed. Better to have the fist fight and get it all over that way, he thought. Out of the corner of his eye he saw Slobski, coming back to the bench for another pair of dry gloves.

Suddenly Mickey heard Dan Cohen, a grinder hand, shouting in laughter: "Whew! What a lady! *Slobski, you stink!*"

Slobski cursed in pure English. As Bangor came rushing at him he dropped a wrench concealed in his safety-glove gauntlet and pulled a flat brown bottle out of his shirt. Holding it in position to throw, he dashed swiftly toward the new multistage grinder.

But faster was the dash of Mickey. With a beautiful sweeping tackle, he crashed Slobski to the floor. The bottle smashed against a machine base, covering it with fuming, spitting acid. In seconds, Slobski was seized by detectives and operators. Mickey got up.

"Mick," said Swede with wide-eyed astonishment, "that was smart. But you always were smart. But, say, how did you know he intended to throw acid into the multistage grinder?"

"I didn't. I thought he was going to

sprint out of the door before I got a chance to sock him in the jaw."

Bangor came over. "Congratulations," he said, "but I don't get it. How the—" He pulled open Mickey's tool drawer. The atomizer bulb was squeezed between the wrenches and the bench apron. It sprayed perfume on Bangor's shirt front, as it had on Slobski's.

"You young—" he roared. Then he grinned. "For bawling you out about the wrenches, I stink, too."

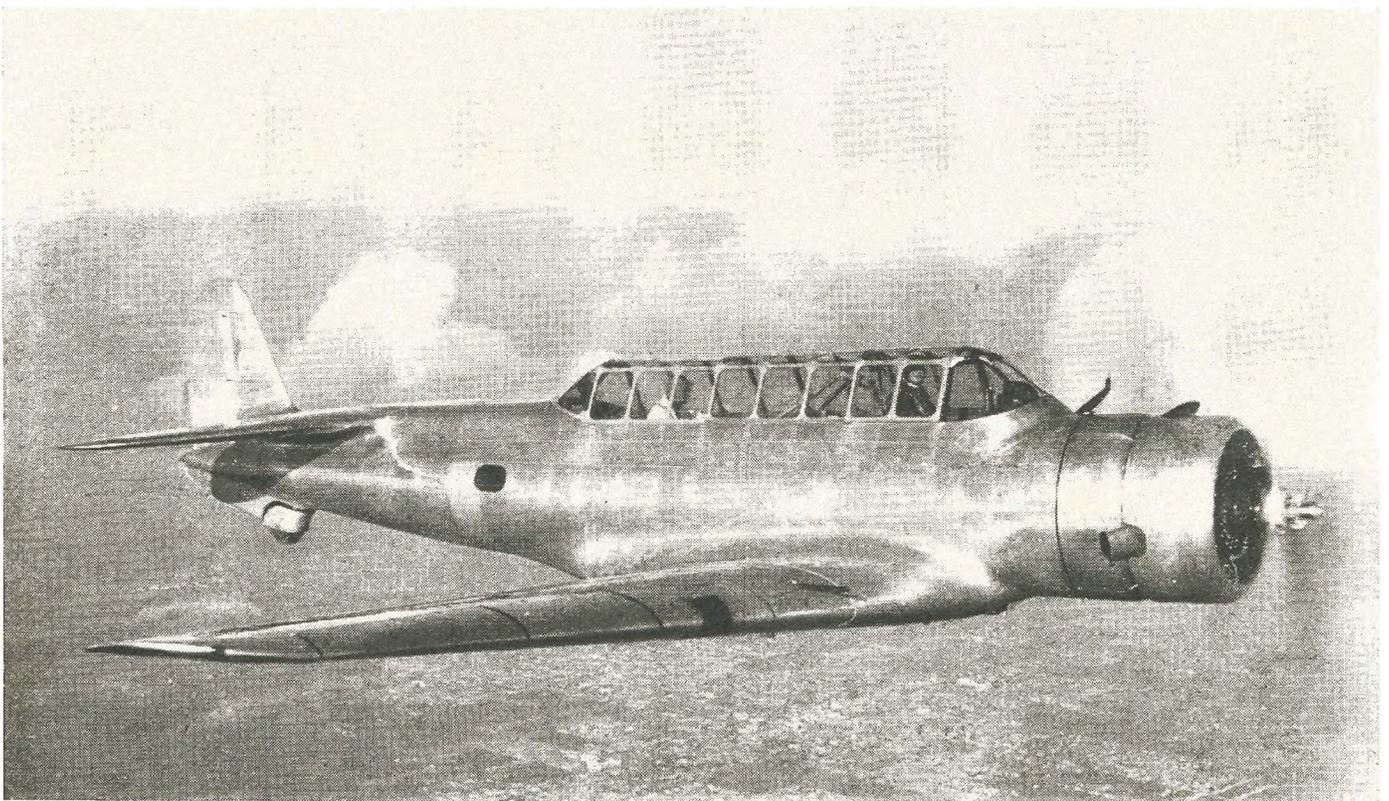
"But, Mr. Bangor," said the bewildered Mickey, "I don't follow it all. What was Slobski doing?"

"Why, Slobski, or whatever his right name turns out to be, would wait until you were at the washroom, then come over to change his gloves, take one of your wrenches, hide it in his safety-glove gauntlet, spill a mess by one of the machines, jam another machine while we were paying attention to the mess, and finally drop the wrench back into your drawer while on another glove-changing trip."

"Yeah!" said Mick. "And his gloves left no fingerprints!"

"Kennedy." Bangor continued, "you're wasted here. Report to the drafting room, for closest possible cooperation between your work and your aviation-school study. And you, Olson, will go directly to the tool and die-making room. I expect great things of both of you."

"Some day, Mick," said Swede with an extensive grin, "I make the world's best engines, and you fly them."



The Vultee VII-AG, manufactured at Downey, Calif. Ship is popular export model.

HEATH MIDWING

(Continued from page 62)

Cover the two halves of the wing and cement them to the fuselage in the proper place as shown on drawing. Make struts of 1/32" square balsa and cement them in the places indicated on the drawing so that there is 1 1/2" dihedral in the wing under each tip. This finishes the wing.

RUDDER AND TAIL

Make a full-size drawing of the tail and rudder, and make templates of them from stiff cardboard. Bend strips of 1/32" square balsa around the templates and then pin the outlines to the full-size drawing. Insert the auxiliary spars, cover them with microfilm, and cement first the tail and then the rudder in place on the fuselage.

PROPELLER

The propeller is carved from a very light block 3/4 x 1 x 7" in the usual manner. That is, first draw the diagonals on the broad faces and remove the wood to them (allowing for a hub) with a sharp knife. Smooth the edges and then fashion the concave sides of the blades, using a knife at first. Progress to a razor blade and then through the various degrees of sandpaper until the concave sides are completely finished. The convex side should be carved with the razor till the blades are 1/16" thick at the tip and 3/32" thick at the hub. Then use varying degrees of sandpaper till the hub is 1/16" thick and the tips 1/32" thick. Make a template of the blade shape of paper and cut the blades to fit. Trim and smooth the edges and insert the shaft, first through the nose plug (and after slipping three washers on the shaft), then through the propeller and cement it in place. Cement one of the washers to the nose plug and one to the propeller, making sure that no cement gets on the surfaces exposed to the rubbing.

FLYING AND ADJUSTING

Cut out the rear section of tissue from one of the sides of the fuselage and force a loop of 1/8" flat brown rubber through the fuselage. Connect it to the propeller shaft and put the nose plug back in position. Glide the model. It should glide well if you have the nose block of the proper thickness and the wing and tail set correctly. Any necessary adjustments can be made by moving the elevators. If the model stalls

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or dives badly you will have to weight the nose or tail accordingly. After a good glide is obtained, wind the model a few turns and launch it. It should fly in approximately forty-foot-diameter circles. If it does not, bend the rudder. The original model, which weighed two

ounces, turned in several flights of over two and a half minutes and appeared to be overpowered. With 7/64" rubber the model would have probably flown nearly four minutes, but an unfortunate argument with a large glider (in which the glider won) ended its career.

CONQUERING THE VIBRATION BUG

(Continued from page 25)

of the metal because of excessive vibration or tip deflections. Years ago, when propeller vibration research was instigated, it was customary to whirl propellers for testing on an electric motor. In the halcyon days of wooden props, this kind of test was adequate.

It was not long, however, before mica carta propellers—compressed, impregnated cloth—came into use. Engineers soon discovered that the fifty-percent overload whirl test suitable for wooden propellers had to be stepped up to one-hundred-percent overload. With the advent of the steel propeller a two-hundred-percent overload whirl test became necessary.

Unfortunately, the susceptibility of the metal propeller to fatigue failure obsoleted the old whirl-test method. Clearly, propeller tests had to be run on a gasoline engine where the power impulse characteristics imposed the vibratory conditions encountered in actual service.

The behavior of the metal propeller on the gasoline engine maximum-output test revealed that blade-tip breakage was most likely to occur at engine speeds considerably less than the maximum. Failure took place within a certain range of revolutions per minute. This range varied with different propellers and with various combinations of engines and propellers.

For instance, a propeller on a certain type engine may have experienced severe tip vibration within the range of eighteen hundred to eighteen hundred and twenty-five revolutions per minute. The same propeller on a later model of the same engine having only minor modifications might have a critical vibration period within a higher or lower range of revs. The only way that this critical period could be determined was to run the engine-propeller combination at an infinite number of trial speeds. Since tip failure might not result from anything from two to ten or more hours, even if, by chance, the critical speed was known, it bordered on the impossible to use these trial-and-error methods.

It must be understood that blade-tip failure was in no way connected with mere centrifugal force. The specific problem was the resonance between the moving parts of the engine, the elasticity of the airplane structure, and the propeller. Although this fact was diagnosed as the cause of the critical period that imposed the destructive stress on the propeller blades, it remained impossible to find the exact part that originated the destructive vibration until,

as already mentioned, some means were devised to find the critical range of r.p.m. This was the problem that defied for fifteen years the best efforts of aeronautical engineers.

The solution, when it was finally evolved by Hamilton Standard, was simple. It was based on the knowledge that certain materials increase and decrease their electrical resistance in direct proportion to the stress imposed upon them. A two-inch strip of carbon one quarter of an inch wide was cemented longitudinally to the propeller blade, but insulated from it. Two fine wires were attached to the ends of the carbon pile. The wires were connected to a source of electrical current. As the propeller blade stretched under stress the carbon strip stretched with it. The change in stress was recorded directly by recording the decrease in current passing through the carbon.

The drawing accompanying the article shows the method of attaching the carbon "strain gauge" and hooking it up to the test apparatus. These strain gauges may be attached to any point of the propeller blade, giving readings for that particular position. Readings from varying points on the blades showing at what time and under what conditions the stress occurs, afford a clue to the source of the vibratory trouble. With remarkable reliability the carbon strain gauge has indicated separately such divergent things as connecting rods, reduction gears, dynamic crankshaft balances, and other moving engine parts. Consequent minor corrections in engine design reduced the already slim hazard of blade-tip failure to the vanishing point.

In one instance a change of .023 of an inch in the diameter of a hinge pin in a dynamic balancer was sufficient! In another it was found that the slight inclination of the rear master rod to the front one in a double-row engine solved the difficulty.

Together with the editor, the writer was present at the Hamilton Standard plant when the device was first publicly demonstrated. The test engine-propeller combination was being run in a test house one quarter mile distant from the laboratory where the demonstration was witnessed. The delicate recording apparatus was, in this way, kept free from test-house noise and vibration.

The record itself is traced by a light ray on sensitized paper passing over a revolving drum. These recordings take the form of waves like sound or light. By measuring the depth of the waves

the engineer can tell their magnitude. By studying the distance between the waves he knows their frequency, or the number that occur per minute.

The demonstration apparatus included a glass screen on which the vibration waves could be seen. At low engine speeds the waves were of low, regular amplitude and frequency. As revs were increased, the depth and frequency increased proportionately until, at the critical speed or "resonance period," the visible waves were broken, dancing beyond the confines of the viewing screen. When gradually increased to maximum speed the magnitude of the waves decreased considerably as the vibration point was passed.

To make the demonstration more graphic a metal propeller was suspended just off the floor. To its hub was affixed an eccentric driven through a shaft by an electric motor. The eccentric simulated engine vibratory conditions and induced vibration into the propeller. At the resonant point the propeller tips flexed so rapidly that they appeared as a blur. Increased speed again showed that the critical speed need not be the speed of maximum centrifugal pull. Viewed, during the resonant period, through a stroboscope—a device for making visible the position of an object when its movement causes it to be blurred to the eye—showed the blade tips bending through a distance of perhaps four inches.

Yes, propeller and engine vibrations are now measurable and traceable. But the strain-gauge technique has far-reaching benefits.

The new fourteen-foot Hydromatic propellers of Hamilton Standard, created for the Douglas DC-4 and the Boeing 314 Clipper, are the largest ever built by that firm. Their weight, if designed according to the old precept of insuring safety by excess strength, would have been, each, two hundred pounds more—eight hundred pounds useless dead weight for either of the ships mentioned. But the strain-gauge vibration-study technique has enabled engineers to forecast accurately the behavior of a propeller in service.

The significance is that aviation progress is again being made. By shaking off the penalty of excess weights in propeller design, through conquering vague vibration problems, Hamilton Standard clears the way for propellers of twenty feet or more diameter, and the huge Clippers of the future move one step nearer to actuality, made possible by this tiny rod of carbon.

BETTER SHOTS WITH AMATEUR CAMERAS

(Continued from page 31)

more sensitive than the ortho. which means you will have fewer underexposures with them. From one to three hours can be added to your photographic day this way, since, being more sensitive to light, pan film can be used earlier and later in the day than the other.

Still another advantage of pan is its sensitivity to almost all colors. You've probably had the disappointing experience of snapping a trim blue-and-yellow army pursuit job on ortho film, only to have wings, fuselage and tail show up as the same tone in the print. In amateur film sizes pan costs only a few cents more than ortho. For all aviation shots it is well worth the slight difference.

One last word on shooting standing planes: Always leave more space in front of a ship than behind it. It prevents that cramped look, adds to the composition of the picture and implies motion. After all, airplanes don't fly backward; space ahead of the nose makes a more natural-looking shot.

You may take pictures of commercial planes on any civilian airport in the country as long as you don't trespass or make a nuisance of yourself, but that isn't true of all military, naval and marine corps fields.

There is usually no objection to amateurs making pictures of regular and reserve flying equipment for personal use, but photos of certain experimental planes are forbidden. Be especially careful if you live near a naval or military testing field. At all government fields permission to take pictures should be obtained from the commanding officer or his adjutant. Flying officers are good scouts and will often assist you in getting shots you would otherwise miss. Many photographers have run afoul of Uncle Sam through ignorance of the rules. Play safe—ask before you shoot.

Now a word with you model builders. If a model is worth constructing it's worth photographing. The fine models being turned out certainly deserve better than average pictures to preserve the details of their construction long after they have been put on the top shelf or "washed out" in a bad landing. By observing a few simple rules you will get better model pictures. The first and most important is one which is often overlooked:

Photograph your models in natural surroundings.

The finest job you ever turned out will not show up to advantage against a background of tools, scrap balsa and glue pots—or on the hall rug.

Weather permitting, do your model shooting outdoors in a well-lighted spot, but not in direct sunlight. Place the model on level ground or some flat surface on which plenty of reflected light falls. Direct sunlight is usually harsh, causing heavy shadows under the wings and loss of the fine detail which marks your engineering skill.

Study the lighting. Use white cardboard, a towel or pillowcase to reflect light on the shadowed parts. When the light is "balanced" all parts of the model will show maximum detail.

When possible, your models should be photographed on close-cropped grass; this adds a realistic touch. Keep the camera low, on a level with the model, which will look more like the ship it represents than if you shoot down at it from above. Be sure no human legs, automobile wheels or furniture are seen in the background.

If you like maximum realism in your model shots, try taking them indoors with the aid of artificial light and a few simple props. Amazingly accurate faked shots can be made against a background of "sky" painted on cardboard or wall board.

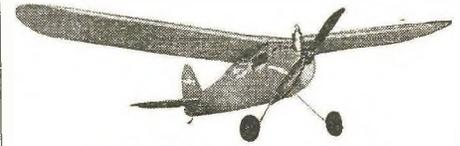
Paint a large sheet of board with light gray, flat paint until it represents an even tone over its entire surface. When the gray paint has dried, fake in a few clouds with flat white. Attractive cloud patterns may be copied from magazine photographs or, better yet, pick a day when there are clouds in the sky and let mother nature be your guide.

