FLYING HIGH


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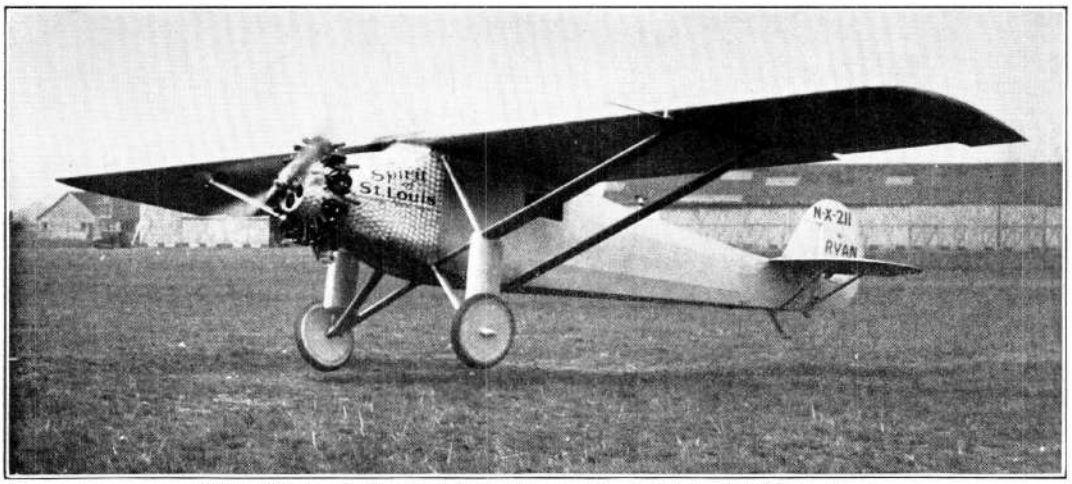
AS there have been golden days of sailing ships, of steam, and of electricity—to-day beckons the adventurous and the pioneer into the air.
—Rear-Admiral Richard E. Byrd.

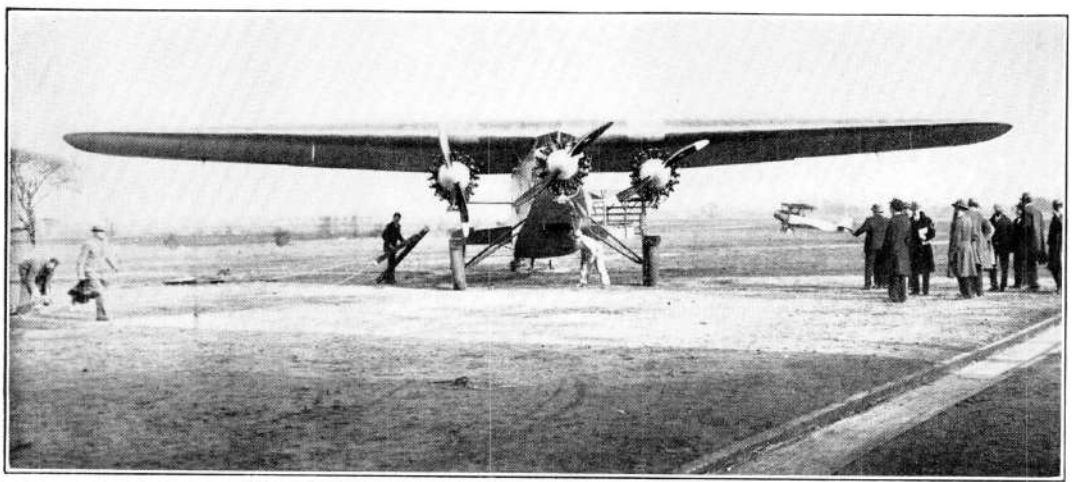


"The Spirit of St. Louis" at the actual moment of taking off.

Clarence Chamberlin

Colonel Lindbergh

Rear-Admiral Byrd



The giant tri-motored plane "America" ready to start.

FLYING HIGH

A BOOK OF AVIATION STORIES AND MODEL AIRPLANES FOR BOYS

Edited by

FRANKLIN K. MATHIEWS

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FOREWORD

"Flying High" is published to satisfy the mile-a-minute-mind of the boy in hot pursuit of airplanes. And what boy is not, from the youngest to the oldest? Rear-Admiral Byrd presents an absorbingly interesting account of "Our First Air Pioneers," and in a gripping way tells also at length of his dramatic flight across the Atlantic. In "A Pathfinder of the Skies," Colonel Theodore Roosevelt pays glowing tribute to "Lindy," and Clarence Chamberlin tells what he would do if he were a Scout. In captivating narrative, other daring aviators recite their enthralling experiences in the air.

Informing and extraordinary all this but the "big moment" for the reader comes in the latest thriller for a boy—the airplane story. In great abundance he will find the kind he best likes—stories brimming full of action, suspense, jeopardy. For, above all, a boy's hero must be brave with courage supreme—willing to dare death deliberately. With such courageous companions boys who read "Flying High" are privileged to associate. Indeed, in these newest story heroes, like knights of old, versatile authors have combined in them all the virtues that appear so glorious to a boy. It is not difficult to believe he will be held spellbound by their gallant exploits.

If the airplane story holds enthralled a boy's imagination, no less does its mechanics capture completely his curious mind. In "Flying High" boys will be delighted with flying models of "The Spirit of St. Louis" and "The America," as well as the "World's Record Model Airplane." Other prize-winning models, with full directions and diagrams, are also included. Altogether, there are enough model airplanes to satisfy the taste and match the ability of every boy, however skilled in handicraft any may be.

FRANKLIN K. MATHIEWS,
Chief Scout Librarian.

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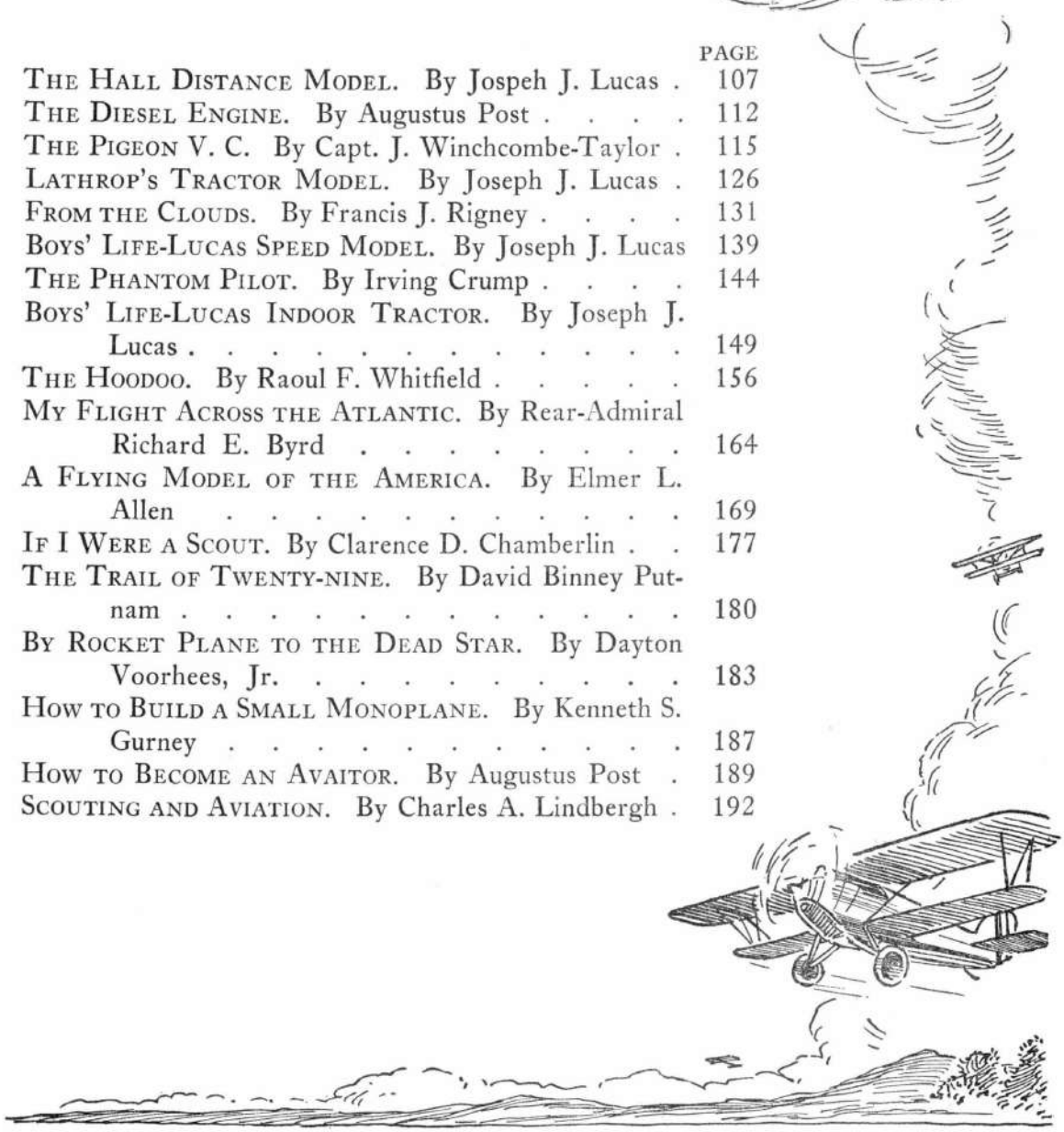
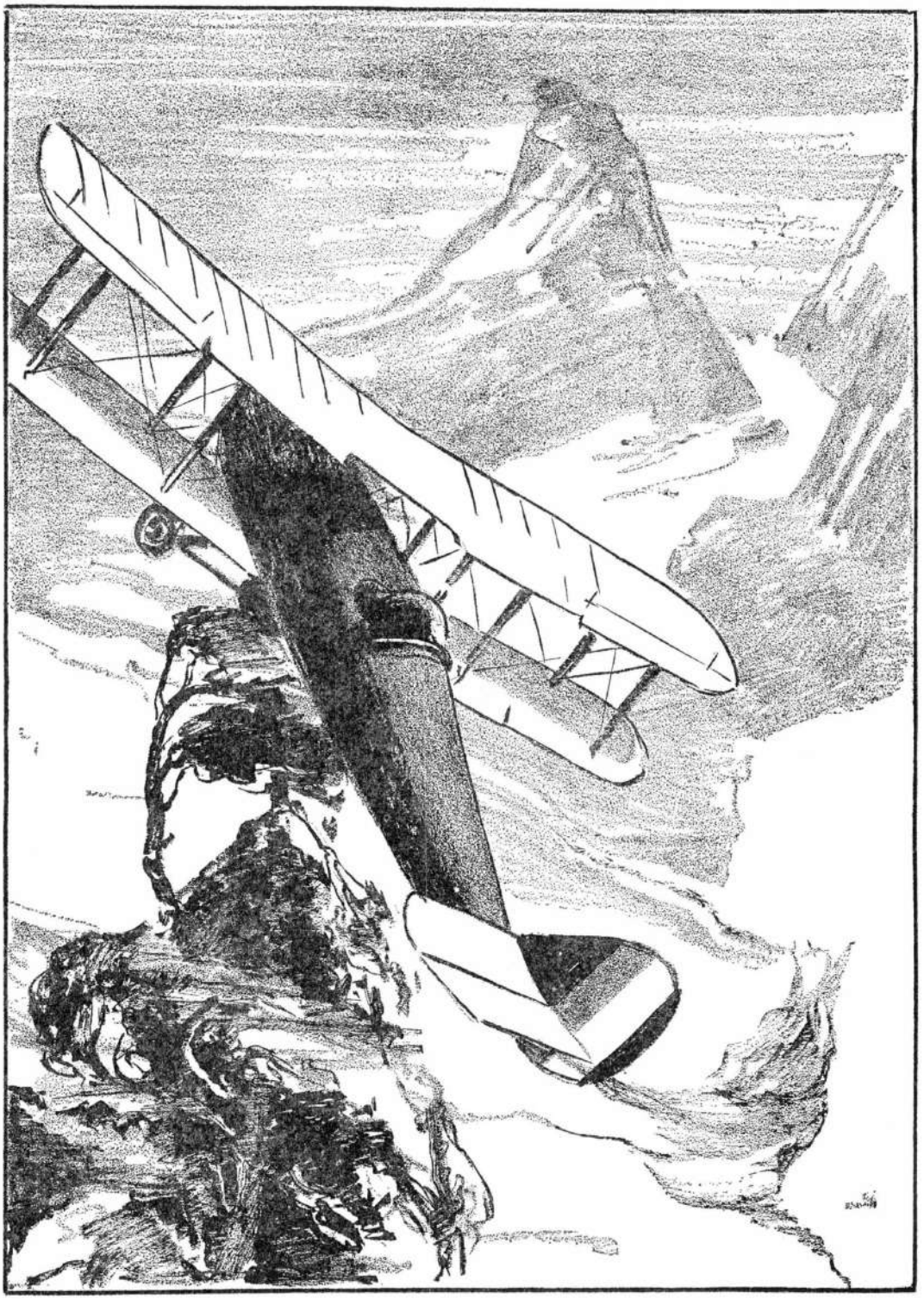




The ship took off into the wind.