Hang your model from the ceiling or some other support by fine, light-colored threads. Cotton thread is better for this purpose than silk as it is less visible. Adjust the threads until the model is in some position of flight which shows it off to advantage. A glide, dive, climb or climbing turn is simple to arrange and will show the model off well.

Place the painted board upright several feet behind the model and support it in that position against the legs of a chair or table. When board and model have been arranged, set up your camera so that the model is between it and the board. The camera should be firmly supported on some level surface in such a position that it is level with the fuselage of the model. Line up the model in your camera finder, leaving more space in front than behind. Be certain the background board completely fills the finder. If it doesn't, move it nearer the model until nothing can be seen behind the ship in your finder but gray paint and "clouds."

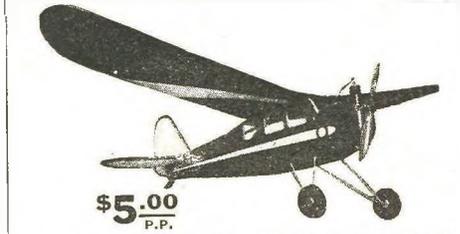
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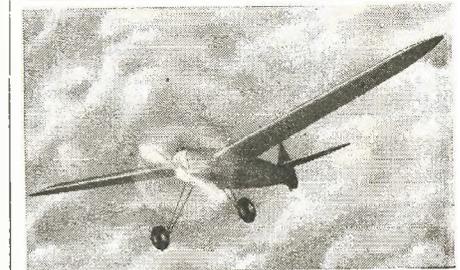
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Place a bridge lamp or metal reflector containing a No. 1 Photoflood bulb (obtainable at camera or drugstores for twenty-five cents) a bit to one side of the camera and slightly above it. Move the reflector around until the model is evenly lighted from the camera side. Badly lighted spots can be brightened up with cardboard reflectors, but care must be taken that they are kept out of camera range.

Squint your eyes slightly and study the model to determine if it resembles a ship flying in sunlight; adjust the light until such an effect is obtained. You then have a shadow of the model on the background, which must be eliminated.

Another Photoflood bulb in a similar reflector should be placed just out of the picture area so that its light falls directly on the background. This light should be placed behind and on the opposite side of the model from the front light. Shift it until the shadow disappears and you are ready to take the picture.

Set your camera shutter for "time" and take a final look through the finder to see that nothing has been disturbed. The model must be completely at rest. If the supporting threads are not stationary the ship will move during the exposure and you will get a blurred picture. When everything is set open the shutter for one-half minute, then close it—but don't move the camera while opening or closing it!

Such an exposure is about right for box cameras using panchromatic film when the Photoflood bulb nearest your camera is not more than five feet from the model. It may be necessary to shorten or lengthen exposure with very light or very dark models. For similar exposures with more expensive cameras follow the manufacturer's instructions for exposures by artificial light. A copy

of such instructions usually comes with the camera.

Your first few shots with artificial light may not be completely successful, but don't be discouraged. Fifteen minutes spent experimenting with lights and background usually solves the problem. After some practice you will be surprised at the realistic shots obtained in this manner. Study the advertisements of model manufacturers in Air Trails; many of them contain excellent model photography. They will furnish useful lighting ideas.

If properly prepared the background board may be used indefinitely. After a few attempts you will learn the best distance behind the model to place it for maximum effect.

When photographing standing models on flat surfaces the background should contrast with the model—use a sheet of white cardboard as background for dark models, dark cardboard for light models. The same lighting setup as employed with the model in flying position may be used.

My photographic friends who fly often ask, "Can I take pictures from a plane in flight with my box camera?" The answer is yes and no! It has been done, of course, but unless you have considerable snapshooting experience and a camera with shutter speeds to 1/200 of a second you should leave it alone.

Contrary to general opinion, any good medium-priced camera may be used for amateur aerial photography. If you have such a camera try some "obliques" on your next hop. If the day is clear with sun shining and you are using pan film, set your shutter at 1/200; lens at f6.3. For best results at these settings your plane should be at least one thousand eight hundred feet above the scene photographed and traveling not more

than one hundred and twenty miles per hour.

Focus on infinity for all aerial shots. Some kind of lens "hood" should be placed around your lens to cut off stray light reflected from the plane's wings and fuselage. An inexpensive hood may be had at your photo supply store. If you want to make one, cut one inch from a cardboard mailing tube of a size which fits snugly around your lens mount, and paint the interior with flat black stove polish. Attach it to the lens mount with adhesive tape.

There are some very important don'ts to be observed when using cameras in flying planes. To disregard them is foolish:

Don't try to fly a ship with one hand and photograph with the other. Always ride as a passenger when photographing.

Don't try oblique ground views when the sun is directly overhead. There will be no shadows and your prints will look "flat." Mid-morning and afternoon hours are ideal.

Don't rest your arms on any part of ship while shooting—vibration will blur your pictures if you do.

Don't expose the leather bellows of your camera to the slipstream—the pressure may damage it. Shield it with your body.

Don't stand up in an open cockpit to get a better view. If the ship suddenly strikes a downdraft it may be the last view you ever get of anything.

If your lens is rated at f4.5 or f3.5, by all means use a yellow filter for all aerial shots. It cuts through haze and gives sharper negatives, but remember that when a "two-times" yellow filter is used with pan film, exposure must be doubled. Set your lens at f4.5 instead of f6.3 when using such a filter.

Beautiful shots may be made through the windows of cabin planes—if they are



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, 73 7th Ave., New York City.

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: _____ (please print) _____ Age _____

Street _____ City or Town _____ State _____

clean windows! Ever-changing cloud formations furnish some of the most attractive subjects in aviation photography. In such shots a part of the plane should always appear to add to the perspective and help tell the story.

Aim your camera at a cloud formation in such a manner that a wing or engine nacelle appears in the foreground. Smooth engine cowlings and whirling propeller disks often change an ordinary shot into a thing of beauty. Use the same technique for photographing mountain peaks. A filter should be used for such shots to obtain full advantage of their pictorial possibilities.

If you are so fortunate as to own a camera with high-speed lens try some aerial shots with infra-red film. Startling effects and pictures of scenes so distant they are invisible to the eye may be had with such film—but it is tricky to use. Better read up on the subject before attempting it. Don't try it unless you have your own developing and printing outfit. Most commercial finishers are not equipped to handle infra-red film.

Shooting other ships in flight from your ship is another interesting form of aviation photography. Planes flying in the same direction you are traveling may be snapped at fairly slow shutter speeds. Beware of shooting ships traveling in the opposite direction—their speed is deceiving. At slow shutter speeds they will be blurred.

When in the air always use the highest shutter speed you have, consistent with the light. Many fine shots are ruined by blurred negatives, caused by using a shutter speed too slow to "stop" the action.

The same thing often happens when snapping flying ships from the ground. With amateur cameras a shutter speed of at least 1/200 is necessary to stop a ship flying at right angles to the camera when you are two hundred feet or less from it. If your camera doesn't have a high-speed shutter try shooting flying ships head-on for best results.

You've seen those beautiful shots of ships flying in a very dark sky dotted with clouds? They appear to have been made just at dusk. You have admired them and probably wondered what kind of fine camera could make pictures so late in the day.

Well, they were more than likely made in bright sunlight with ordinary cameras! The tricky effect was obtained by placing a red filter over the lens. Such filters supply novel effects but require greatly increased exposure. If your camera has a fairly fast lens you can get the same effect with them, but consult your camera dealer before buying.

Before our photographic flight comes in for a landing let's take a quick look at that subject we mentioned just before taking off—profit.

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N.A.A. NEWS

(Continued from page 39)

three miles flown and one million two hundred sixty-seven thousand five hundred and eighty passengers carried.

At the present rate of international banditry, let us make no mistake about the fact that the United States, as the wealthiest nation on earth, is faced with the need for either (1) a huge regular military air establishment, large enough to ward off even the most predatory groups of nations, or (2) a relatively small regular military aviation establishment backed by a civil aviation component obviously so quickly convertible into a tremendous military air machine that even the boldest banditry combine will think twice before maneuvering against us.

Let us make no mistake either about the importance of the part aviation will play in any further sittings of an international poker game. Out of the recent European crisis one fact stands clear. The aerial bomber played the major rôle. The recognized striking power in the German air arm and the realization of the havoc air warfare would bring to the citizenry of warring nations won concessions which would not otherwise have been possible. Most observers believe that the settlements made were only a thin face-saving border line from defeat.

Confirmed once and for all is the much-argued importance of air power. And of immediate concern to us all is the fact that every European nation is working toward even greater armaments, while in the Far East international banditry makes even greater inroads on a peace-loving nation. It is evident that now is the time to prepare ourselves against a final chapter that seems sure to come. Not tomorrow, when it is too late.

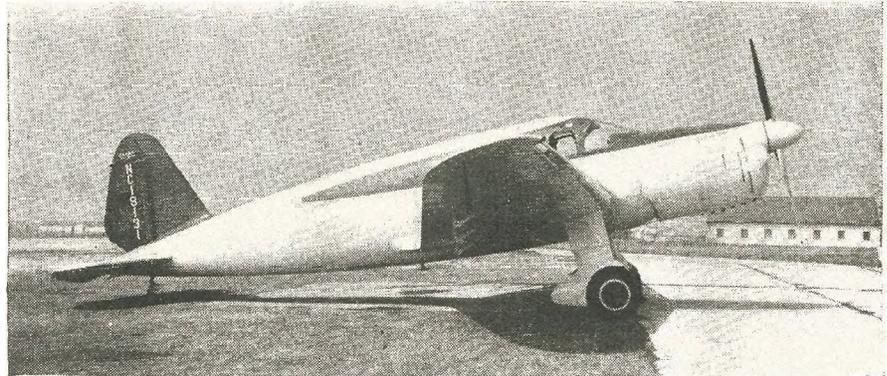
Therefore, we should take due stock of the fact that the part that scheduled air transport can play in an emergency expansion of the strictly military forces is necessarily limited. Further, that private flying offers in terms of an emergency air force large enough to match the tens of thousands of war planes

predatory nations are headed toward abroad, for dollar-for-dollar government cost, perhaps the best possibilities as our principal civil defense bulwark for peace.

The alternative is eventually a huge regular military air establishment, or the consequences of the time lapse that would be sure to come between when a small regular air force, however good, would no longer be able to hold off greatly superior air numbers, and when an emergency force developed mainly from scratch would be able to regain mastery of the air. It is a lapse that might well be fatal to the nation and would be sure to be fatal to untold thousands of women and children who in such an interim would be left largely

assistance for building the many war planes that would be needed?

The airlines of the nation now operate a total of two hundred and eighty-two airplanes. Factory production of airliners last year totaled perhaps one hundred and fifty planes. The fact remains that even with the continuing rapid growth of air transport and even with the advent of smaller airline feeder services, annual production of transport planes will never reach large enough quantities to warrant maintenance of a plant capacity that will be of much help in case of war. If we discount recent large foreign orders of transport craft, which probably will fall off as foreign competition increases, it is even more



Clark (Fairchild) "46," a wooden airplane; 450 h.p. Ranger.

to the tender mercies of enemy bombers.

If war came to the United States there is little doubt that a major part in winning or losing it would be played by our ability to immediately produce large quantities of war planes. Mr. Bernard Baruch brings back reports from Europe which confirm the reports of earlier observers, this writer included, of a greatly expanded European war-plane productive plant. The bald facts are that both in productive capacity and in flying personnel we are probably already outdistanced by Germany alone.

If war came, where would the government look for the specialized factories and, even more important, the trained personnel to immediately produce fighting craft in large quantities? Other than to our strictly military aircraft factories, where could the government look for

apparent that the manufacturing needs of the scheduled air transport industry will always fall far short of military emergency requirements.

In the light of these figures the importance of private flying begins to make itself apparent. Even today there are over ten thousand private and miscellaneous owned planes. Production of new and replacement aircraft last year in this class approached a two-thousand plane total. It is true that many of these planes were in the light-plane class, but the materials, parts and equipment which went into their construction were supplied by manufacturers who would be of important value in a military emergency.

But with Europe thinking in terms of tens of thousands of war planes, the United States probably needs to think

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in terms of fifty thousand private and miscellaneous fliers, not ten thousand. If we had fifty thousand private plane owners in the United States operating their own craft for business and pleasure, the productive plants in the form of airplane factories, engine factories, instrument factories, and the like, necessary to supply annual replacement needs, would certainly make any predatory nation, however bold, think twice before considering the possibilities of trying to cut a piece of American cake.

A fivefold increase in private flying sounds startling to say the least, but even fifty thousand private owners would probably not result in an annual production of more than ten thousand private aircraft. Such a productive plant producing war planes in an emergency at double the normal productive rate would be able to turn out twenty thousand war planes in a year. Yet this is only the estimate that Mr. Baruch makes for the present war-plane productive capacity in Germany, and his estimate is believed by many observers to be low. Thus the need for thinking in terms of fifty thousand private owners, rather than ten thousand, may not be so fantastic as it sounds. Don't forget also that in considering productive capacity, of even greater importance than plant layout and equipment are the specialized factory personnel needing years of training for the proper preparation for the exacting needs of aircraft and equipment construction.

But productive capacity and trained manufacturing personnel, important as they are to our national defense in the air, are only a part of the story. With planes produced, there must be pilots to fly them. The strain on the individual pilot in war-time flying is such that to get most efficient service out of each fighting plane, a number of pilots per plane will be required. Present army "M" (mobilization) day tables even now call for ten thousand pilots for approximately three thousand five hundred fighting craft.

Ten thousand fighting planes might well mean fifty thousand pilots for best fighting efficiency. And where could those fifty thousand needed pilots better be obtained than from among the operators of private and miscellaneous flying craft?

Here again comparison of the possible reservoir for fighting pilots needed in emergency offered by scheduled air transport and by private and miscellaneous flying indicates clearly the importance to our national defense of the private owner.

Today there are one thousand and forty-nine pilots and co-pilots employed on the airlines. In comparison there are approximately eighteen thousand nine hundred and twenty-seven pilots now

holding active licenses who can be considered in the private and miscellaneous plane class!

By any yardstick, be it the present ten thousand private and miscellaneous planes or a theoretical fifty thousand, this class of flying obviously plays an important role in our national defense picture. Take the matter of airports. In war time, the large military air bases and scheduled air transport terminals would be easily located and become attractive targets for air bombing. Moreover, the trend in air tactics is decentralization of ground concentrations of fighting planes. This is due to the obvious havoc that could be wrought by air bombardment of large groups of military planes caught together on the ground.

However, military aircraft need prepared landing fields. Thus, there is special significance to the national defense in the two thousand airports and seaplane bases which are not military or scheduled air transport fields, but fields used by the private and nonscheduled operator.

With the foregoing in mind consider what is now being done by the government to foster and develop this branch of flying. Viewed retrospectively and in comparison to airline and strictly military flying, government assistance to private and nonscheduled flying has been so small as to be almost infinitesimal. In fact, a great many private owners today feel, with some justification, that in recent years the government not only has failed to support private flying, but has been going out of its way to regulate it out of existence. It is a fact that the development of airline operating standards, with their relatively rigid governmental control, has tended unduly to flavor governmental regulations pertaining to the private owner. True, the government has developed an air weather reporting system. But everybody recognizes the fact that these services have been developed primarily for the air transport services of this country. And many private owners feel, again with some justification, that there is a growing attitude that they are allowed the use of such facilities by sufferance only.

The government has spent many millions of dollars in direct subsidy of the airlines through airmail contracts. The government has spent many millions more in the purchase of strictly military aircraft. The totals in each case, reaching back through the years, would come to very large sums indeed.

What money has been spent specifically to help and promote private flying? The answer is none. Or at least an amount so small that it is ridiculous by comparison. True, there has been some unfortunate activity, such as that in connection with the seven-hundred-

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dollar airplane, which, it is practically unanimously agreed, did more to retard private flying than otherwise.

Most private fliers feel that the navy and war departments hardly know that such a thing as private and nonscheduled flying exists in the United States. Based upon any steps that have been taken by these establishments to instruct civilian pilots in the rudiments of military air organization or tactics, or any form of assistance for civilian flight training of young men physically and otherwise qualified for military service in case of emergency, there is some justice in their view.

As for the C. A. A., it has recently established a Private Flying Section. However, it cannot claim too much credit since such a section had been announced by the bureau of air commerce prior to the establishment of the C. A. A. Actually, the new section's advent was delayed by the establishment of the C. A. A., since the bureau of air commerce officials felt, and perhaps rightfully so, that the C. A. A. should have the opportunity of making its own decision regarding such a new section.