Through Night Contact

By Raoul F. Whitfield

ART BENDER dropped to the clipped grass of the small but level San Fernando Valley field, expelled his breath heavily and grinned at "Speed" Connors. Art was a head taller than Speed, red-headed and blue-eyed. His face was tanned by the sun and wind; he spoke slowly, almost lazily.

"Thirty-five gallons of gas stowed away in that fuselage compartment, Speed! Guess we're set for some real flying and hunting, eh?"

Speed Connors grinned back. He was dark-haired, and his eyes were black in the dusk. His face, too, was browned even darker than that of his pal. It was Speed who held his *limited commercial* flying license; he had held it more than a month, since his eighteenth birthday. Art lacked six months of being eighteen; he held a *private* license. But he flew a ship almost as well as Speed.

"We'll take off at dawn, Art," Speed stated. "The crate'll be all right here to-night. Fog's coming in a bit, but there won't be much wind."

Art nodded. "She's staked down good enough," he said slowly. "Looked like we weren't going to make this trip for a while, Speed, but I guess we're set now."

Speed chuckled. "Thirty-five gallons of gas costs money!" he muttered, grinning, and stared toward the darkening slopes of Mount Wilson and Mount Lowe. "And we had other things to buy, too."

Art sighed happily. The two boys had earned the money to purchase the ship, to take instructions in flying. Summer vacations from high school had given them the chance. And now they were ready for their first real flight, an air jaunt across the mountains, a landing at Whiting Flats, and some hunting. Then more flying, perhaps over the desert country eastward of the range. There weren't many gas stations on the desert, thus the thirty-five-gallon cans of fuel stowed away in the fuselage compartment back of the rear cockpit.

Art moved around the two-place, radial engined plane, inspecting her. Suddenly he called out to Speed, who was staring toward the shadowed mountain slopes.

"Let's go into the radio shack and try to get a weather report, Speed. It may be that——"

He stopped. Both boys looked toward the southern sky. The drone of ship engines drifted down to them. But there was one plane, to be seen dimly in the distance. One plane with three engines.

"The *Record Breaker,* Art!" Speed's voice held a note of excitement. "Coming up from San Diego for a refueling, I'll bet. Her engines sound good, too."

Art nodded. "If she stays up until midnight she'll break the world's record," he stated. "And she *sounds* as though she'd bust that record all right."

Speed turned slowly toward the west-

ern sky. The sun was out of sight—gray fog was rolling over the foothills of the valley. It was thick fog—and low. He shook his head slowly.

"It isn't only the engines that count," he muttered. "She's got to make contact with the refueling ship, and this fog looks bad, Art."

The red-headed one frowned, then grinned.

"Maybe the radio'll give us some dope on *that,* too, Speed," he suggested. "Anyway—*we'll* get off at dawn. Here's luck to us—as well as to the *Record Breaker!*"

Speed Connors chuckled. His eyes were on the big cabin monoplane, almost over their field now.

"And how!" he muttered grimly.

It was ten o'clock. Art Bender's mother had cooked a fine dinner; Speed and Art had listened in with head-sets for several hours, in the radio shack behind the Valley ranch-house. Fog was drifting across the fields, toward the mountains. Several times they had picked up the short-wave length of the *Record Breaker.* But now, for more than an hour, there had been no radio trace of the ship.

And then suddenly Art stiffened in the chair on which he was sitting. Speed had just suggested that they turn in; they would have to be up early, as the fog would probably lift with the dawn.

"It's the *Record Breaker!*" Art muttered. "She's in trouble!"

Speed reached for his head-set hanging on a nail. He could read code as well as Art. Tense, silent, both boys sat in the shack, and caught the dot and dash talk from the big Army craft's radio man.

"Gas left for only thirty minutes!" Art muttered. "Heavy fog over North Field, failed to make connections. Opposite beacon on Mount Sharrel, bad air. Trying to get over Valley Field—send refueling ship up with gas!"

Art stopped decoding the message. He listened. The radio operator high in the sky was repeating the message. Art slipped off the receivers; Speed already had dropped his, was moving toward the door of the shack.

"Should hear the engines, if he's opposite Mount Sharrel beacon!" Speed stated. "It's going to be close but that refueling plane can find her all right."

They were outside now. Sure enough, they could hear the beat of the great cabin ship's engines. The fog was rolling over the valley, less than a hundred feet above the earth. It was thick and muffled the natural roar of the engines from the ship that was trying to break the world record for staying in the sky. The beam of the Mount Sharrel beacon came through the gray stuff only in a yellow, faint glow.

Speed shook his head. His eyes were narrowed, grim.

"They missed connections at San Diego!" he muttered. "If something goes wrong *here*——"

He broke off as Art moved into the radio shack again. The Valley Field, from which the *Record Breaker* had taken off almost four nights ago, was less than seven miles from the Bender ranch-house. At that field was one of the refueling planes, her tank filled with gas. It was transferred to the big plane through a rubber hose, after contact above the ship was established. Now, with the darkness and fog combining to make contact difficult, it looked bad for the ship attempting to break the record.

Art's voice came to Speed. "Radio man says they're flying at twenty-five hundred!" he called out. "Air's pretty clear at that altitude and all the refueling ship's got to do is get up above the stuff. It's a low bank."

Speed nodded. "Good!" he muttered.

"You can bet she'll go it, all right!"

He stood listening to the dull beat of the Army plane's engine. She was north of their field now, probably above the Valley Field. The gray fog seemed to be rolling lower over the earth. But the pilot of the Army refueling plane, a single-engined ship, could get up through the gray stuff. And it wouldn't take him long to establish contact.

"Night contact!" Speed muttered grimly. "That's what I call *flying!*"

He stared out toward the staked-down, two-place plane in which they were to fly at dawn. There was a faint smile on his browned face. And then Art Bender's voice cut in on his thoughts. It was raised sharply, excited.

"Speed! I've got Valley Field on a short-wave length. They're trying to get the *Record Breaker!* The refueling plane took off a few minutes ago and crashed on the ground! Skidded, dropped a wing, and nosed over. The pilot wasn't badly hurt, but the ship was wrecked. She didn't burn in spite of the gas load. But she can't climb up above!"

Speed Connors stood in the doorway of the radio shack, his eyes on Art's. The refueling plane cracked up, on the take-off! He could hear faintly the beat of the test ship's engines. Gas left for only about twenty minutes now. And the five men up above in the great craft were within striking distance of the world record!

Speed groaned. Art was working with his receiving set; he shook his head.

"Something's gone wrong somewhere. Can't get a thing now. My batteries were low anyway. Gosh, Speed, twenty minutes and then she'll have to drop! The Belgians hold the record and they'll keep it!"

Speed was staring at Art with narrowed eyes. He spoke suddenly, in a low tone.

"Art, there's the gas in our ship! If we could get up there, establish contact——"

He broke off as Art jerked off his headset, jumped to his feet. His pal's eyes shining.

"No hose, Speed, but the stuff's in five-gallon cans. A good length of rope—I've got it in the house. I can wind the rope—lower the cans over the fuselage. But can they handle it in the other plane?"

Speed spoke rapidly. "The captain's been handling the hose, he can tilt the cans into the funnel. If I can fly steadily enough, Art! Seven cans, thirty-five gallons. That would be about an hour's flight. We can land in the flood-lights of Valley Field, take on more fuel. They can radio North Field, at San Diego, and the other refueling ship can make Los Angeles in a few hours."

Art cut in, speaking excitedly. "We haven't much time, Speed; you get the crate warmed up. I'll get the rope and handle the cans from the rear cockpit. We may not be able to make it, but we can try!"

Speed nodded. He spoke grimly. "It may mean that we can't start on our trip, Art," he reminded. "It takes red tape, a lot of it, to get stuff from the Army. And we'll use all our gas. May be hard to get it back in time."

Art's face twisted. He'd looked forward to the sky jaunt for a long time. But there was the plane in the air needing gas. And the refueling ship cracked up. He smiled grimly.

"We've got to *try,* Speed! We're set to go. The gas is loaded. I can handle that much weight, with the rope I've got in the hangar. If you can get off, get up through the white stuff."

Speed Connors grunted. "I can get *off* all right," he muttered. "And maybe I can get *down*. Let's go, Art!"

He ran toward the ship, got the rope loose from the ground stakes. He wound the inertia starter, then pulled the covers off the open cockpits, climbed into the front one. There were wheel blocks in place, he snapped the ignition on. The prop swung into motion as the inertia starter did the trick. The engine spluttered, then roared. Speed reached for his helmet and goggles, adjusted them as the engine warmed up. Both he and Art wore heavy flying jackets, and he knew that his pal's helmet and goggles were in the rack of the rear cockpit.

He stared up at the white stuff rolling above the field. Art's mother had gone into town on a visit; she would not be around to be worried by this night flight. And once before Speed had handled a ship in the air at night, but not to establish contact or to take off with a fairly heavy load.

The engine was roaring smoothly as Art came running up, a length of coiled, heavy rope in his hands. He climbed into the rear cockpit as Speed fitted the 'phones over his helmet, adjusted the receivers over the ear flaps. A mouthpiece hung on his chest and a wire ran back to the head-set that Art would wear. This allowed talk in the air, even with the roar of the engine through the ship's exhausts.

He twisted his head, cut down the throttle speed. Art was working rapidly. He was attaching the rope to fuselage, inside his cockpit. He adjusted his helmet, goggles and head-set, then spoke to Speed.

"Better get off, Speed! I've got fifty feet of rope. I'll get the first can tied up as we climb. We've got about fifteen minutes!"

Speed nodded. He climbed down and got the wheel blocks from under the wheels of the two-place ship. Then he climbed aboard again. He thought, suddenly, of the 'chutes.

"Art!" he called sharply. "How about the silk spreads?"

Art Bender grinned. "*I* can't use one —too bulky for my work," he shouted back. "Not much time, Speed!"

Speed grinned. He roared the engine into twelve hundred r.p.m. and the plane started to roll. Fifteen minutes! And in that short time they would have to get above the Army plane and lower five-gallon cans of gas! And before they could get above the Army plane she must be located.

The ship took off into the wind, and he lifted her off the ground prettily. The engine was beating a steady tattoo; he opened her up wide, pulled back on the stick. And almost instantly they were in the fog. He had his air sense, flying sense, and two instruments on the lighted dial-board to guide him. The level glasses helped a lot. His eyes went to the angle-of-climb indicator, the bank indicator. He held the ship in a steady climb for altitude.

The air was rough. White clouds of fog obscured the wing lights at times. At other times it was thinner. The engine was roaring steadily, but Speed knew the danger of taking off and climbing directly into a change of temperature. He was tense in the cockpit.

For three minutes they climbed a wide circle. And then there was a break in the fog. A slice of moon showed to the southward. It was obscured by another layer of fog almost instantly. The altimeter showed eighteen hundred feet. Art's voice sounded through the receivers of the 'phone-set.

"Pulled a can through the back compartment and got it fast to the rope,

Speed! Got the rope fixed so there won't be much weight for me to handle as I let it out. Pretty much up to you and the flying."

Speed nodded his helmeted head. He tried to make his voice sound natural.

"We'll make the transfer, Art. But we've got to find——"

He broke off. Art's voice, a hoarse scream, sounded in his ears. And at the same instant he saw the shape, the great shape of the Army plane, roaring in from the port side!

Fear struck at him, gripped him for a precious second. And then he saw the nose of the three-engined ship go up. He shoved the stick forward, dove the two-place plane!

Fog closed in; he thought for a second that the tail assembly of his plane would batter into the landing gear of the Army ship!

And they had no parachutes!

Then they were clear. Instantly Speed pulled back on the stick, roared the ship upward. Art's voice came to him, shaken. "That was awful close, Speed!"

The pilot nodded. He jerked his head as the plane climbed up through the fog.

"Sure was!" he muttered into the 'phone mouthpiece. "But we know where the *Record Breaker* is now. She'll climb out of the fog, ten to one, and we'll spot her!"

The two-place ship had twenty-two hundred feet now. The fog was thinning. At three thousand they suddenly roared out of the thickest of the white stuff. Wisps of fog were above them and the air was not clear. But it was fairly clear. And less than a half mile to the southward was the shape of the *Record Breaker!* She was banking lazily. Her wing lights glowed in the distance.

Speed banked the two-place ship. He climbed her. The Army plane was heading southward. He winged his ship in close, then spoke to Art.