The section has received considerable publicity. The fact remains, however, that it is but one of a half dozen sections within one of the several divisions of the C. A. A. and consists at the moment of a single individual and his stenographer. This out of some three thousand one hundred and sixty-seven C. A. A. employees. On the favorable side recurring indication that the chairman of the Authority is earnestly desirous of doing all he can for the advancement of this important side of aviation.

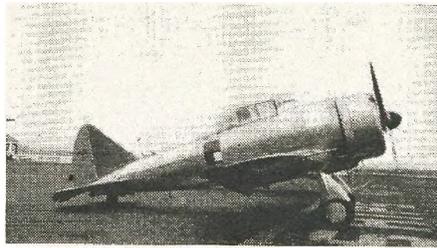
The fact still remains that there has not been any real help, comparable to that given the airlines and to strictly military flying, for private aviation.

If there is any truth in the present and future value of private and nonscheduled flying to our national defense, this is serious indeed in the light of the recent European crisis and the gloomy prospects ahead, in so far as international peace is concerned.

But so much for the situation as it now stands. The question that is of real importance to every peace-loving citizen is, "What can be done about it?" The answer obviously is that there is need for the immediate development of a national program of government assistance to private and nonscheduled aviation and for militant action by informed citizens throughout the country in mobilization of congressional support for active legislation in support of such a program in the coming Congress. If such a program is confined to active and reasonable forms of assistance there is no reason why indorsement could not be expected from the civil and military establishments. For in the end it is probable that no thinking official in our

government can fail to recognize its vital place in our national defense picture and the wisdom in giving it every practical assistance at this time. Failure to do so in the past can probably be attributed more to limited appropriations with resulting restriction of staff and equipment and to the pressing needs of closer objectives, than to any conviction that this branch of aviation should not be assisted.

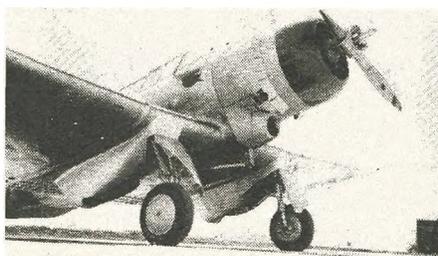
A program to remedy this situation has been outlined and will be presented



Seversky Executive.

to the annual convention of the National Aeronautic Association for its consideration.

Remember, this is no brief against an immediate increase of our regular air establishment, or against greater government support of the airlines. There are indications from the press dispatches of recent weeks that the president will ask Congress for an increase of the regular strength of the air corps from two thousand three hundred to four thousand planes. There are many who feel that even that number will fall short of a



Northrop Dive Bomber.

suitable regular air force. Certainly this proposed increase should have every support. As for airlines, greater government support is justified on a strictly economic basis, discounting entirely any national defense value, which obviously is great.

This article rather is a plea for the proper evaluation of and recognition of the advantages private flying offers as a defense bulwark for peace. This in the light of the huge air armadas that are in course of construction throughout the world. In many ways it is an opportunity unique to America. Only in America is it possible to visualize fifty thousand private owner fliers. Fortunately in our nation of long distances and among our one hundred and thirty million people owning some thirty mil-

lion automobiles, such a number can be not at all fantastic.

Let our government give this branch of aviation the support it deserves to the end that fifty thousand private owner fliers will become a reality. Then, in the words of Teddy Roosevelt, "We can speak softly but carry a big stick," with recognition that the cheapest way to carry the biggest stick is through active government support of private flying.

1939 REQUIREMENTS FOR RACING PLANES

An important step in the history of national air racing was taken this year by the decision at the N. A. A. contest board to establish landing and take-off run requirements and similar design and performance minimums to be met by racing craft. In May of this year a proposed set of engineering requirements was drawn up and sent to the Racing Pilots Association for consideration and comment. Immediately after the National Air Races at Cleveland, the technical committee of the N. A. A. met with representatives of the Pilots Association for a discussion of the proposed requirements, and as a result of this meeting, the following requirements have been drawn up. They were to be considered exhaustively and final action taken at a meeting scheduled for November 1st, to which a group of outstanding experts were invited.

The requirements:

The engineering check will, in general, consist of three parts: (1) examination of the technical data presented to the Washington office of the N. A. A.; (2) examination of the completed plane at the airport immediately before the races; and (3) landing and take-off tests. The technical data required by check (1) should be presented to the Washington office as soon as possible, but at least ninety days before the races in order that a proper examination may be made.

Airplanes shall be flight-tested at the maximum load to be carried in the races, and final flights following adjustments shall be made before the airplanes arrive at the site of the race meet. In the event that the flight testing is done at the site of the race meet, it must be completed before the qualifying flights for any planes are started.

Airplanes used in the races may be classed in three groups: A. Stock models in accordance with manufacturers' A. T. C. and having no alterations or additions; B. Stock models in which changes have been made in any of the following: gross weight, wing area or section, tail area or length, engine model of power available, or landing gear; C. Special racing planes.

The technical data desired under check (1) are: Group A. Certification

that the plane has not been changed in any respect from the stock model; Group B. A detailed account of the change, together with sufficient drawings and stress analyses to show that the structure is of sufficient strength to take the loads of the speeds obtainable; Group C. Drawings with complete dimensions and specified material of: three-view general arrangement, showing full range of C. G. locations; wing assembly, wing beams, and typical wing rib; fittings (principal ones only); fuselage; tail surfaces; landing gear.

Technical information desired: gross weight; engine model and power available, propeller; wing area and airfoil section; tail area; gasoline and oil carried.

Stress analyses as follows:

Wings. The ultimate design load factors to be used are 12 in the positive lift range and 8.5 in the negative lift range. With these design load factors, the analysis shall be prepared in accordance with the C. A. A. new C. A. R. 04 for symmetrical and unsymmetrical flight conditions. In general, the following conditions are critical: front wing beam—Condition I; rear wing beam—Condition III; front wing strut—Condition II; rear wing strut—Condition V; drag system—Condition I.

Control surfaces, control systems, fuselage and landing gear shall be analyzed in accordance with C. A. R. 04 except that a design average load of seventy-five pounds per square foot must be used on the horizontal surfaces; sixty pounds per square foot on the vertical surfaces and on the ailerons, and a load factor of seven must be used on the landing gear.

All control surfaces must be statically mass balanced.

In general, it should be understood that it will not be necessary to carry all of the design conditions completely through. The critical conditions should be determined and only these should be carried through.

Properly witnessed static and dynamic tests will be satisfactory in lieu of stress analyses. For the landing gear, a drop test of eighteen inches for planes without flaps, and twenty-four inches for planes with flaps, will be considered satisfactory. The platform on which the wheels strike shall be inclined at an angle of ten degrees.

In regard to take-off and landing, both the take-off and landing ground runs shall be not more than three thousand feet with no wind. These may be proved by: 1. Test; 2. Calculations.

It is understood that the C. A. A. will issue "X" licenses to racing planes not otherwise classified, upon application and after careful examination. These licenses will be issued for some limited time and will have certain restrictions.

N. A. A. GOVERNORS

Roger Wolfe Kahn, New York.—Active participation in a wide variety of aviation activities can be claimed by Roger Kahn, N. A. A.'s New York governor and long prominent in the association's work. Scion of a wealthy and influential family, Roger has been interested in flying for many years, and his log now shows about five thousand hours in many types of ships.

He learned to fly at Curtiss Field, Garden City, Long Island, during the summer of 1927 under the tutelage of Al Tunstall. During the last eleven years he has owned more than a dozen aircraft ranging from a one-hundred-and-ten-horsepower Puss Moth to a Lockheed Electra, powered with two four-hundred-and-fifty-horsepower engines. He was employed as a test pilot during the Lindbergh era, and for a time rightfully claimed the spotlight for such activities as being the first pilot to pick up mail while in flight from the roof of an office building in the heart of a crowded downtown district. This was accomplished at Norfolk, Virginia, in 1930.

Besides being an N. A. A. official, Roger is a member of the Quiet Birdmen; International League of Aviators; Sportsman Pilots Association; Private Flyers Association; Institute of the Aeronautical Sciences and many other flying organizations. He is chairman of the N. A. A. race committee and a member of the contest board.

Roger has no co-pilot and flies his Lockheed Electra all over the country, usually alone. He explains that he gets more relaxation in that manner, being free from the responsibility of having others in his ship to think about. The two ships he owns at present are equipped with hoods and he religiously practices blind flying a certain number of hours each month. To keep up with his own proficiency, and check his knowledge of the newest procedure of getting there "while in the soup," once each year he takes a complete advanced course of beam and orientation problems on a Link trainer.

Despite these impressive accomplishments in aviation, Kahn is probably more widely known to the man in the street as a famous orchestra leader. When only seven years old, Roger tackled the violin, mastering it in short order, and later specialized on the ukelele and guitar, also studying symphony drumming. In his teens, he learned to play nearly every instrument in an orchestra. At the age of fifteen, directing his own band, he scored a success.

He hails from Morristown, N. J., where he was born in 1907. Although his early years were spent in studying music, he was hardly out of his teens before he had learned to fly and was making a name for himself in flying.

NATIONAL AIR MAIL FEEDER CONFERENCE

The next step in scheduled air transportation will be a vast network of "feeder" lines, in the opinion of many experts.

With this thought in mind, the National Air Mail Feeder Conference was held at Kansas City in October, with a wide geographical representation.

The widespread demand for inauguration of feeder air-mail services throughout the country found expression in the forward-looking resolutions adopted. To give teeth to the resolutions, a demand was formulated as a request to be presented to all candidates then running for election to the United States Senate or House of Representatives in the hope that successful candidates, when Congress convenes in January, will help form a larger and more forceful group friendly to aviation.

The two hundred delegates adopted this line of action in the confident belief that they voiced the popular attitude. Arrangements were made through sectional meetings, representing types of business rather than geographical divisions, to carry on a national campaign seeking to develop support through public expression and congressional action for an immediate conservative and businesslike expansion of air-mail service into the feeder field.

This request was made in the face of considerable uncertainty as to just what "feeder air-mail" lines are, or should be. All speakers who represented civic or business divisions at the conference were unanimous in wanting feeder air-mail operations extended generally with as much celerity as sound development would permit.

The hope for early extension of feeder air-mail lines was not encouraged by Clinton M. Hester, administrator of the civil aeronautics authority, or by Jesse M. Donaldson, first deputy assistant postmaster general. Both urged that the public reconcile its desires with the facts that Congress must first appropriate funds expressly designated for the feeder system and that the physical development of such service would require a long period of careful preparation, including the provision of adequate airports and other facilities.

The conference adopted resolutions indorsing the airport survey ordered by Congress and urged the C. A. A. to recommend Federal participation in the "construction, improvement, development, and operation or maintenance of airports."

The convention accepted from the National Association of Postmasters a resolution adopted at its St. Paul convention declaring in favor of feeder air-mail development, and adopted that statement as the conventions own viewpoint.

THE MIRACLE OF METAL SHIPS

(Continued from page 29)

covering is not as yet practicable, and riveting is used entirely. In nonstructural portions, the welding of aluminum alloys is extensively undertaken. The restriction of welding to the nonstructural parts is so because the forces on the rivets in stressed skin are in shear, and welds in shear and tension are uncertain so far as dural is concerned. No doubt with the perfection of better welding equipment it will be possible. Rivet heads on the surface of the skin present considerable drag; however, on the leading edge the rivets are countersunk so as not to disrupt the air flow about the leading edge.

There are several types of construction which typify American metal-aircraft construction. These may be divided into two general groups, those that tend to approach the pure monocoque fuselage construction and which have few secondary stiffeners, and those which have a multitude of secondary stiffeners to supplement the strength of the skin. In the former class fall the Ryan and the Vultee. These two designs depend upon a somewhat heavier gauge skin backed up by a few secondary members to carry the entire load. The latter class is represented by Boeing, Lockheed, Douglas and Northrop. The wing construction of the specific types mentioned are all metal, except that some have a single spar, some two spars and some are multispar. The skin cover carries a sizable proportion of the load. The strength virtues of each type are a matter of conjecture when one type is compared with another.

The Douglas type of fuselage construction is considered to be of the multipanel type. By this description it is meant that the entire fuselage shell is made up of many panels, with the stiffeners disposed circumferentially about the bulkheads. The longitudinal stringers comprise the secondary structure. The stringers are continuous from the nose end to the empennage and their spacing between centers is comparatively small.

The ring bulkheads are spaced on approximately sixteen-inch centers and are made up of several segments which are riveted together to permit a low-cost production. The outer skin is 24-SRT on the fuselage sides, while the belly of the structure is 24-STAL, which permits a slight degree of flexibility. The bulkheads are approximately three inches in depth and have a channel cross section. The channel section is very efficient as a bulkhead shape, and it may be easily formed and produced in segments for low cost. The flooring

of the cabin is made of 24-SRT corrugated duralumin. See Figure 2.

The various types of dural are chosen for their purposes according to their physical properties. Where extreme strength and panel instability are necessary, a hard alloy is used such as 24-SRT. On a portion of the structure where some flexibility is necessary and often desirable, 24-STAC is used because it is softer than the first-mentioned material. For non-structural parts, half-hard aluminum or even quarter-hard aluminum is employed. On formed parts the degree of hardness restricts the degree of forming. On nonstructural parts, rivet holes are punched in die presses, whereas on structural plates the rivet holes are drilled because punching is generally detrimental to the strength characteristics of the lighter alloys. Excessive working tends to harden the alloys. Hard alloys are first annealed, then worked and then raised to their designed strength by heat treatment. It can be understood that the choice of alloy is determined by the use to which the alloy will be subjected and its method of attachment and jointing is limited by this.

The Northrop fuselage consists of circular bulkheads, longitudinal stringers, and the conventional shell plating. The shell plating is laid on in long sheets or strips, whereas in other types of construction the plates are laid on in rectangular shapes. All rivets in this and metal construction are either squeezed or else pneumatic-hammered when the heads must be formed. The Northrop fuselage is built in two halves in a jig, and then each half is joined together. The stringers are of conventional design and are continuous. See Figure 3.

The Ryan fuselage is made in two halves of special formed shell plates which are curved to shape by powerful drop-hammer dies. This type of construction is sturdy and offers a high strength to weight ratio. Two heavy longitudinal stiffeners and ring bulkheads of channel section complete the skeleton structure. This type of construction is a cross between semi and full monocoque. The shell plating is of the single-panel type.

The Boeing type of fuselage construction is very rugged. The internal skeleton consists of closely spaced stringers running fore and aft, and heavy ring bulkheads which carry the main loads, and lighter intermediate bulkheads which function to preserve the shape. The fuselage is made in three parts and bolted together in final assembly and lapped by the sheets of the shell plating. Where it is necessary to use curved

sheets these are preformed, while on portions where the radius of the shell plating is large, flat sheets are riveted on and sprung into place.

Vultee fuselage construction represents a unique adaptation similar to the full monocoque. The skin is laid on in circular sheets, and at each joint a bulkhead occurs. The cross-section is circular. In the region of the cabin the bulkhead spacing is close, while toward the tail the spacing becomes larger. There are no longitudinal stringers, the entire resistance to bending is incorporated in the skin. In shell structures there are two methods of increasing the stability of the skin where heavy loads occur. One method uses a light-gauge material with many stiffeners of light gauge, while the other method is to increase the gauge of the skin and the stiffeners. This type of reinforcement may be applied to the empennage or the nose.

The Lockheed fuselage is similar in construction to the Douglas. It consists of circular bulkheads and longitudinal stiffeners to sustain the load. The fuselage is constructed in one piece on a jig and is then removed for final assembly. The spacing of the secondary members is a function of the concentration of load in each portion.

The subject of wings, like every other component of a metal airplane, is very complex if considered in detail. It may be said that at the present time there are three distinct types of wing construction which are employed on current airplanes. These are the multicellular wing such as the Northrop, the monospar as used by Lockheed, and the trussed type of wing used by Boeing, which incorporates the features of the first two types. See Figure 4.

A multicellular wing panel consists of several spars and the usual number of ribs. The wing skin carries approximately ten percent of the wing loading and the skeleton structure carries the balance. This type of wing may be constructed in several parts and then assembled and made into a homogeneous structure when the wing skin is applied, or else it may be built in one integral unit on a conventional jig. The ribs consist of flanged dural profiles which have stiffening elements and flanged lightening holes. The top surface of the wing skeleton is further stiffened by a layer of corrugated sheeting disposed laterally across the top surface of the ribs. This corrugated sheeting, which runs in the same direction as the wing spars, adds to the rigidity in bending under the imposition of the flight loads.