"Show them the first can! Point to the rope, Art! When they nod I'll get up above and ahead. I'll hold altitude. It's up to their pilot to do the rest."

"Right!" Art shouted back.

Less than twenty feet of air separating the wings of the big monoplane and the little two-place ship, they roared along southward, side by side. The Army plane was soaked with fog, as was the smaller ship. A head emerged, then shoulders and arms, atop the fuselage, back of the cabin. Speed waved. The man waved back. He wore what appeared to be, in the faint moonlight, a rubber coat.

"That's the captain!" Speed shouted through the mouthpiece. "He handles the rubber hose from the refueling ship. Signal him, Art!"

He watched the officer as Art signaled. He was forced to throttle the little ship down to sixty-five miles an hour, the speed of the big plane.

Several times he saw the officer stare toward their plane, then nod. Art was standing in the rear cockpit. He had lifted the heavy can and was bracing it on the edge of the fuselage. He spoke.

"I've showed him we've got seven cans, Speed; he nodded that he understood. He pointed up above, signaled me back a sixty-five. Our air speed, eh?"

"Right!" Speed returned. "I'll get above and hold that. You report how things go. I won't take my eyes off the horizon and the air-speed indicator."

"He's signaling for us to hurry!" Art shouted. "Get her up, Speed!"

Speed pulled back on the stick, the nose of the little ship tilted. She climbed, then he banked in, above the Army plane.

That ship was ahead and slightly below now. She had gained as Speed had climbed. Slowly he advanced the throt-

tle, crept up on the test plane. Then he throttled down to an even sixty-five miles an hour.

"Steady!" Art shouted. "She's coming up a little. Watch the bumps, Speed, don't let this crate drop any. I'm starting to lower away."

And then for several seconds there was silence except for the roar of the planes' engines. Every bump sent a little panic through Speed, but he flew the ship as he had never flown before.

And then Art was speaking through the 'phone-set.

"She's down fifty feet, Speed, swaying a little, trailing back. The Army's plane's below her; the captain's reached for her twice, he's trying again, he's got her, Speed! Hold the course! They've got slack; he's tilting the can now, got her opened. I can see the gas going into the funnel of the big tank. Hold her, Speed!"

And Speed held her. Held her until Art shouted—shouted as he hauled up the empty can.

"He got *that* five gallons, Speed! Didn't spill a drop. Hold the course, we'll lower down the next can!"

Speed twisted his head, grinned at his pal. Then he looked over the side of the fuselage. He saw the great shape of the Army plane roaring below. He saw the man in the rear compartment of the fuselage. And the captain raised both gloved hands, clapped them together. Then he waved.

Speed felt the thrill of pride go through him. The pride of accomplishment. Night contact! And they were getting the test plane gas when organized plane refueling had failed. They were keeping the *Record Breaker* up, even though the method of doing so was crude and dangerous. High above the valley the two ships winged and Art Bender slowly lowered the second can of precious fuel.

"Steady!" he warned Speed. "That can has weight; if it smashes the captain——"

But it didn't. The fourth can was hard for the captain to handle and they spilled fuel when rough air dropped Speed's ship hastily and the pilot of the Army plane was forced to bank away. But the fifth and sixth cans were lowered, and tilted toward the tank's funnel with comparative ease.

They had banked, were roaring northward now. Art lowered the last can and shouted through the 'phone-set to Speed.

"He's got it, Speed! Line's pretty taut, drop a bit and give him more slack. That's good, hold it!"

Speed held it. Thirty feet above the bigger craft, and slightly behind the three whirling propellers, he roared the two-place plane. He risked a glance over the side, saw the captain suddenly straighten, signal to them. He saw the rope tighten, then climbed the ship slightly as Art Bender pulled the empty can up.

"He's got almost thirty-five gallons, Speed! Pretty near enough for an hour. We'll hit the Valley Field and get more fuel. That other plane'll be up in a hurry."

Speed banked away from the Army plane, dove his ship. He waved, saw the captain wave. He thought his eyes detected figures back of the misted glass of the cabin. There were four other fliers in the cabin. They would pump the gas into the wing tanks and it would be distributed to the three engines.

He dropped the plane into the fog. At less than a hundred feet they came out of it. He wiped his goggle glass clear. They were cutting across a road; Art recognized it.

"Head north!" he shouted. "That's National Boulevard, running east and west. The Valley Field's about seven

miles northward, a little to the westward!"

Speed grinned. The little ship roared toward the flood-lighted field. He picked it up easily, made a nice landing. Near the dead-line a large group of men were working over a plane. Speed taxied in close. An officer wearing wings, and with two bars on his khaki-colored shoulders, came out toward the halted ship, frowning.

"What's the idea?" he shouted. "This field's closed to joy-hoppers who——"

Speed climbed over the side. But Art stood up in the rear cockpit and started throwing out empty gas cans. The officer glared at him.

"Look here!" he muttered. "You fellows can't throw those cans out."

"The *Record Breaker* has got the gas that was *in* those cans!" Art called down loudly. "You should be mighty glad to see 'em, Captain!"

The captain stiffened. He stared at Art, then at Speed. And Speed told him the story. Even before he finished the captain was snapping out orders. And he was grinning. When Speed had finished he spoke slowly.

"You two fellows have saved the ship!" he stated. "We'll have the refueling plane ready for the air in twenty minutes. There was only one other ship at the field that could take the air, and she was a baby Ryan fighter. We were working against time, but we wouldn't have made it. This plane"—he pointed toward the refueling ship—"wasn't badly damaged. Just the landing gear. But the Ryan couldn't take up gas, no place to stow it. And say—you made night contact!"

There was admiration in his tone. Speed grinned. Art was smiling, too. Speed spoke slowly.

"We were planning a trip to-morrow Captain," he stated. "That's why we *had* the gas stowed aboard. Now we haven't got the gas. Do you suppose——"

He broke off, confused. But the captain's eyes were twinkling. He tilted his head. The beat of the *Record Breaker's* engines came down through the fog. The captain put a hand on a shoulder of each boy.

"You fellows can have all the gas you want!" he stated grimly. "You deserve it—and then some!"