Metal cantilever wings weigh approxi-

mately two and thirty-five hundredth pounds per square foot. The smooth skin which covers the corrugated layer varies in its gauge thickness, depending upon the loads and the concentration of the loads. It is common practice to develop high resistance to lateral deflection by a graduation of the gauges extending from the wing root to the wing tip. This same graduation of the gauges of the metal structure may be applied to the webs and the flanges of the wing spars. Since the disposition of the lift forces on the wing assume more or less an elliptical form, the greatest bending moments on the wings of conventional airliners is close to the wing roots. Thus heavier rivets and gauges of metal are necessary where the loads are more highly concentrated.

The other forms of wing structures combine the features of the conventional truss type of wing and multicellular de-

The joints are made tight by a process of sealing compound known as Duprene. This type of fuel container is efficient from a weight standpoint, but is costly if a repair must be made.

The tail areas of metal aircraft may be all metal in their construction or they may have the movable portions covered with fabric over a metal framework. The reason for this construction is predicated upon weight. Certain types of metal wing use fabric-covered trailing edges extending from the rear spar to the trailing edge of the wing. The problem of fluttering of the control surfaces is a serious one, and for this reason a mass balance is attached to the movable surface. Since these weights must equal the weight of the movable surface, a fabric covering permits the weight in both instances to be reduced in a general way. See Figure 5.

Tail surfaces of metal aircraft are

the United States army air corps make use of equipment which has a specially built pressure type of cabin which has the internal pressure supercharged to correspond to an altitude of ten thousand feet, although the airplane may be operating as high as thirty thousand feet. The pressure shell is built to withstand an internal pressure of fifteen pounds per square inch. This necessitates rather a heavy-gauge material for the skin, heavy internal stiffeners and airtight joints. The problem of airtightness is comparatively easy in a metal structure because the doors, windows and the cabin can be equipped with gaskets and clamps, which assures a hermetically sealed structure. The pressure cabin has riveted joints, sealed with a calking cement and double riveted with small intermediate rivets between the regular rivets, which assures complete freedom from leaks. It may be



Special Sikorsky S-43 for French African air line "Aeromaritime" has upturned tips.

sign. On one type the single metal wing spar carries the major portion of the load in conjunction with supplementary stiffeners to the covering. The two-spar metal wing consists of a built-up truss system of wing spars and wing ribs. The skin cover aids materially to add stiffness to the wing, but the importance of the skin in assuming the burden of the load is inherently intended to be carried by the truss structure of the wing.

The stowage of fuel has always been a problem in airplane construction. It can be solved in two ways. The wings may hold tanks of conventional design, as on the Northrop. These tanks are made in several units and are removable. This type of construction is conventional, but it is heavy and costly in maintenance. The multicellular wing offers a solution by the incorporation of the fuel system as an integral part of the wing such as is used in the Seversky aircraft. In this instance the wing in its central part functions as a tank.

built along the same lines as those of the wings. The strength members consist of metal spars and ribs. The cover may be a smooth or corrugated stressed skin, reinforced on the underside or stiffened externally. The tail planes may be cantilevered or else braced to the fin. The unbraced tail weighs considerably more than the braced structure. In most cases the tail plane is built integral with the fuselage, as is the fin. Trimming for longitudinal balance is achieved through the use of trimming tabs upon the elevators.

The trend of aircraft operations points toward the use of the stratosphere as the next field which will be investigated in a technical way by aeronautical scientists. In this respect the all-metal airplane serves the purpose admirably because pressure cabins must invariably be used if each of the personnel is to be free of the cumbersome oxygen equipment needed for high-altitude operations.

The experiments so far conducted by

assumed from this brief discussion that metal is the only material for stratosphere aircraft, since it offers the easiest solution for joining and gives the strength required.

The constructional problems involved in the design of seaplane hulls are similar to the problems encountered in the design of large airliners except that the necessity for watertightness and good hull lines must be provided for. The hull may be likened to a large beam, the same as a fuselage, and is placed in bending during flight and planing operations. In landing and taking off, large pressures are applied to the forward part of the hull. Then there are also the problems to overcome due to the corrosive action of sea water on the rivets and shell plating. Alclad must be used to the exclusion of all other dural alloys, and this must be coated with a bitumastic protective paint. At the immediate time, the most suited material for hull construction is stainless steel because of its high strength and its

resistance to the inroads of the corrosive effects of sea water.

It is customary to use steel fittings of high-strength steel for the joining of various components. Now in joining a heavy steel fitting to a thin shell structure something must be done to distribute the concentration of load over as large an area as possible in order not to exceed the strength limit of the thin sheet and induce local failure. This is best achieved by laminating the area by several gauge thicknesses riveted together, which offers a solid foundation for the attachment of the fitting. In this manner the load per square inch can exceed the normal design limit of the thin skin and the load is distributed over a large area so that the unit loading per square inch still retains its design limitation. Fittings use steel bolts and are cadmium-plated or sand-blasted, and in some cases they must be insulated by a gasket to prevent electrolytic reaction with the aluminum.

In closing this article, it may be said that while the industry is tooled up for production on a mass scale, no such scale can be achieved such as would be comparable to the popular conception of the idea. This is so because of rapid changing of the technical aspects of the subject, and also because of the price per pound of the basic raw material which goes into the construction of modern aircraft. Until this latter item is lowered to an economical degree and

until lighter, low-costing and longer-life engines are available, flying as conceived by the layman is still many years away, until all the facilities of the industry are combined to make it economical for the civilian to own his own machine.

Editor's Note—The following definitions of terms used in the above article may be both helpful and interesting:

Anneal. This is the process of heating metal to its critical temperature (the temperature where basic changes in the molecular structure occur) and then allowing the metal to cool. Annealing tends to remove brittleness and to soften the material for better working characteristics.

Axis. When speaking of the axis of instability of a thin plate, we mean the axis which failure will occur on. For instance, flat plates have two axes which are ninety degrees to each other in their line of action. A thin plate may be stiffened on either axis or fail on either axis, as the case may be, failure being a function of the intensity of the load and the disposition of the stiffening elements.

Bitumastic paint. A protective surface paint which is black and which has as its base bituminous materials such as mineral tar, et cetera.

Casting. A casting is a fitting of metal, steel or dural, zinc alloy, et cetera, which is cast in a mold. The material is heated to a molten state and then poured into a sand or metal mold. After the material cools to room temperature, it is removed from the mold and dressed up by filing or machining as necessary.

Draw bench. A long metal bench which has steel jaws which travel along its full length. A forming die is bolted to one end, and the metal is fed through the forming die into the moving jaws. The metal is pulled through the die or a form or mandrel and assumes the shape of the die. This process is used for special requirements and tends to strain-harden the alloys and make them brittle. The jaws are power driven.

Extrusion. A special metal structural section, usually aluminum, which is forced through a special die while the metal is in a plastic state, by hydraulic action.

Forging. A forging is a casting which is formed by the action of pressure while the casting or metal is in a state of plasticity.

Leaf brake. Sheet-metal machine which has a movable forming leaf and which is mainly intended for making angle bends. It may be manual or power driven.

Local instability. This term is used in the design of shell or monocoque structures. It refers to buckling of the thin sheet metal by wrinkling, rupture, or cracks. Local instability is caused by too great spacing of the stiffening members, which causes the shell to be loaded beyond its normal margin of safety.

Nibbler. The nibbler is a machine which is used for making fittings of irregular shape from the flat sheet steel fitting stock. The principle involves the use of a rapidly moving up and down cutting die which is electrically driven. The machine is mounted on a pedestal, and the cutting speed per minute is very high, depending upon the thickness of the sheet stock and the capacity of the machine.

Nonstructural alloy. An alloy which is used for nonstructural purposes. Soft aluminum or magnesium or zinc alloy die castings come under this category.

Stiffness ratio. This term is used for the strength computations of shell structures or long column members occurring in airplane construction. It can be defined as the margin of stiffness which is incorporated into a member over that of the applied load on the member. In other words, if the applied load on a member is one hundred pounds, and tests show that the member fails with an applied load of four hundred pounds, we say the margin of safety or the stiffness ratio is four.

Structural alloy. An alloy, either steel or aluminum, which has special high-strength characteristics solely for resisting applied loads.

Swaging machine. A machine which is used for making depressions, stiffening seams and raised edges on flat sheets.

AIR ADVENTURERS

(Continued from page 41)

Another airplane mechanic is Earl Lock of Torrence, Cal., who has built two very good models, developed from designs of his own. They appear to be very interesting.

At last we have found another topographer who really knows his stuff. He is Frank Noble, of Harrisburg, Pa., who has completed a perfect layout of the Harrisburg Airport, showing all the runways, giving details as to direction and length, and including a well-written explanation of the hangars, shops, administration building, and some detail on Mr. Fred Nelson, who was responsible for much of the work there. Noble claims the field should be a memorial to Mr. Nelson, who died a short time ago.

They come in bunches. Another topographer, this time R. Z. Pfeifer of West Allis, Wis., shows us what the layout at the Waukesha Airport looks like. It is an L-type field with a hangar, parking space and two very good landing stretches.

Mr. Edwin Linder, a pattern maker and designer, has joined our club, and we are very glad to have him. He speaks highly of our efforts toward

boosting aviation and checking up on our national defense. He is a model builder and is taking instruction for his pilot's license. On top of all this he has the photography bug, and sends us a picture of the Indianapolis Air Show, which was sponsored by the West Side Citizens, Inc., of Indianapolis. Mr. Linder is a resident of Greenfield, Ind.

We get them from all over the world. This month we gathered in Barrie Connor, of Cambridge, England, who is an apprentice aircraft worker at the Cambridge Airport, where he works on both civil and military planes. He is sold on American light planes and admires their finish. He hopes to encourage more light-plane flying in England, and particularly light-plane racing. Thanks for your letter, Barrie, and the kind things you say about our magazine.

Ferdy Sisto, Jr., of Grand Concourse, Bronx, N. Y., has claimed a Topographer's award for two drawings of unchartered flying fields suitable for emergencies or forced landings. One is near Saratoga and the other about seventeen miles from Ballston Spa.

Miss Marjorie Gay of Dartmouth,

Nova Scotia, has joined our club and tells us about a girls' flying squadron organized up there by a Miss Melda Walters, of Halifax, N. S. The club is affiliated with the Halifax Aero Club, in which the girls actually learn to fly. Miss Gay is second officer in No. 3 Squadron. Weather has held them up a little, but considering everything, they seem to be doing a grand job. We welcome Miss Gay and any other member of such a fine group.

Another Canadian member is William Berry of Regina, Sas., who is a real fan. He says he can't wait until the next issue comes out.

John Morinello of Lackawanna, N. Y., sends us a picture of a crash. Two pictures, in fact, one being that of the new Curtiss P-37 taken at the Buffalo Airport just before the take-off, the other after the accident had occurred. It seems the ship was being tested and was on its way in for a landing. The undercarriage folded up, and she slid along on her belly.

A new member is Lloyd Walker, of Konnapolis, N. C., who sends us a long letter about his ambitions. First off,

he's nuts about our light-plane department, and is going to learn to fly if he has to scrape every cent together to do it. His pals have been trying to tell him that light-plane flying is a rich man's game, but he remembers the stories of practically all famous pilots.

Miss Patti Powell, of West Palm Beach, Fla., is a new member, and we're certainly glad to have her. Her dad is a pilot down there and flies a Grumman G-21 amphibian and a Stinson Reliant. Patti has been all over the country with her father and knows all the aviation ropes. Only recently she was introduced to Doug Corrigan, she has been aboard Al Williams' Gulfhawk, and she thinks she is the only girl who has ever been inside the two German airliners that landed at Port Washington two years ago.

Leonard C. Rohlfsingmeyer, of 1205 Howard Street, St. Louis, Mo., is a member of the 110th Observation Squadron connected with the Thirty fifth Division Aviation Corps. He's a great model builder, and is out to make a gas model now. He says his outfit has nine planes, only one of which is new, a North American O-47A, and the rest are Douglas O-38s. Leonard would also like to communicate with some interested aviation fan in Australia, if possible.

Other members who have been awarded their Photographer's award this month are: Ted Mitarnowski, of Nanticoke, Pa.; Ray Lee, of Celeste, Tex.; Donald Monroe, of New York City; William Grant, of Norfolk, Va.; Dave Foust, of Akron, O.; Drexel Sibbersen, of Omaha, Neb.; and John C. Bowman, of Sierra Madre, Cal.

An Airplane Mechanic's award goes to Raymond Chauvin, of Fiskdale, Mass., who completely smothered our desk with photographs of his nine models, which run in size from a Boeing bomber to the Grumman Gulfhawk. On a Monocoupe 90-A he spent no less than ninety man hours of work. It has a full instrument board, a complete cabin, and even a "pilot" to fly it.

As usual, the Panama division has reported again. This time Abel Villegas, honorary commander and foreign representative of the outfit, writes in from St. Petersburg, Fla., to report on their activities.

It might be well at this time to remind our members that many of them are very careless in signing their names, and for this reason we often make mistakes in listing them. Since we have so many letters to go over every month, it would be a big help if you would all take more care with your writing, and whenever possible use ink and be sure to date your letter and include your home address. We like our readers who have unusual names to print them beneath their signatures.

William A. Anderson, of Birvabik,

Minn., has sixty youngsters in an air-plane model club he directs, and wishes to know how he can get them into Air Adventurers. The rules are simple, Bill. Have each one cut out the coupon, fill it in, and send a dime apiece for the pin.

Bill Clendenin, of Wilmington, N. C., has a yen to become an airliner test pilot. He's a good worker for Air Adventurers, too, for he has sent in the names of five new members: Roland Cooper, Tommy McGrew, Billy Pieper, Charles Sanders and Billy Turner.

Miss Nicki Foster, of Birmingham, Ala., wants to take her Flight Captain tests, and wants to know how to get the papers. Simply send in for them, Nicki, and we'll do the rest.

We are getting a swell reaction to our Diesel articles. Louis Ronaldo, of Oyster Bay, N. Y., who has sent in three new members, is out to become an engineer with his eye to the future of Diesels for aircraft. Charles Miller, Jr., of Gloucester, Mass., has taken the business up so far as to design a four-cylindered Diesel, of which he has sent us a drawing.

Hubert Smales, who fails to include his address, has sent in two grand sketches for us to look over. One is the Vickers Wellington and the other his "Ship of the Future," which appears to be a single-seater fighter not unlike the Hawker Hurricane.

Listen to this one. Mr. George H. Picard, who's a wireless operator at the St. Hubert Airport at Montreal, Canada, has signed up with the club, and we'll bet a lot of our members would like to correspond with him. Well, let's see how we can welcome him into the outfit.

The bag still has a few more letters to look over. Here's one from Frank M. Allen, of Dillon, Col., who claims his Airplane Mechanic's award on a model he has built, flown and photographed.

John O. Bouchie, of Detroit, Mich., writes in to tell us that his parents have at last given their consent to his taking up flight training, and is John happy! Well, best of luck, John, and don't forget the Solo Club once you have done the first circuit.

There are more Photographers, too. Joseph Manos, of New York, clicks with a picture of the Burnelli transport. R. G. Burr, of Leavenworth, Kan., wins his with a picture of a Boeing B-17 bomber; John Chaffin, of Oklahoma City, with a shot of Braniff Airways airliner; Robert Hess, of Elgin, Ill., for a close-up of an old Ford tri-motor ship; and George Howison, of Hamilton, Ont., for a good picture of the new Canadian Fleet Freighter.

This is all we can handle this month, but we'll try to get more in our next issue. In the meantime, keep your eye on the future of aviation, and don't forget to do *your bit* toward giving the industry a boost.

HE PRIZED HONOR MORE THAN LIFE

They let Clint Yancey keep his badge when they kicked him out of the Arizona Rangers—because, by allowing the notorious Tex Fletcher to escape he had so disgraced it that no other ranger would ever be given the number it bore. But dishonored, broken though he was, Clint Yancey knew he'd always be a ranger at heart, and even though he could never hope to vindicate his name, he meant to try to right the wrong he was accused of.

You'll be thrilled by reading

ARIZONA RANGER

by JAY LUCAS

which starts in the
current issue of

WESTERN STORY

THE MAGNIFICENT GESTURE

(Continued from page 48)

took a position around Bill at Ricardo's order.

"Put him in the room below the chateau," the prince snapped in his native tongue.

"Forward! March!" Ricardo said in the same language.

Bill moved away between them without a word. Ricardo walked beside them. At the end of a long hallway a corporal threw open an iron-studded door leading to a series of musty stone steps that went deep down into the bowels of the earth. Little rivulets of water oozed through crevices in the foundation. At the bottom of the steps they threw open another iron-studded door which opened into an evil-smelling room, partly carved out of solid rock. The floor was covered with moss and lichens.