Our First Air Pioneers

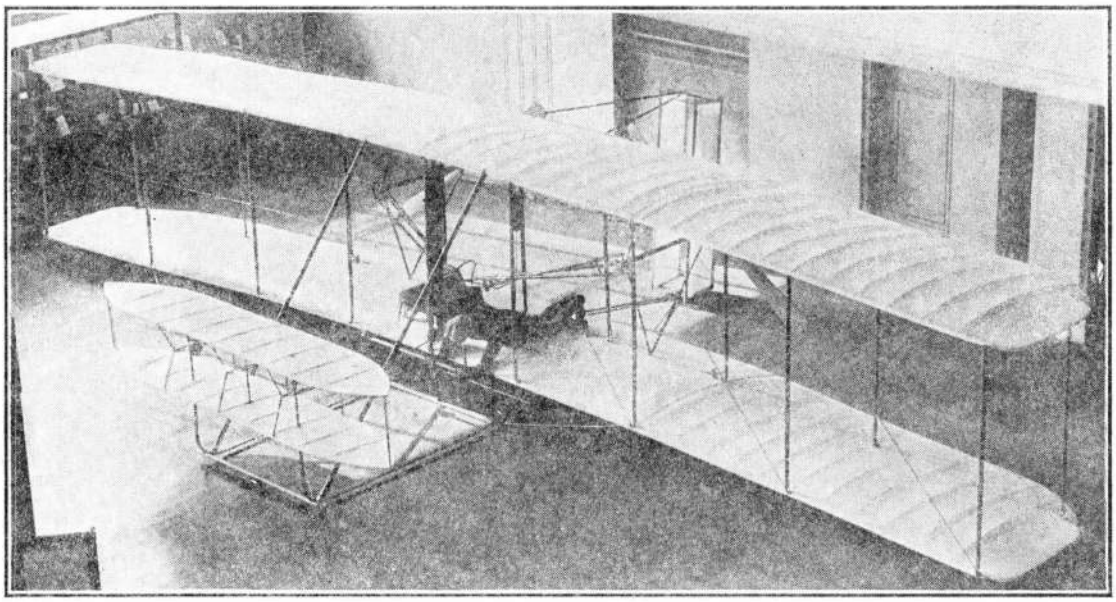
By Rear-Admiral Richard E. Byrd

SINCE time began, three things, more than all others, have teased the imagination of men—the philosopher's stone, that alchemy whereby baser metals can be turned to gold; perpetual motion; and the art of flying. At least that is how the record would have stood thirty-five years ago. Then those stories in classic literature of men flying and weird yarns of men in the folklore of many countries who were reported to have actually launched themselves into the air with wings made like a bird's, were dismissed as "stuff that dreams are made of," as indeed most of them were.

But to-day flying is no longer among the "foolish dreams," for the oceans of the world are being crossed by heavier-than-air machines, even as broad lands have been, and travel by air is almost as common as travel by automobile was twenty years ago. Nothing so grips the imagination of our generation as the swift and graceful airplane winging its way into space. In one great leap the air has become the realm of pioneering, calling the adventurous to dare. What romance the names of these pioneers breathe—Lilienthal, Langley, Chanute, Wilbur and Orville Wright, Farnam, Bleriot, Curtiss—to name only a few, and those the very earliest. In the story of America's pioneers the Wright brothers and their conquest of the air make a wonder chapter.

In 1896 Wilbur and Orville Wright, the latter only twenty-five years of age, were running a bicycle shop in Dayton, Ohio, when they read in the newspapers a short news item of the death of Otto Lilienthal, a German engineer, while flying in a glider. As very tiny boys the Wrights had been given a helicopter, a paper toy with a screw arrangement, that was very popular at the time. Thrown into the air, the spinning screw would cause the helicopter to rise before settling downward. So delicate a toy lasted only a little while, but it aroused an interest which later led them to make and fly kites with so much ability that their companions looked upon them as experts. Coming upon the paragraph about Lilienthal, they were interested immediately, and with characteristic thoroughness set about learning all they could about man's attempts to fly, and especially the recent experiments which Lilienthal's example had stimulated in many places. A marvelous thing about the Wright brothers showed itself immediately—for four years they studied and talked and mulled over what had been done, and the many problems that must be mastered before men could fly. When finally they were ready, they knew just what had been done, its value, and what it was necessary to do before man could make a machine that would fly under its own motive power. Theirs was the careful, painstaking spirit of science.

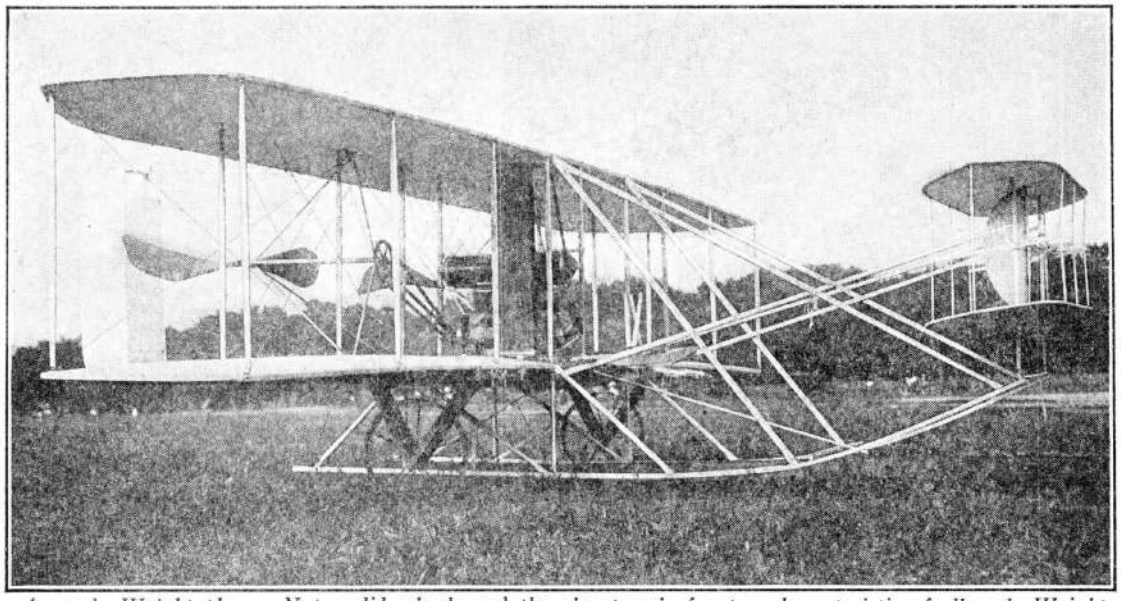
Our First Air Pioneers



The first machine actually to fly under its own power. This is the original Wright plane as it appears to-day. Notice how the pilot had to lie flat to control it.

To understand the success that gave America the unique honor of being the first to fly a heavier-than-air machine, propelled by its own motive power, it is necessary to know something of the experiments of which Lilienthal had been the fountain head. Lilienthal as a boy had been fascinated with the idea of flying. He had made many experiments. He had closely observed a family of storks learning to fly, noted for one thing that they always faced the wind as they jumped off, for another that even birds had to learn to balance themselves in the air.

It was not until many years later, when he had earned a sufficient amount of money in his profession of engineering, that he came to apply all this study and observation to practical flying. He built gliders, in imitation of a bird's wings, with a frame in the center into which he could insert his head and shoulders. The wind passing under a bird's wings, he had observed, actually lifted it, and by imitating them he felt he could learn to soar or, taking advantage of the wind, stay up almost indefinitely. He stored these gliders on top of a hill, the hill itself acting as a runway. When he had a favorable wind, facing it, he would run down the hill and spring into the air. His theory worked! The wings would bear him up, and he would come gliding down gracefully with a forward motion through the air. He discovered that the wind did not, as was generally supposed, blow "steady," but consisted of gusts of varying intensity, and that these tended to overbalance his glider, but he became quite dexterous in righting it by moving his body and legs. As he became more and more dexterous he built larger and larger gliders. The larger the wing space the more easily would it bear him in the air, and he made some wonderful flights,



An early Wright plane. Note solid wheels and the elevators in front, a characteristic of all early Wright machines.

some of them lasting many minutes. Wings with a larger surface meant a larger lifting capacity. The larger the wing surface, however, the less adequately could he balance it by contortion of his body. With the result that his biggest glider, made at the end of five years of experimenting, was caught by a gust of wind, turned over and crashed despite his frantic effort to right it with his body contortions.

There were others experimenting along these lines, but none to take the further step now necessary—a method of controlling larger wing-surface gliders. That was the first problem the Wright brothers would have to solve before they could go ahead with the experiments that ended so tragically for Lilienthal. And that is just where they began.

So these two wonderful brothers—Wilbur, the older, quiet, patient, dogged; Orville, the younger, the enthusiast; both of them unassuming, simple, endlessly painstaking—built their first glider, with four wings—a biplane (in which experiments had been made, notably by an American named Chanute), as providing better wing surface, and took it to Kitty Hawk in North Carolina, where on the sand dunes lying between Albemarle Sound and the ocean they hoped to find those winds that would provide the most favorable conditions for their experiments.

It is difficult to realize what our pioneers have faced, especially when we are dealing with a smooth and perfect machine in everyday use. All the Wrights had before them was convincing proof that, given a sufficient surface, wings would bear up a man in the air, and beyond that an absolute limit as to the size of a plane a man could control by contortions of his body. Could they make a glider rise and descend at the will of the pilot? If, as in Lilienthal's case, a gust of wind was turning over the plane, what

could he do to right it? Could the glider be turned? Was soaring possible?

The biplane that the Wrights built had rigid wings. It was larger than anything Lilienthal had built, and the man operating it lay on the lower wing at the center of the plane. Launching it was problem. The sand dunes at Kitty Hawk were not favorable for anything but launching the glider from the little sand hills, so the Wrights hired men to run with it a little while gathering sufficient momentum to launch it in the air. And the controls, which are absolutely the same in principle as used on airplanes to-day, did all that was expected of them. It was a most important step in the conquest of the air.

In front of the rigid wings they had inserted a small movable plane. As this was lowered or lifted into the teeth of a wind the machine rose or glided down. Watching the flying of birds, they had observed that a bird being tilted over in a wind would lower its further wing, the increased wind pressure on that side resulting in righting it again. So they made the tips of their rigid planes movable. It was simple enough when they had worked it out! The man lying on the lower plane moving his stick to which the controls were attached either forward or back could make the plane rise or descend, or by moving the stick to one side or the other warp the wings so that the plane could right itself. Before the three years they spent in experimenting with gliders were over, they had added a tail, with a rudder, which could turn the machine just as effectively as a boat was turned in the water.

Early in their experiments the Wrights realized that before they could become masters of the new element they must "learn to fly." Controls that worked were one thing, it was quite another to develop their ability to make the proper motions at the proper time. They had to learn the speed with which the plane answered its controls, and the extent to which it could be controlled, before it would be safe to launch it into the air under its own motive power. The difficulties these pioneers faced in an unknown element has no better example than the enterprise of Bleriot, the first man to fly the English Channel, who some years later built a monoplane with Wright controls in it. He raced the shapely machine along the turf, and when he had got up flying speed, pulled his stick back sharply. The machine sprang into the air, climbing at a steep angle. In surprise and excitement, Bleriot pushed his stick forward as sharply as he had pulled it back, and before he realized what had happened, the machine had dug its nose into the turf and Bleriot was climbing out of the wreckage of what had once been a monoplane.

Slowly, surely, the Wrights mastered not only the technical difficulties of flying but of the science of aeronautics. At that time nobody knew what was the center of gravity of an airplane, and air pressure and other scientific data connected with flying were mostly guesses and mostly wrong.

In 1902, feeling satisfied that their experience of three summers with gliders had brought them to the point of their next big step, they returned to their bicycle shop at Dayton, and in their leisure time set themselves to the problem of an engine that would lift their glider into the air. Again they went into it in a most thorough manner. They read and studied and debated its possibilities. They wrote to all the automobile manufacturers asking if they could supply an engine weighing less than two hundred pounds that would develop eight brake horsepower. Most of them were too busy

making their stock models to construct a special engine, and only one, the manufacturer of a French engine, had an engine that came within specifications. Deciding against this engine, however, the Wrights determined to construct their own. They had only the slightest experience with gasoline engines, but they set about their task in their characteristic thoroughness. They shaved the weight wherever they could, and in the end they had a light four-cylinder engine, and instead of developing 8 h.p. it gave a steady 12 h.p., allowing them to use a larger glider than they planned at first. A chain drive from the engine turned two propellers behind the planes (the pusher type)—the propellers revolving in opposite directions, which gave it a gyroscopic effect.

Engine and plane were shipped to Kitty Hawk in the fall of 1903, but trouble of one kind or another with the engine postponed the first experiment until December 14, 1903. A couple of men from the coast-guard station and two from the village were the only onlookers. They had discarded an undercarriage for these experiments, and mounted the plane on a detached carriage running on a monorail. The carriage was held by a weight, which when released ran forward with the plane, a man running alongside steadying it. For the purpose of the first experiment the monorail was laid down the incline of a hill into the wind, and Wilbur and Orville tossed a coin to see who would have the honor of that first ride. Launched along the monorail, the propellers whirling, the plane rose into the air, and slid down again after twelve seconds and 105 feet of flying! A mere fraction of a minute, but man had flown in a machine of his own making, under its own motive power! These brothers were never anything less than scientists. It is significant that even in this great moment of experiment they had devices for measuring wind, air pressure, time and other factors.