"Listen, Ricardo—" Bill said as the guard stepped outside the doorway. But Ricardo did not answer him.

The door clanged shut with a hollow thud.

V—"HERE IS MY DUTY"

BILL sat down on the bare wooden bunk that was built against one of the damp stone walls and surveyed his prison under the light of the single electric bulb.

For five minutes he alternated in cursing himself, Ricardo and Prince Michel. He cursed himself for his own stupidity and Prince Michel for his madness. Toward Ricardo went the full force of his anger. He was certain now that Ricardo had double-crossed him. But why? He was also double-crossing Prince Michel. What was his purpose?

He tried to put the weird puzzle together in his mind and each time he got nowhere. But of one thing he was certain. Prince Michel was mad and he was dangerous. Bill knew that his life hung on the thin thread of Michel's mad fancy. And he was helpless with the one person who could help him, Princess Rene, in England.

So deep was he in thought that he did not hear the turn of the key in the great iron-studded door. He became aware of it as the motion of the big door swinging inward caught his eye. Then Ricardo was in the room with one finger held against his lips. Quickly he closed the door behind him.

Bill rose with every sense alert.

"It is useless for me to say that I am sorry," Ricardo said in a low voice. "You saw for yourself that he is mad."

"He is insane with power," Bill said. "Why in hell did you get me into this mess, Ricardo?"

"I have come to tell you," Ricardo said. "I did not dare tell you the truth at Cannes for fear you would not come. You must get the princess away before he loses complete control of himself. He is torturing her to bring her to her knees. She knows that he is mad."

"She is *here*?"

"In her rooms in the chateau," Ricardo said. "She has been a prisoner for the past two months, under lock and key. Aside from her maids and guards, and the prince, I am the only one who knows she is here. She is in constant terror for her life. He has threatened to kill her and one day soon he will do it."

"Why don't you do something about it?" Bill snapped.

"He is my ruler," Ricardo answered simply. "We are trying to set up a regency to rule for him. But until we do his word is supreme."

"Even to murdering his wife?"

"You of the new world do not understand our laws of the old. I was born under his rule and under it I shall die."

"Yes," Bill said grimly. "You probably will and sooner than you expect."

"We are wasting time," Ricardo jabbed a hand into the side pocket of his coat and pulled out an automatic. "It is loaded with a full clip," he said, handing it to Bill. "And here are two more clips."

"What—"

"Listen! You must work fast. I have everything planned. The princess is waiting. You will go with me to the top of the stairs. I will take the guard away while you slip into the hallway. You will go straight down it until you come to the stairs at the end. At the top of the stairs will be another guard, outside Princess Rene's rooms. You must cover him and tie him. He will have a key to the door at the top of the steps. She will be waiting and ready just inside. She will lead you to the terrace that opens on the courtyard. A car will be waiting there with the engine running. I will be at the wheel. Climb in the back, fast. I will drive you to the hangars. Your Charger will be on the apron, ready to go. The engines will be turning over. I have one mechanic I can trust. You must get her

aboard and get away quickly. Everything depends on speed. You will take her to Cannes where another car will be waiting for her. I have made all the arrangements. That is why I went to Cannes to bring you back to see Prince Michel.

"When you arrive in Cannes your men will be waiting at the airport. You must get away immediately for the States. Your life will be in double jeopardy when Michel knows the truth."

"And what about you?" Bill asked. There was no little admiration shining in his eyes for this man who would risk a horrible death for a woman who was not a native of his country.

"We both must gamble," Ricardo said. "I will try to avoid identification when I drive you to the airport. If I am seen—" Ricardo smiled and drew his forefinger across his throat. "She is worth the gamble. You are ready?"

"I am ready," Bill said.

"Remember, everything depends on speed," Ricardo said.

They shook hands, silently, and turned toward the door.

"You will count to thirty before you come out," Ricardo whispered at the top of the stairs, and disappeared.

Bill could hear a few murmured words and then footsteps as hours seemed to pass while he slowly counted to thirty. His fingers fastened around the latch to the iron-studded door and he pushed it slowly open. Eerie shadows played across the flagstone of the dismal old corridor as he stepped into it.

The next second he was running down its length on his toes, taking care to make no sound. A guard's voice called that all was well in the courtyard as he went up the stone steps at the end. A guard came out of a chair beside the door at the top as he reached the landing. He challenged Bill, sharply, in words Bill could not understand.

A smile spread over Bill's bronzed face as his right fist sped forward with the speed of light, landing on the guard's chin. The man dropped face forward as though he had been struck with a sledge.

The next instant Bill had the key hanging from his belt, and slipped it into the lock.

Then he was gazing into the deep, terrified eyes of the girl he had first known as Rene Roebing. She stood with one small fist pressed tight against her teeth as the door swung open.

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"Oh, Bill!" she exclaimed. "You have come!"

"Quick! You're ready?"

"Yes," she breathed. "I have locked both my maids in their room. Follow me."

She darted from the hallway across a long living room to a stone terrace. Bill heard the guard he had felled outside the door stirring as he ran after her, and followed her down a long flight of stone steps to the courtyard.

At the bottom of the steps lay another guard on his stomach, bound and gagged. A stride beyond was a long, low, open car with the form of Ricardo slouched down behind the wheel.

"Let her ride!" Bill said, and the tires screamed as Ricardo threw it in gear and poured in the gas.

Lights sprang up behind them as the car sped the length of the field toward the hangars, and then the lights of two more cars cut the darkness behind them.

"There are cars following us!" Bill screamed in Ricardo's ear.

Ricardo nodded his head as he drove up on the apron at a speed that made it seem they must go straight on through the hangars. But just before he threw on his brakes he cut the front wheels to the right so that his tires would bite. For one perilous moment the car teetered over, then righted itself, and Bill was over the side helping Rene to alight.

The Charger's twin, single-blade props were idling over a few feet away from them.

"You better go with us!" Bill shouted at Ricardo as he shook his hand for the last time.

Ricardo shook his head as he looked over his shoulder at the two cars racing down the field.

"Here is my duty," he said. "Good luck, Bill. Goodby"

He threw the touring car in gear as Bill raced over to help the princess into the forward cockpit of the Charger.

The Charger went down the runway like a silver streak of light as two armored cars came to a swirling halt and trained their guns on it.

With the touch of a master Bill eased the wheel forward ever so little to bring the tail up. Then he yanked her off the runway and hung her on her props as the thirty-six hundred horses in the wings thundered their full-throated roar and machine-gun bullets drove through the air where she had been.

VI—GREEN MENACE

AT five thousand feet Bill leveled off and locked his controls. He showed the white-faced girl in the navigator's seat how to fasten her safety belt and how to pull out the spring reel and use her microphone, and how to plug the earphones into the helmet he gave her.

"This is reminiscent of the time I took you to Maxembourg," Bill said over the interplane telephone when he had finished.

"The end," she said with tears in her voice, "of my beautiful romance. But he is mad, Bill, mad."

"I know," Bill said grimly. "He wanted me to help him develop an air force that could conquer Europe."

"War!" she said. "How I hate the word. It is all I have heard for the past year. He—he—"

"You'd better try to rest," Bill said sharply. "It's four o'clock. We'll be at Cannes by six. Try to forget it—don't think about it."

"That won't be easy."

But she lapsed into silence and Bill turned on the little light over his chart rack and quickly plotted his course, after taking his bearings.

Dawn had just crept out of the east and Bill was half asleep when the sound of screaming props outside the Charger struck terror to his heart. He glanced over his shoulder at the princess and saw that she was asleep.

He shouted into the interplane telephone to awaken her as he caught sight of three fast, tear-drop biplanes converging on them from three sides! They were only three hundred yards above him and traveling at terrific speed. He yanked the wheel of the Charger back and hung it on its props. The three diving ships were easing out of their dives to come up underneath him as he poured juice into the engines of the Charger and took it upstairs.

"They are Michel's ships!" Princess Rene shouted in his ear as he leveled off a thousand feet above the three biplanes and came around in a vertical bank.

Bill's finger hovered over the electric trip of the 23mm. cannon in the nose of the Charger. Suddenly, he opened up the throttles for a moment and went up and back in a flashing Immelmann turn as the three biplanes leveled off. They were coming at him head-on now. When they were four hundred yards away they opened fire with their six machine guns. Their concentrated fire was terrific.

Bill skidded the Charger out of range and eased back on the wheel as the three ships passed by him. As he saw their rudders bite into the air to return to the attack, he yanked the Charger up and over on its back just as they began their turn. At the top of his loop he neutralized his controls for a moment, then eased the nose down in a steep inverted dive.

He got the first three ships under his hair sights for one brief instant. His finger came down on the trip of his cannon. The rapid-firer threw five high-explosive shells within the space of two seconds, but Bill's speed was too great and his dive too steep to make his shooting effective. Between the time he

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had the ship under his sights and when he tripped his trigger the little fighters had passed out of his range of fire.

Bill cursed softly, leveled off and half-rolled the Charger upright. The single-seaters were coming around on one wing tip as he lifted the nose for altitude. He knew he could and should run away from them because of Princess Rene, but the thought of the madman who had sent them after him and the girl with him enraged him almost beyond reason. It came to him that if he halted the pursuit of Rene now he might stop it forever.

He was trying to justify his desire to give battle when he became aware of a screaming prop beneath him. He rolled the Charger completely over and whipped it up and around to reverse its direction. Then he dropped the nose and poured a burst of ten shells at the little green ship arrowing up at him. But again his aim was bad and the little ship kicked its tail in the air and dived out of danger.

He gunned his engine and dived on its tail. His line of tracer smoke curled above the head of the pilot. He eased his wheel forward a little and his bullets drummed into the tail assembly and climbed forward along the fuselage to the engine block. A half dozen of those powerful .50-caliber bullets drove into the back of the pilot's head as his aim traveled forward. He was driven forward over his stick, while his ship kept straight on toward the mountainous country below.

And then the air seemed to be alive with little green ships as the other two fighters came back into the battle. Bill realized only too well that if these were a sample of Prince Michel's fighters he was training them well. They were masters at their craft as they converged like two darting hawks with their guns screaming fire and death.

Bill knew that his muscles and mind must coordinate perfectly if he was to survive that terrific onslaught. He eased the throttles of the Charger open another notch and took it through a series of aerobatics to throw it out of range of their fire. Twice he saw his own bullets tracing designs on the sides of the little green biplanes, but his speed was too great for accurate shooting.

He felt the Charger buck and shiver as bullets drove into it from that never-ceasing hail of lead. He turned his face and saw that the girl who had been Rene Roebing was white and wide-eyed but not afraid. A smile twisted the corner of her lips for an instant and was gone.

Bill's face was tense and terrible in its absolute concentration on the horrible job before him as he turned back to his task. He whipped the Charger up and down, skidded and side-slipped, zoomed and dived and rolled to avoid

the fire of those two fast fighters. He knew, only too well, that one single error in judgment would be the end for both of them.

Then the two ships got him inside a tight circle, one a little above and the other a little below him. Each time he tried to break out a terrific burst of fire would cut across his path, forcing him to swing back, and then they would be on him again, trying to get him under their sights.

If he had been alone he would have risked taking their deadly fire to break through, but he was fearful for the life of his passenger.

Bullets drummed all around them, and Bill's breath was coming in quick, agonized gasps. He was using all his inherent genius as a flier, getting the utmost from the Charger's great speed and maneuverability, while he tried to keep from being annihilated.

When the two ships began to tighten their circle again, Bill waited until they almost had him between a cross-fire. He waited until one of the pilots became overconfident of his own ability. Then, for that brief instant that is enough, he got the green ship under his own sights. His finger clamped down on his Madsen cannon to release five explosive shells just before he pushed open his throttles and nosed down in a power dive.

The green biplane became a great mass of black smoke streaked with saffron flame. The other green ship zoomed upward to escape the shooting debris as it exploded.

Bill looked up and back as he pulled the Charger out of its dive. The remaining ship was diving on their tail as Bill began a tight turn to the right. As it went underneath him Bill dropped his nose again to get on its tail.

It was streaking down at terrific speed when the pilot tried to bring up the nose. But the nose would not come up, and Bill choked back a cry of horror as he saw its wings fold back like the wings of a diving gannet and start plunging to its death far below.

He leveled off, checked his course and laid the nose of the Charger on Cannes before he spoke to the white-faced girl behind him.

"Now," he said, "I think you'll be safe."

"You—you shot down all three of them?" she asked, her voice trembling.

"Only two," Bill said. "The third one folded up. I hope that's the last I ever hear from the Prince of Maxembourg."

"Oh, Bill," she said, tearfully, "I hope so, too."

"He won't be able to find you after I land you at Cannes?" Bill asked.

"Never," she said.

Shorty Hassfurter, Red Gleason, Bev Bates and young Sandy were standing beside their Snorters on that small air-

port between Grasse and Cannes when Bill kissed the runway with the wheels of the Charger.

They watched him in silent amazement as they saw him help a woman out of the cockpit and hand her into the closed car that was waiting beside the apron. They saw him bend over her hand and then saw the door of the car close and speed away.

"Thanks for the buggy ride, mister," the irrepressible Sandy piped in a falsetto voice as Bill sauntered toward them.

Bill didn't answer.

"Check over the Charger and have her refueled while I get some breakfast," he finally said to Shorty.

"We're shoving then?" Shorty wanted to know.

"We're shoving then," Bill said. "We're going to get back to Barnes Field where we won't have to hear anything more about war. And on the way give thought to the things I was talking about yesterday morning. I'm even more sick of talk about war now than I was yesterday."

"Why don't you become a monk, Bill?" young Sandy asked, his freckled face twitching.

"Shut up!" Bill roared, and disappeared into the airport restaurant.

THE END.

LACKEY ZENITH

(Continued from page 60)

ered with bands of paper where the curve is not too great, and strips otherwise. Make all joints in the covering over a former, or upright. Shrink the paper with water first, and when dry, give the fuselage two or three coats of clear dope. If there appears to be any twist in the fuselage at this point, brace it in a straightened position while the first two coats of dope are drying.

Any available size of wheels, within reason, may be used, with preference toward those of less weight. They are installed by soldering a small washer on the axle on either side of the wheels, making sure of enough clearance so that the wheels turn freely. The tires should always be kept properly inflated.

The fuselage complete, with motor and prop, batteries, coil and condenser, and the landing gear, on the original ship weighed thirty-five ounces. Of these thirty-five ounces the motor, tank, prop, mount, coil, condenser, and batteries took about eighteen ounces; the landing gear (with Voight airwheels) weighed eight ounces; and the fuselage with covering, nine ounces. When building your model try to maintain these weights.

(To be concluded next month.)

MODEL MATTERS

(Continued from page 57)

QUEEN CITY GAS MODEL CLUB. The First Annual Open Meet of the Queen City Gas Model Club was held at Hadley Field, Plainfield, N. J., on September 17th. Contest was directed by W. E. Marienschek, club president.

Winners:

Event One (30-second engine run)—1. Roger Des Broesses, N. Y. C., 9:08; 2. Herbert Grimes, Iselin, N. J., 5:00.6; 3. Donald McFarland, Tenafly, N. J., 3:00.6.

Event Two (workmanship)—1. Harold Hjemlo, Staten Island, N. Y.; 2. Donald McFarland, Tenafly, N. J.

Event Three (highest of three official flights)—Roger Hammer, N. Y. C.

N. I. G. M. A. The Northern Indiana Gas Model Association Championship Meet, held at Gary, Ind., on September 25th, produced the following winners: 1st, Martin Young; 2nd, Bob Roberts; 3rd, Dr. A. L. Evans; 4th, C. F. Magee.

Bob Roberts directed the meet. Plans are already under way for the annual big contest next June.

TRENTON EASTERN STATES GAS MODEL MEET. This Second Annual contest, held during the latter part of August, at Mercer Airport, New Jersey, produced winners as follows:

30-second Engine Run—1. Magnus Anderson, 12:18.4; 2. John Findra, Jr., 4:26; 3. Wm. Deans.

Design and Workmanship—1. Larry Low; 2. Walter E. Marienschek; 3. Henry Struck. **Consistency of Flight**—1. Magnus Anderson; 2. John Findra, Jr. **Lucky Winner**—Ed. Seegmuller.

The meet was directed by Lt. Everett C. Plummer, chairman of the Senior N. A. A. of Trenton. He was assisted by members of the Junior N. A. A. chapter, with headquarters at 458 Cleveland Avenue.

GENERAL NEWS. The Northern Indiana Gas Model Association Annual Gas Meet will be held in June, 1939. Information may be obtained from Contest Director Roberts, 4490 Broadway, Gary, Ind.

There will be a model meet in conjunction with the All-American Air Races, Miami, Florida, January 6th to 8th. For information write Air Races Headquarters, Miami, Fla.

This department would be interested in learning of models which have been consistent prize winners. Pete Dillon of Jackson, Mich., reports his Corben Super Ace has won a total of \$75.40 plus several kits and trophies. Readers will remember this model was presented in the February, 1938, issue. Owners of other high-money winners are invited to send in their records.

RADIO HOMING PIGEON

(Continued from page 10)

The accompanying photograph shows the Sperry-R. C. A. D/F mounted before the throttle quadrant. The large glass indicator face is parallel to the ship's floor, enabling the pilot to easily visualize the position of the plane by the bearing of the indicator pointer relative to the miniature airplane "ship's head." As the pilot approaches the station and flies over it, the needle, by swinging around, gives a positive cue that the ship is over the cone of silence. Previously the cone of silence—immediately over the station—could be ascertained only by the lack of radio signal.

The unique manner in which the D/F functions makes it advantageous for a variety of navigational uses. The pilot can use its indicator to find his drift. Or he can tell just how far he has passed along a given beam by tuning a station off to one side and observing the pointer. He can then utilize the indicated reading to obtain magnetic bearings. And he need do no arithmetic!

The top-view drawing of the D/F included herewith appears just as the real one would if you were the pilot. The cranking handle, marked "tune," rotates the indicator pointer to the known frequency of any desired radio station.

The outer band of figures is a non-movable scale. The inner band rotates. For an example, you, the pilot, desire to find the relative bearing of the station tuned, with respect to the flight path being flown. Your flight path, we will assume, happens to be 230°. This reading on the inner movable band is brought into agreement with the zero reading on the outer fixed scale. Suppose, furthermore, that the needle then points to 46° right on the outer band and 276° on the inner. The first reading is the bearing of the radio station in respect to your flight path; the second, magnetic bearing of station.

The reciprocal bearing—bearing of the ship relative to the station tuned—is indicated by the other end of the needle.

The remarkable capabilities of the new D/F are fully realized when hooked up with the gyropilot. The airliner is not only then guided to its destination, but the controls are properly actuated by the gyropilot to bring it there.

No simile would be more apt than to liken the device to a radio homing pigeon. For in that capacity it raises aerial transportation to an even higher level of safety. Hats off to Sperry and R. C. A.

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AIR PROGRESS

(Continued from page 9)

O-25C planes was flying from Duncan Field, San Antonio, to Fort Riley, Kansas. En route a buzzard attacked one of the planes and struck the leading edge of the wing. So determined was the attack that the bird lodged in the broken portion of the wing and stayed there. The pilot sensed no particular difference in the flying qualities of the ship and continued on to Belton, where he landed to determine the extent of the damage. A front spar had been broken in two places, and the buzzard had suffered a broken leg, which had to be amputated before it could be removed.

The buzzard died shortly after being removed, but the O-25C continued on.

The first of thirteen modified Lockheed-12s designed for high-speed communications work and army transport work has been delivered to Wright Field for testing. The ship uses Pratt & Whitney Wasp-Junior engines. It is also to be used for training where pilots require instruction on multi-engined craft.

Italy has formally advised most seaports, harbors, municipalities and large armament factories that they will be expected to provide their own anti-aircraft defenses and equipment, such as guns and searchlights. In event of war, however, the guns, ammunition and other equipment will come under the control of the Italian militia.

The De Havilland Aircraft Company of Canada has just delivered twenty-six Tiger-Moth trainers to the Royal Canadian Air Force. The Canadian Vickers Company is building ten Supermarine Stranraer flying boats for Canadian military use. The Boeing Aircraft Company of Canada is engaged in constructing seventeen British Blackburn Shark seaplanes, and the Fairchild Aircraft Company of Canada has orders for eighteen British Bristol Blenheims for Canadian bombing and reconnaissance squadrons. Canada is fast becoming a real air power.

A month of highly important maneuvers was started on October 9th in the vicinity of Fort Bragg, N. C., when the G. H. Q. air force began carrying out an extensive program of air attack in the face of three hundred warning observation posts manned by approximately two thousand civilians who had volunteered. The main idea was to establish whether reports and warnings provided by the civilian population could be

counted on should an enemy force attempt to raid any part of the country.

The new Navy Appropriations Bill, which will allow a sum of five hundred fifty million nine hundred forty-seven thousand six hundred ninety-four dollars to be spent for equipment increase, if it passes the bureau of the budget, calls for at least one new aircraft carrier and the increase of the naval air arm to three thousand planes. The previous limit was two thousand and fifty planes, but the expansion bill will authorize an additional nine hundred and fifty planes. When these will be available is not known.

The Glenn L. Martin Company of Baltimore just recently completed the three hundredth Martin bomber of the twin-engine type series which began with the prototype of the famous B-10-B and which is now represented by the present Martin 166.

New improvements are being continually added to the British Hawker Hurricane. The most recent photographs received in this country indicate that the Merlin engine has now been equipped with the new ejector-type exhausts and a revised tail assembly which offers more keel surface under the fuselage.

The British Air Ministry recently asked for volunteers from the ranks of amateur radio operators to assist the anti-aircraft defense squadrons in forming a civilian net of information. Within forty-eight hours after the appeal was made more than a thousand British amateurs had volunteered.

The new Polish four-seater medium bomber known now as the P.Z.L.-37 has a top speed of two hundred and seventy-three miles per hour and cruises at two hundred and thirty-six. It uses two Bristol Pegasus XX nine hundred and fifty horsepower motors, carries three machine guns and twenty fifty-kilogram bombs.

North American N. A. general-purpose machines now being built in Australia for the Australian Royal Air Force have been named, of all things, Wirraway G. P. ships. The Wirraway does two hundred and twenty top on five hundred and fifty horsepower and has British standard-screw threads on all parts. The N. A. ships to be built in the United States and sold to Great Britain will have American standard threads, which will probably drive a few mechanics mad, if there is ever an exchange of British and Australian training ships.

Switzerland has ordered a batch of Morane-Saulnier MS 406 C1 single-seater fighter monoplanes. They carry Hispano-Suiza 12Y 31 liquid-cooled Vee-12 engines equipped with Chauviere propellers, which are variable-pitch metal airscrews.

A flying dreadnaught naval bomber-reconnaissance of long range is now under test in France. It is a direct development of the Lieutenant de Vaisseau Paris, flying boat which visited the United States recently, but it carries more powerful engines, the eight hundred and eighty-five horsepower Hispano-Suiza 12Y 27s, and has provisions for machine guns and a large bomb load.

The Royal Norwegian Naval Air Force has ordered six Heinkel He.115 twin-engined torpedo bombers for delivery next summer. The He.115 is a typical Heinkel product powered with two B.M.W. engines and carrying a projectile load said to be in the neighborhood of two thousand two hundred and fifty pounds. It has a top speed of about two hundred and fifteen miles per hour. Light cannon may be mounted as well as regular machine guns.

MISCELLANEOUS

The modern one thousand horsepower aircraft engine using the water-cooling system has approximately one quarter of a mile of copper tubing in its radiator. The new Serck radiator weighs about a hundred and twenty pounds and has but one and eighty-five hundredths square feet of frontal area.

The British Short-Mayo pick-a-back plane *Mercury* failed by less than three hundred miles to better the world's distance record now held by the Russians. The *Mercury*, released from the *Maia* above Dundee in Scotland, attempted to reach Capetown, South Africa, but headwinds forced her down at the mouth of the Orange River after a flight of approximately six thousand miles nonstop. The present record is six thousand two hundred and ninety-six miles.

Herman Koehl, noted German pilot who flew the Junkers monoplane on the first east-to-west flight across the Atlantic in 1928, died in a Munich hospital on October 8th. He was fifty years of age.

The Germans have gone Consolidated one better in the matter of retracting wing-tip floats. In the PBV patrol boats the float is folded upward and outward, so that it becomes something of a bulged wing-tip buffer. In the German Dornier 26, the float is set midway along the wing and folds upward and inward into a motor nacelle, where it is completely covered.

RADIO WINNER

(Continued from page 55)

soldered to a small rectangle of sheet iron. The top armature piece is cemented to the lower armature piece, which will let go in case of crack-up and prevent damage to the escapement stubs. The escapement wheel is made of two strips of 1/8"-wide sheet brass and soldered together. Care must be taken in bending up the tips so that all of them are an equal distance from the center. A medium-size piece of piano wire is soldered 1/4" from the center of one of the legs. Any typical double-thrust bearing will work in the escapement. Mount the magnet and the escapement on a piece of 1/4" square balsa. Adjust before installation in the rudder. Armature movement of 1/32 to 1/16" is needed.

The rubber-band power needed will be one loop (the height of the rudder) $1/30 \times 3^3 / 32^2$ ". Although 9 volts (6 penlite cells in series) are used, the wise procedure is to adjust the unit carefully enough to work on 6 volts. This gives a safety factor of several volts and insures positive action.

The control mechanism operates as follows: with the rubber band wound to 400 or 500 turns with a winder the escapement wheel is held against the short stub. Connecting a battery to the coil pulls down the armature, which pulls the short stub out of the way and puts the long stub in the way, resulting in a movement of the wheel of about one-eighth revolution. When the battery is disconnected the long stub slips out of the way, allowing the spoke to pass by, but now the short stub is in position to stop the next spoke. No matter how long the battery is connected the wheel makes just one quarter revolution. It is easily seen how this motion is transferred into turning the rudder tab.

When installing the mechanism in the rudder remember that you want to have two neutrals, a full left, and a full right so the mechanism may have to be slanted and protrude slightly outside the rudder. The rubber band extends to the top of the rudder and a few holes will be necessary in the ribs.

The size of rudder flap will depend entirely on the ship being used. We find that about 20 square inches works well on a slow-flying, 8-foot-span job. In general one-fifth of the rudder area should be used for the control flap. This feature requires experimentation—the flap we're using is the sixth one on this ship. The flap will move from one position to another with great speed. It can be put through the whole sequence of positions as fast as you can push the button on the transmitter—

four times, about one-half second! The tail magnet draws only 80 to 90 mills, and the six penlite cells should last several weeks.

ARRANGEMENT

A logical, convenient manner of arrangement of the receiver, relay, and tail mechanism is necessary for smooth operation. The relay and receiver are mounted in a balsa rack suspended on sponge rubber. The batteries are bound firmly with rubber bands to the floor of the model.

In former years we have mounted the batteries in the bottom of the balsa rack. In rough landings the batteries moved forward, damaging the rack. This is what happened at the 1938 Nationals at the bottom of a power loop. Since then we have tied the batteries to the floor. The remaining part of the rack is still mounted on sponge rubber which prevents the "buzzy" vibration of the motor from being transferred to the relay and tube elements. With this last arrangement the plane accidentally hit a wire and dropped in from twenty feet—damage, broken propeller and loosened motor. The ship was flown again within an hour.

Build the receiver rack from 3/8" square hard balsa. The dimensions of the rack may be changed to suit the particular ship. The back of the front face is covered with hard 1/16" sheet and suitable holes cut for the grid bias resistor shaft and the tuning condenser shaft. Cement the receiver and the grid bias resistor in place. A short metal rod inserted in the grid bias resistor shaft will aid in making fine adjustment.

Cut a hole for the coil part of the relay, allowing enough room so the motion of the armature is not hampered. Cement in place. Hook up the various parts. All the connections end with small-size Fahstock clips cemented to the rack. Mounting stubs are cemented onto the rack. This type mounting is especially convenient, since it can be removed for servicing in a few seconds.

The battery box is 1/8" sheet. (Yardstick material works nicely.) The bottom is covered with 1/16" sheet hard balsa. Small clean screws are used for contacts. Springs are coiled from medium piano wire. The penlite batteries are installed and the box is bound to the 45-volt battery with rubber bands. (See photo.) With a large slow-flying ship the batteries may be mounted on the bottom of the fuselage without affecting the stability because of the lowering of the C. G. But with faster models the spiral stability will be more important and an effort should be made to place the C. G. of the radio equipment on the original C. G. of the model.

The sponge rubber for the unit

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RUDY ARNOLD PHOTOS
272 FLOYD BENNETT AIRPORT, BROOKLYN, N. Y.

mounting is a ten-cent bath sponge cut in two pieces and cemented to the supports inside the fuselage. Rubber bands hold the unit in place—tight enough to compress the sponge slightly. A hole or trapdoor should be cut in the side of the fuselage for access to the unit.

Two wires extend from the unit to the tail inside the fuselage and are fastened to the Fahnstock clips. The other ends of the wires fit into the battery box and the relay armature. The antenna is pinned horizontally to the inside of the fuselage.

Now for the wiring. Slip the two tail magnet wires into the clips and fasten the tail surfaces to the fuselage. The B— wire from the 45-volt battery is led to the A— connection on the battery box and then just one wire from there to the Fahnstock clip on the unit marked A—B—. The TB clip takes the wire from the tail. The other tail wire goes to the battery box on the —9V connection. Connect the B+ wire. The A+ and TF wire are the two that are disconnected when not in use. All the others may be left connected at all times. If the TF wire was left connected the tail armature would immediately slap down because the relay contacts are closed when the receiver is off.

Connecting the A+ wire turns on the receiver and opens the relay contacts. TF wire may now be connected. For testing slip out the B+ wire from the clip and insert the milliammeter between the clip and the wire. Tune the receiver to the transmitter as before and adjust the grid bias for critical operation. Now every time the push button on the transmitter is pressed the tail flap will click from one position to the next. As you slowly click the push button the flap will click slowly through the sequence of positions. Pushing the button many times in rapid succession will cause the flap to click through its positions just as rapidly. In fact the flap will work just as fast as you can push the button—which is very convenient when flying the model.

Before taking the ship to the airport this operation should be repeated with motor running. It should work just as well, but sometimes a little trouble may be caused by having the relay contact set too close, or the tail flap may “stutter” if the tail magnet spring is too weak. Both these faults are easily remedied, and the ship is ready to fly.

TRANSMITTER

The account of the transmitter was written by Bill Good, my twin brother, who has done much of the radio work involved. His call is W8IFD. He's never been able to attend the Nationals with me, so I've borrowed his friend,

Paul Krielick, W8QQE, since I do not have a license myself.

Bill built the transmitter and it is really a beautiful job. The total cost is a little under \$20. Frank Tompkins, W8OBP, helped me build the other transmitter. With a little outside help any gas modeler should be able to handle the job.

When using two controls the transmitter has a frequency changer on it. Fred la Violette, W8HSJ, contributed this piece of work. You can readily see radio control is more than a one-man job.

My brother Bill's account is as follows:

The transmitter uses the old standby TNT circuit in a push-pull arrangement and is more or less offered to show what has proved successful in our particular case. The in-put runs between 75 and 100 watts, which is plenty to control the plane. The push-button control to turn the transmitter on and off to give the necessary impulses is connected at the end of about ten feet of cable to allow the operator ample freedom while the plane is flying.

It is absolutely necessary to have a government license for the transmitting station and a licensed operator to run it. Unless the model builder already happens to be a licensed radio amateur or “ham,” it is strongly advised that he enlist the services of one of these persons. The “ham” holds the required license and will be able to assist materially in the construction of the transmitter and the receiver. In many cases if the modeler contacts the right radio amateur, the “ham” may already have a 5-meter transmitter which could be put into service. If you know of no “hams” in your locality, try inquiring at the nearest broadcast station or radio service man. After locating one “ham” in a community, he will know the rest and be able to direct you to one who'll be willing to give you a helping hand. If there are absolutely no radio men of any description in your neighborhood and you still want radio control, you will have to obtain a license yourself. Information may be obtained from the American Radio Relay League, West Hartford, Connecticut.

We have experimented with several types of antennæ including the directional Reinartz beam, but have finally ended up with a horizontal half-wave doublet fed in the center with a short line spaced about two inches. This seems to be entirely satisfactory and saves the operator the nuisance of having to turn a directional antenna.

The amount of power used has been found to be sufficient in all cases. If a different type transmitter is used—which will probably be the case if a “ham” is helping you—it is suggested

that no more power than this is necessary, and less power would work without a doubt. The following possibilities occur to the builders:

1. This type of transmitter using power from AC or DC generator powered from fan belt or external gasoline engine.

2. Lower power transmitter running from Vibra-pack or Gene-motor from car battery. Installation could be made in automobile and therefore would be ready for operation at a moment's notice.

FLYING

Extreme caution in preliminary ground testing will insure positive controlled flight. There's nothing so heart-breaking as a radio ship that won't control. With this lightweight control the model will not fly much faster than normal and no additional power will be needed. Our ship flies on a Brown Jr. and has actually maintained level flight when the motor became accidentally retarded in flight.

At the airport assemble your ship and check it carefully while your “ham” (who *must* be with you) sets up the transmitter and the antenna. Turn on the receiving apparatus and check close to the transmitter. Then test again at 100 to 200 feet. At this distance you'll find adjustment much more critical and the meter may have to be put in for accurate check. Always check again after the meter is removed. We have found that 100 to 200 feet on the ground corresponds to 1,000 to 2,000 feet away in the air! If there is a slight hill between the plane and the transmitter while testing on the ground it may not work because the ground will not let the radio waves pass through. No need to worry about this happening in actual flight if the plane is always in sight of the transmitter.

After the ground testing is satisfactory there are still several precautions. We always let the ship off with neutral rudder, with left rudder as the next position. Let the ship climb until it has enough altitude to turn safely in either direction.

Turn on the control apparatus and have the operator click the rudder into the neutral—going left, as we say, meaning the next position will be left rudder. The take-off should be fairly close to the transmitter (25 to 100 feet) to be sure of good control near the ground and to allow the launchers to get back to the control box quickly. With the rudder in correct position warm up the motor. As a final check (we always do this) have the operator push the button four times. This should swing the ruddler through all four positions and back to the original setting.

After the take-off allow the ship to get up-wind and climb to sufficient altitude before giving it left rudder. When you push the button you will see the wings tilt immediately and the model start a left bank—staying in the bank until you change the rudder. Most fun is to bring it back into the wind, and one click will give it neutral rudder. The next position will be right rudder. But if you want left rudder again, click the button three times instead of once.

This will continue just as long as the flight itself. Try to keep the model slightly up-wind. When the motor cuts you will still have the glide to control, and bringing the ship to a landing directly in front of you is the purpose of the radio control. The ship should be adjusted for a flat, straight glide with rudder neutral. Don't adjust the model to have a flat circling glide which will result in a "stally" glide when the ship is straightened out. Let us assume the ship is still several feet above the ground in a circling glide. Using the control, straighten out the glide path and the glide will flatten noticeably and the model will flare out for a smooth three-point.

This same effect is noticeable in the power flight when the ship is in a good fast circle with the motor running. Straightening the rudder will cause the ship to climb more than usual. Sometimes in switching from left to right rudder in a hurry the ship, rolling over to circle against the torque, will give a considerable zoom. So it can be seen that although we are using rudder control alone, there are a large variety of maneuvers easily performed.

If you have reason to suspect that your model might want to bank steeply and spiral in before control is effective, it might be wise to use a small flap and slowly increase its size.

About thirty flights have been made with the present radio ship and it's going to have many more. One morning the plane landed on the runway three out of five attempts. Most flights average about ten minutes, or practically a full tank of gas. Several of our flights have been up to 2,000 feet overhead, where we had fun doing figure 8s through the low clouds!

The model and apparatus have proved themselves to our own personal satisfaction countless times. And also to the public on many occasions. We hope this model will do away with some of the justifiable skepticism concerning radio-control models. We look forward to 1939 being a banner year for radio-controlled models.

5-METER TRANSMITTER PARTS

(See Fig. 11)

- Tubes—2 Taylor T-20's (@ \$2.45)
 1 83 or 5Z3 rectifier (\$1.05)
- T₁—Power transformer (\$2.45)
 Primary 110 volts AC 60 cycles
 Sec.—600-O-600 at 200 MA 7½ V., 5 V.,
 2½ V.
- R₁—Grid bias resistor 15,000 ohms—10 watt
- R₂—Bleeder
- C₁, C₂—Filament by-pass condenser
 .0005 ufd mica
- C₃—Filter condenser 1 ufd—1000 V.
- C₄—Split stator tuning condenser
- R. F. C.—Radio frequency choke
- M. A.—Milliammeter—O-300 M. A. (\$.59)
- L₁—Tank coil, one-inch dia.—4 turns of ½"
 Copper tubing spaced to fit condenser
 terminals
- L₂—Grid coil
- S₁—Push-button switch for control
- S₂—Toggle switch for transmitter

RECEIVER PARTS

- National Ultra-Midget 15 UM15 μuf .75
- Fixed condensers ("postage stamp"
 size or smaller) Aerovox or Cor-
 nell-Dubilier .0001 μf .09
 .002 .21
 .005 .26
- Interruption frequency coil
 (without shield) .55
- Type 30 tube .50
- 50,000 ohm volume control .59
- Padding condenser .06
- Burgess W30FL 45-volt battery 2.00
- 2 penlite cells .10

These prices are all wholesale and are only approximate, as they vary slightly from place to place.

ZLIN XII

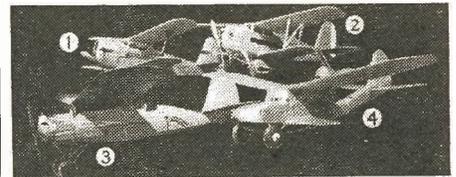
(Continued from page 24)

pilots, and is answering the same purposes in other countries, including France, Italy, Sweden, and England. A few models have been fitted with the later Persy III engine, which gives a somewhat improved performance because of its fifty-five horsepower. In 1937 the Zlin won the world's speed record for class "C" light planes over a one-hundred and one-thousand-kilometer course. In a ten-thousand-kilometer fuel-consumption competition the ship gained a first place. The following figures are given for the Zlin XII as powered by the forty-five horsepower Persy II engine.

Span	32' 10"
Length	24' 11"
Height	5' 11"
Landing-gear tread	6' 7"
Maximum wing chord	6' 11"
Empty weight	660 lbs.
Useful load	442 lbs.
Gross weight	1,102 lbs.
Top speed	94 m.p.h.
Cruising speed	84 m.p.h.
Landing speed	40 m.p.h.
Take-off run	280 ft.
Climb to 1,200 feet	3 mins.
Ceiling	12,460 ft.
Cruising range	3 hrs. or 250 mi.
Fuel	10 gals.
Fuel consumption	3.25 gals. pr. hr. or almost 26 mi. per gal.

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(1) The Winner Biplane Beach Type, Wing Area 640 sq. inches.
 (2) The Challenger Biplane Waco Type, Wing Area 700 sq. inches.
 (3) The Sky Racer - Navy Racer, Wing Area 680 sq. inches.
 (4) The Amphibian Clipper - Land gear retracts, Wing Area 710 sq. inches.

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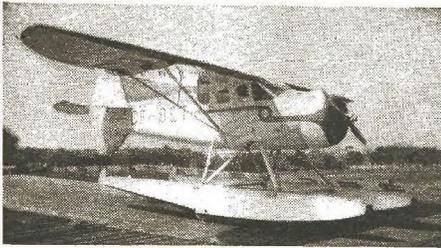
WINGS OF MERCY

(Continued from page 33)

patrol flights concern themselves with searching for menaces to navigation and looking for small vessels which may be in distress. The smaller craft are inspected carefully to see that they are all right.

We spot one drifting about aimlessly, and a frenzied waving of arms greets us as the plane zooms past for a look. Evidently the boat's engine has died out. Looks like a party of Izaak Waltons out of luck. The plane circles around as the radioman speeds off a message to the nearest shore station. In a short time a coast guard cutter or patrol boat will appear on the scene to tow the hapless anglers back home.

A few minutes later the onward-speeding plane looks over a freighter which is standing still in the middle of nowhere,



Howard DGA-8, on Edo floats.

stacks almost smokeless. But he gets under way shortly, and we can make out the name of a well-known line, so we know they are O. K.

Somewhere off Cape May we begin to hit trouble. The bright sun and clear skies that had been ours when we took off are replaced by a leaden sullenness as hazy, gray wisps of fog begin to pile in gradually around the plane. Soon the water disappears from view and the stuff blankets out all semblance of visibility. Climbing doesn't help us much as the fog holds on tenaciously. Nothing to do but fly along and rely upon instruments and radio. The co-pilot comes back and gives a reassuring word that there is nothing to worry about.

Soon we are slipping along in total blankness—the fog is so thick that you can't even see the wing strut, six feet away, and drops of water begin to trickle down the inside of the hatch cover. The motors drum on steadily as the pilot sends back a message to the radioman to contact shore stations for the purpose of getting our bearings by direction finder. In the interim, he checks over the battery of gauges, instruments and what-not in preparation for blind flight by instrument.

A shore station is soon picked up in the direction we want to go, and the

plane requests that they transmit a continuous signal for a few moments while we get our bearings. As the shore-station transmitter emits its signals, the plane's radio direction-finder loop antenna is rotated until the radioman hits upon the "null" point (the point where signal fades out altogether). That is the direction we must head for; the bearing is taken and we proceed on anew. At regular intervals this procedure is repeated as a check on our course, while the big plane heads for home. The pilot estimates that we will arrive at Floyd Bennett in about forty minutes, so everybody takes it easy and chews on gum which one of the mechanics hands around.

The pilot decides to go down for a look around, and we lose a little over fifteen hundred feet of altitude as the plane finally begins to break through the stuff to find an open spot. Can't lose too much altitude, although water can be seen far below. In foggy or hazy weather, what appears to be water may be just sky, and vice versa; more than one pilot has been killed spiraling into what he thought was an open spot and which turned out to be water. This has never happened to a coast guard airman, but they don't take any chances, regardless.

In another ten minutes we are circling the air-station hangar, and the beaching-gear apparatus is being hauled out of the hangar and pulled down the ramp as we come in for a smooth landing, water rushing by and slapping around the hull. Stiff legs are exercised as the ship comes up the ramp and approaches the hangar, with a watchful ground crew walking along to see that everything is all right. An uneventful flight (for the coast guard) has just been completed.

It is truly a long cry from this to less than two decades ago, when the coast guard aviation unit was first brought into existence. There's quite a gap between the antiquated, single-engined flying boats with a land speed of about eighty miles per hour, with hardly any cruising range, and unable to land except on fairly smooth waters, and the present giant, twin-engined Hall-Aluminum PH-2 long-range flying boats, one of which we had just flown in. The latter, built for the special purposes of coast guard aviation duty, combine ruggedness and stamina with a cruising speed of better than a hundred and twenty-five miles per hour, and a fuel capacity that can keep them aloft for almost a day on a two-thousand-mile trip—enough, practically, to take them

to Florida and back, and able, if necessary, to pick up a score of passengers in an emergency. The coast guard has marched along with commercial aviation in aeronautical pioneering, and has been able to build up an enviable record of operation activities.

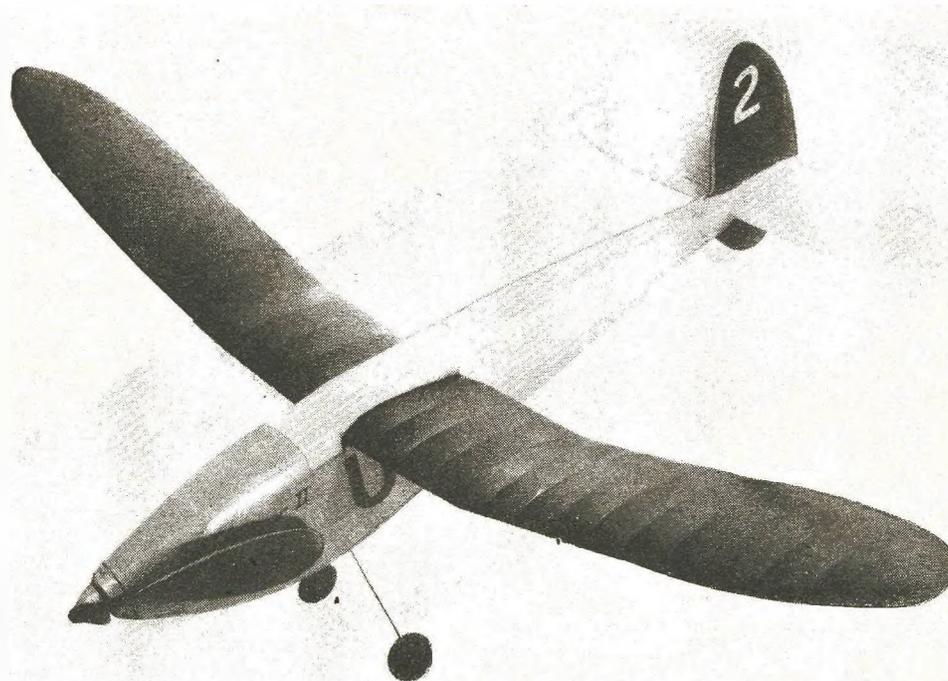
The eight planes which are now stationed at the new air base find plenty of work. Whether it's a matter of spotting an obstruction to navigation, transferring a medical case, engaging in law enforcement activities, or cooperating with another government agency, the big ships are kept pretty busy.

When not engaged in actual flight, there is plenty of other activity to be found. Checks and overhauls of equipment cover an airplane from the very end of its propeller tips to the tail landing light. Mechanical facilities at the base provide for about everything except a major overhaul. The coast guard owes a great deal of its success to its careful and thorough system of maintenance of its flying equipment.

This aerial peace-time army never rests, but is ready constantly to perform its manifold duties. The new air base, for instance, has approximately seventy-two thousand square miles of sea area and thirty-six thousand miles of land area to cover. Some of the figures taken from the service's annual report for the fiscal year of 1938 can give the reader an idea of the scope of coast guard aviation division operations:

Area covered by planes	5,386,363 sq. mi.
Miles cruised by planes	934,430 mi.
Persons assisted	212
Persons warned of impending danger	2,135
Emergency medical cases transported	148
Persons transported from disabled vessels	21
Disabled vessels located	63
Smuggling vessels located	27
Illicit distilleries located	607

We take a final look around the various offices and shops that dot the ground floor of the giant hangar and appreciate the fit and businesslike atmosphere that permeates the entire place. As we enter the radio room for a good-by word, the teletype chatters out a message concerning a missing cabin cruiser, overdue now for two days. The public-address system barks again as the man on watch, on orders of the executive officer, calls another crew to prepare one of the Douglas RD-4s for flight. Just in case, the collapsible CO₂ rubber life raft is broken out and reinspected, and a stretcher put on board. A pharmacist's mate packs up a first-aid kit and prepares to go along. Engines roar to life. It is just another routine flight for the coast guard.



Guarantees a Merry Christmas for any boy

The model airplane pictured here, which is offered FREE with a year's subscription to Air Trails, was made from the exact specifications of the Championship Model designed by Jim Cahill, Captain of America's 1938 Lord Wakefield Team, which won the three most important model contests in the world. As a Christmas gift to any boy it will be appreciated tremendously for in addition to the model airplane the boy receives twelve issues of Air Trails, the most popular aviation magazine in America!—all for \$1.50. We'll also mail to the boy a beautiful Christmas card announcing the gift from you.

The contests won by this airplane were:

1—MOFFETT TROPHY. America's leading yearly model competition. Jim Cahill won this event with the model pictured above.

2—AMERICAN ELIMINATIONS. Against all the best models produced in America, Jim Cahill's model won this event. Then he was made Captain of the American Team and was sent to Paris to compete for the Lord Wakefield Trophy.

3—LORD WAKEFIELD TROPHY. Leading model builders from all over the world enter their ships in this, the most important of model contests. Jim Cahill's model won first place.

These three Championships make Jim Cahill's ship the World's Champion Model Airplane. This model which has been made up in kit form under the supervision of Jim Cahill is not for sale. The only way you can get it is ABSOLUTELY FREE with a year's subscription to AIR TRAILS.

Hobby Craft Stores in New York

The Hobby Craft Stores at 112 West 42nd Street and their Mt. Vernon store at 23 East Second Street, Mt. Vernon, N. Y. are featuring this most unusual Christmas present for boys. Stop in at their stores.

Kresge's In Newark

Kresge's Department Store in Newark, New Jersey, so appreciated the wonderful interest this offer has to boys and their parents that they are selling the Kit and Air Trails as a Christmas gift for \$1.50. If you do your shopping in Newark stop in Kresge's, look over their display.

Mail This Coupon Today

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Inclosed is \$1.50. Kindly send a year's subscription to AIR TRAILS and the Jim Cahill Model Kit to

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and mail him a Christmas card announcing that the gift is from me.

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This offer good in the United States and Canada. Canadians please add 25c to cover kit mailing costs.

GLIDING

(Continued from page 37)

Many new members joined the club, and enthusiasm is high. Emil Lehecka is the official instructor. Charles Barg is president.

The Hudson Valley Gliding and Soaring Club is doing active flying every week-end at Wurtsboro Airport, Wurtsboro, N. Y. There are now twelve members enrolled in this fast-growing club. A Schweizer all-wood utility is used for training, and the all-metal boom-tail ship for advanced training and soaring. Herbert Sargent is acting as instructor.

As we get ready to go to press, an enthusiastic letter comes in from Lewin Barringer telling of his successful soaring expedition to North Conway, New Hampshire. On the first soaring day there he reached the record altitude of 9,000 feet on a thermal. Imagine what flights can be made in this vicinity in summer if 9,000 can be reached in cold-weather thermals. For a long time the editor of Air Trails has argued for the side of soaring possibilities in the White Mountain section of his native State, and it is a real pleasure to have such an outstanding soaring pilot as Lewin Barringer prove this contention. Let's explore this section further.

SILVER "C" PILOTS

Harland Ross. Harland Ross, designer and builder of the Ross-Stephens and the Ross R-2 sailplanes, two of the most outstanding soaring ships in this country, holds Silver "C" certificate #510. He got interested in gliding in 1929 while in naval aviation at San Diego, Cal., watching Hawley Bowlus soar along Point Loma in one of his sailplanes. Wanting to try this fascinating sport, Harland enrolled in the Bowlus glider school at Lindbergh Field, San Diego. After qualifying for his "B" license he built his first sailplane, the Silver King.

During 1930 Ross made several duration flights, one of which exceeded five hours. The same year he made the first high-altitude flight in southern California, being launched by shock cord from an altitude of fifty-eight hundred feet off the top of a hill and soaring for thirty-five minutes. In February, 1932, he won first place in the Pre-International Gliding Contest held at Redonda, Cal. In July of the same year he won second place in the Pre-Olympic Contest held at Grand Central Air Terminal, Glendale, Cal. The following year he was retained as instructor for the San Diego Boys Club. While working in this capacity Harland made a most remarkable out-and-return flight of ten miles utilizing slope currents along Point Loma.

Back in his home State, Texas, in 1934, Ross had his first experience with thermal currents over the plains. Returning to California in 1935, he made his first duration flight in a Franklin, utilizing thermals from level ground. During this flight he reached an altitude of twenty-five hundred feet. In 1937 he designed and built for Harvey Stephens the Ross-Stephens sailplane, which he flew at the National Soaring Contest at Elmira. With this ship he made a number of successful long-distance flights, one of which was in excess of a hundred and twenty miles. During the 1937 National Contest he won his Silver "C," as well as second place for distance and duration, second place for design, and the Air Trails Trophy. The following year he designed the Ross Ibis sailplane for the Soaring Society of America, with which Robert Stanley made the flight from Elmira to Washington. This was the ship intended for Barringer's Texas expedition.

At the present time Ross is working on a two-place sailplane that he hopes to enter in the next year's contest. He lives in Wichita Falls, Texas, where he and his brother Vernie fly a modified Prueffing. With this ship Harland made one out-and-return flight of sixteen miles, and one flight in which he reached an altitude of seven thousand feet above point of take-off, thus claiming an unofficial altitude record.

LIGHT PLANES

(Continued from page 35)

we are trying to do and get them to cooperate on the Solo Club. This will really be something you will be proud of. You won't see a million of these wings up, everywhere you go. They have to be won—through solo.

Think it over, grab yourself a chunk of altitude and join the Solo club.

More next month.

NEWS AND NOTES

Rearwin is exporting Sportsters by the carload lately. Recent shipments were sent to Tasmania, New Zealand, Brazil, Costa Rica, and, of all places, Bangkok.

* * *

Grove Webster of Hackensack, N. J., has been appointed head of the Civil Aviation Authority's new Private Flying Section. Many believe Webster will be able to do much for the private and amateur crowd.

* * *

The 1939 Aeronca Chief is out and has won high praise everywhere. It sells at one thousand seven hundred and ninety-five dollars. In Great Britain it is being offered in two models, the Scout

forty horsepower for two thousand and forty dollars, and the Chief, fifty horsepower, for about three hundred and sixty-five dollars more. What strikes one are the modern finish, the cabin comfort and the very modern lines.

* * *

Luscombe's new light plane is a fifty horsepower all-metal side-by-side job which sells for one thousand eight hundred and ninety-five dollars. It uses the Continental A-50 engine and has a startling appearance about the nose, which features a very determined-looking engine cowl. To us this seems nearer what the amateur wants than anything that has come up in some time.

* * *

The Cessna Airmaster for 1939 is Cessna from prop to rudder and you couldn't mistake it anywhere. It has smart but undeniable Cessna lines and for those who can afford extra power, we have seen nothing quite equal to it. The cabin is smart in its Spartan way, and not quite as luxurious as one might wish, but it is complete and well designed. We like the new faired landing gear and the roomy luggage compartment. The one hundred and forty-five horsepower Warner Scarab is set in a detachable engine mounting. Very handy, that, for repairs and overhauls.

The side-by-side Cub has been seen and generally accepted. It has a comfortable and roomy cabin, most suitable for the sportsman pilot who does not want to see "all the works" when he is flying. The regulation wing has been retained but somewhat stiffened with two extra ribs and swaged drag and anti-drag wires to give additional strength for the greater gross load. They also give you two entrance doors.

* * *

Mike Murphy, who gave exhibitions of taking off and landing with a Taylor Cub fitted with normal Edo floats at the recent National Air Races, has set the industry thinking. Most certainly he proved that under ordinary conditions a float-equipped plane can be set down and taken off again on land as well as water. Mike simply had a strip of polished steel welded along the bottom of the floats, to protect the dural sheeting, but beyond that the whole outfit was a regular seaplane.

* * *

The Private Fliers Association is doing a mighty fine job for the non-professional pilot. Why not write to Wm. W. Brinkerhoff, secretary, at 96 Wall Street, New York City, care of Brown Crosby & Co., Inc., for literature and information regarding joining this organization?

QUESTIONS

(Continued from page 42)

Question: Could you tell me all records made last year in altitude, speed, et cetera, and dates on which they were made? Also state records made this year and the dates. A. H. S., Brooklyn, N. Y.

Answer: Records of this kind are classified into so many types of different aircraft which established them that there would not be room on this page to list them. Write to the Aeronautical Chamber of Commerce, Rockefeller Plaza, N. Y. C., for the information.

Question: Where could I get a good aeronautical engineering education so that I may specialize as instrument technician? What are the tabs on the control surfaces for, how are they operated, and why are the double tabs used on the

Boeing B-17? What is the price of the Payne Knight Twister? M. S., Saugus, Mass.

Answer: In the September issue of Air Trails we published a list of aircraft schools together with complete information as to courses they offer. The tabs on control surfaces are used to trim the ship either in flight or just before landing and take-off, or to overcome engine torque. The double tabs on the B-17 are used because of the four engines and its size. Write to the Payne Aircraft Co., Joliet, Ill., for the price of the Knight Twister.

Question: On page 36 of the August issue of Air Trails there is a picture of a Dal Special manufactured by Wayne Dalrymple and Charles Pheiffer of Wichita, Kan. Will you please let me know the cost of the plans and blueprints, the wingspread, and whether it seats two people? If not, could it be made to hold two? About how much

would it cost to build this airplane? R. N., Dallas, Tex.

Answer: Sorry, but we haven't any information on the Dal Special available beyond what was published in the August issue.

Question: A friend and myself have been having an argument about whether an American Flea is expensive or not. By the way, is it true that at one time you performed heroics high above the good terra firma? What happened and how did you make out? M. S. and J. H., Ada, Okla.

Answer: The American Flea is not available any more. I think that the whole ship could have been purchased for approximately \$700. I don't know what you mean by heroics high above terra firma, but I did barnstorming with the old Gates Flying Circus, put on stunting exhibitions, and have flown the Pacific. What happened? Nothing in particular.

YARDSTICK PROPELLERS

(Continued from page 67)

When the laminated propeller blank is dry (give it 24 hours), remove from the press, and it is ready to be shaped. First, by cutting away, on the sides and ends, you can roughly get the shape of the finished blade. See illustration (1). You can safely trim off all the projecting part of both top and bottom layers, where they extend over and beyond the next layer. See shaded portion in (1).

Lay the blank upon a smooth surface, with the shaft hole vertical. Mark a line across the blank at 2 inches from

the hub, on what will be the back or inner side of the blade, as this is the side which is carved first. By placing the template, using the angle for 2 inches, at right angles across the prop blank (see illustration 3) at this point, the amount to be cut away to leave the proper angle can easily be seen. By cutting carefully and a small amount at a time, the inner blade may be shaped to the correct angle. It is essential that frequent template checkings be made, at 2, 3, 4, 5, 6 and 7 inches from the hub.

When the inner blade has been shaped to the correct angle at all points, the front surface is shaped. This should leave the leading edge heavier than the trailing edge, and be somewhat convexed. If desired, the inner blade may be slightly concaved, the greater concavity being at about a third back from the leading edge, or about as a wing inner surface would be.

With the shaping completed, the entire blank should be sanded to a smooth, even streamlineness, tested for equal blade length, as well as for balance. The first is easily done by laying the propeller on a flat surface, putting a well-fitting nail through the shaft hole, and measuring, with a vertical knife blade, the length of one blade, then comparing with the other end when ends are changed by rotation. If the propeller is balanced, it should stay in any position in which it is placed, when held by a horizontal, loosely fitting shaft through the hub. By careful sandings on the heavier blade, the two can be equalized and so balanced. This is the time to get the center thickness just as you want it, as you will wish to sand off the ruling marks anyway.

Wipe free from dust, and apply evenly a thin coat of clear varnish, and allow to thoroughly dry. The prop may be stuck on the end of the 1/4-inch drill, which can then be placed in the center hole of the clamp, for a base, to dry. Sand with fine sandpaper to a smooth finish, and revarnish. When this second coat is dry, rub down with a paste made of linseed oil and Bon Ami, using a piece of soft cloth with which to rub. Be quite careful here that the job is thorough, and a velvety-smooth finish obtained. Wipe dry, revarnish, let dry, and rerub. Your propeller is ready to take your ship aloft, provided you feel it isn't too good to take chances with.

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If you'd get up some morning and find yourself not yourself—physically—what would you do? Especially if you found yourself a criminal wanted by the law?

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the book-length novel complete in the current issue of DOC SAVAGE magazine, shows you what one man did, and how Doc Savage and his scrappy pals got mixed up in this unique and thrilling story. Other stories and features give you a great buy in reading entertainment in the

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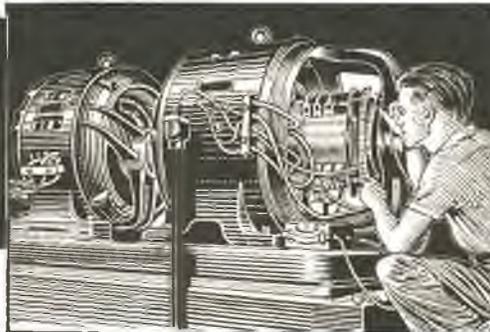
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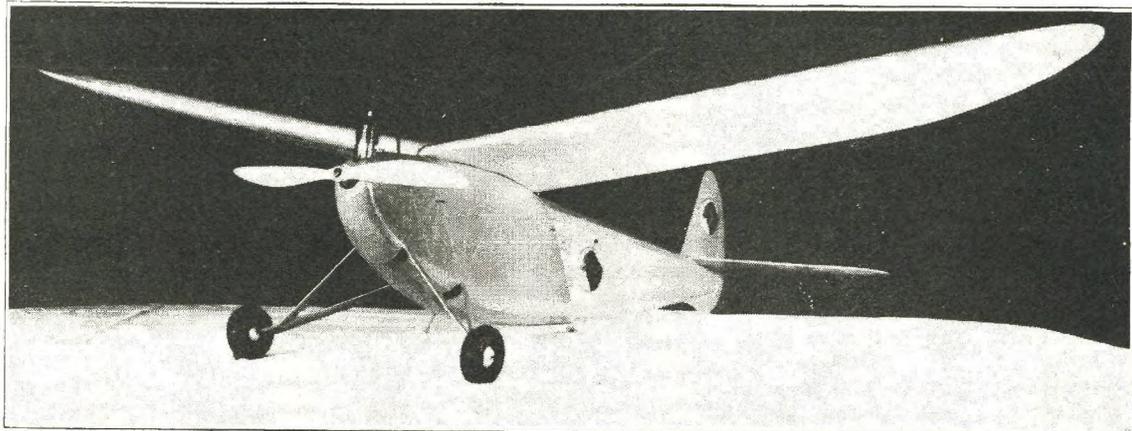
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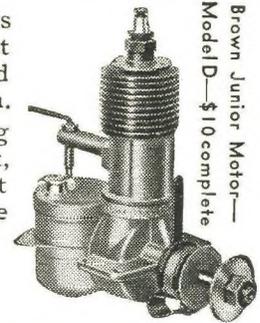


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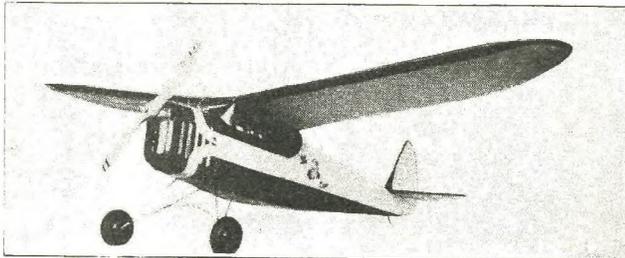
The model you will enjoy building and take pride in flying, because there is absolutely no guess work about its performance, in addition to winning first place at Detroit, it has consistently won first place in open competition all over the United States. Its ability to climb fast and glide perfectly places it above all competition.

Each kit contains:—full size detailed working plans, air wheels, extra strong wing ribs cut to perfect shape, select extra hard and firm balsa, cut smooth and straight, formed to shape spring steel landing gear struts, colored bamboo paper, cut out propeller, large can of cement and numerous other exclusive features, which space will not permit mentioning.

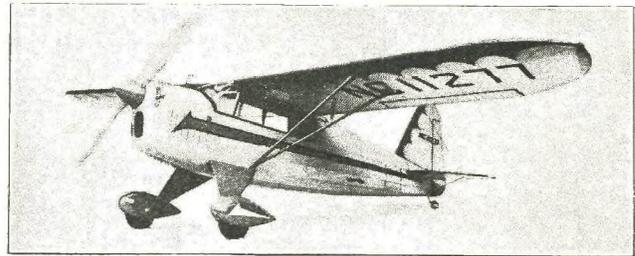
Wing span 76 inches, weight 3¼ pounds, recommended power: Brown Jr.
Price \$5.50, plus 50c extra for mailing.



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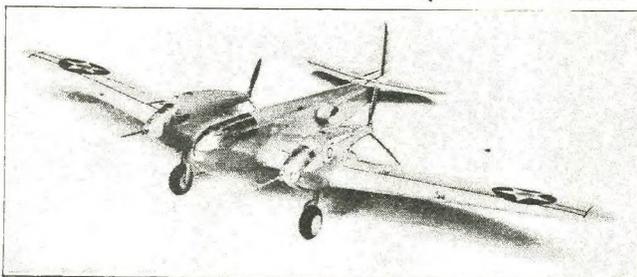


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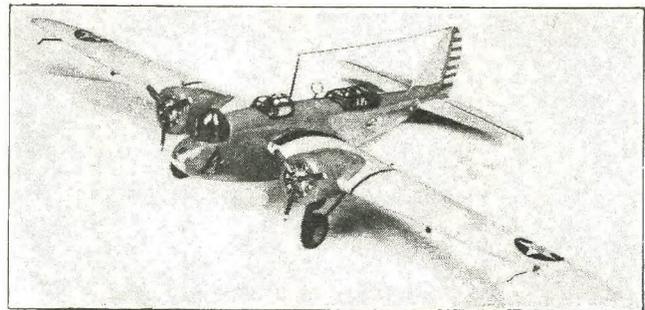


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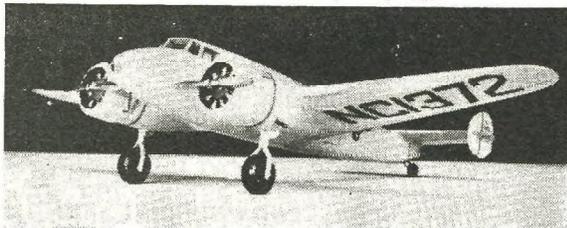


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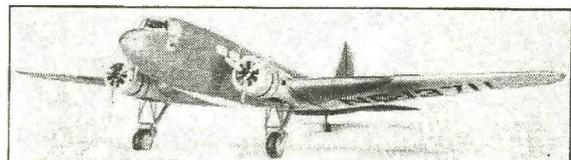


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