This was the beginning of triumph. Two days later, at the fifth attempt, the plane stayed up fifty-nine seconds, flying 852 feet. An accident put the plane out of commission and they returned to Dayton to build another. In 1904 and 1905 at Dayton, practically under the public eye, but unnoticed, they learned to handle their plane with increased efficiency, and before the end of that time had made one flight of over twenty-four miles.

Wilbur and Orville Wright had turned to flying as a hobby, and put into it much of their savings. They approached it as scientists, and as scientists with thoroughness and patience—and, most remarkable of all, without any serious accidents—they had mastered every problem before them. They were not business men, however. They hoped they would recover some of their expenses by selling their machines to one of the governments. As their experiments were beginning to attract attention, they dismantled their machines, and stored them for two years. A Captain Ferber, a pioneer aviator, was sent from France to inquire into their experiments. They wouldn't show him their machine—for all its secrets would be visible in a moment to an expert—but they told him enough to make him recommend to his government that they buy it, but this the French Government refused to do. In the meantime others were experimenting. It was Mr. Hart O. Berg, a business man, who finally convinced the Wrights that they were in danger of losing the great honor as well as the rewards that they had earned. Patents were taken out, and Wilbur went to France with one machine, while Orville in the United States demonstrated to the

Army authorities what his machine could do. As a result many machines were ordered, and through their patents the Wrights not only got back what they had put into their experiments but became comfortably rich.

The simple study character of these men is nowhere better illustrated than in Wilbur's experience with the French. There was tremendous interest in him, and the rich sportsmen wanted to dine and wine him. He refused, choosing, rather, to sleep in a bed in the shed where he was assembling his machine. The Frenchmen insisted that at least they be allowed to provide him with a cook. The chef put himself out to make the tastiest dishes he could think of, but Wilbur, accustomed to a simple fare, was worried by such delicacies, and asked that he might return to his own cooking, much to the chef's disgust. Wilbur encountered difficulty after difficulty in assembling his machine, but nothing could ruffle him. The rough finish of his plane made the French lookers-on audibly skeptical, but Wilbur went about his job whistling cheerfully, until he showed them that his machine could do not only all he claimed, but more. And during this trying period, Orville, whose exhibitions in the United States were earning him the reputation of being a "demon in the air," met with his first serious accident. One of the propellers of the machine broke, and the machine crashed. The passenger, Lieutenant Selfridge, was killed, and Orville's leg was broken. When Wilbur heard it—these brothers were devoted to each other, and until the trip to France had always been together—he burst into tears, but he went ahead with his preparations unfalteringly. Of such stuff are our pioneers made. It has been my pleasure to meet Orville Wright personally. His simple, unassuming character puts everybody under a spell.

That is how the conquest of the air began. There is invention within invention, and pioneering within pioneering. In twenty-four years the power for weight of Wright's first engine has been multiplied many times. The twelve seconds of their first flight has been lengthened to over fifty-three hours, the 105 feet have grown into 3,900 miles. Task by task men are carrying forward that first great step. New uses are found for the flying machine, new mail and passenger routes are being drawn up every day. As there have been golden days of sailing ships, of steam, and of electricity—to-day beckons the adventurous and the pioneer into the air. Lindbergh was an infant when the Wrights flew their first machine; when Lilienthal began his experiments Chamberlain wasn't born.

Can anyone doubt the greater triumphs that await our next generation of air pioneers?

Herb Cleans Up Le Pas

By William MacMillan

Illustrated by Louis G. Schroeder

AS THE Arctic dawn came up, bleak and gray, a figure emerged from the tiny post of the Northwest Mounted Police, stared intently up the Le Pas trail for a second or two, then broke into an excited shout that brought a second figure tumbling out into the cold.

"What is it, Herb?"

"Bristol's team," curtly replied Corporal Herbert Daly.

Silently the Mounties, unconscious of the biting cold, watched their comrade's oncoming team, with a nameless dread clutching at their hearts. Well aware of the desperate character of the rascal Bristol had set out to snare, this driverless sleigh could only mean disaster of some terrible kind.

"Yaw," shouted Corporal Daly, as the leg-weary team tried to weave past them to their kennels. Obedient to the sharp command, the exhausted brutes swayed uncertainly in their traces, then flopped where they halted. Whipping the caribou robe off the sleigh, Sergeant Perkins stared down at the unconscious form of Ted Bristol, the special officer headquarters had sent down to clean out Black Dufour's nest at Le Pas. Gently they lifted the moaning man out of the sleigh and carried him into the post. Stripping off his clothing, they growled at sight of the cruel welts on the tortured body, and bound them up in a neat workmanlike manner.

Hours later, just when the Mounties were beginning to wonder if Bristol would ever come to, the wounded man stirred, threw up his arms as if to ward off a blow, and shouted hysterically. Daly and Perkins were at his side in a flash, and the sight of them seemed to shock him into clearer consciousness.

"Dufour caught me in the Pass," he groaned.

"What did he do?" cut in Corporal Daly grimly.

"Pulled me into his nest," gasped Bristol through pain-twisted lips, "and burned me with a hot poker."

The sergeant's knuckles showed white where he gripped the side of the bunk. "I've asked headquarters a dozen times to give me the chance to clean out that fiend's nest . . ." he growled, "but they insist upon taking him alive."

"He's a devil," panted the man in the bunk. "Though I had long ago determined to shoot it out with him if I ever got cornered, I didn't have a chance in the world. I saw the fur loot, though," he added, his eyes gleaming triumphantly in his pain-twisted face—"huge piles of silver fox, fisher, and marten——"

"Worth ten thousand bucks, as the last circular from headquarters states," cut in the sergeant.

"Ten thousand nothing," exclaimed Bristol. "He's got a hundred thousand dollars' worth of fur cached in an outhouse, and nobody dares set foot near the place."

An hour or so later, leaving the wounded man in his senior's charge, Herb Daly slipped on his sealskin flying-coat, pulled up the wolverine-lined hood, and stepped outside. When confronted with some knotty problem to solve, he liked taking the air—it soothed his nerves and cleared his brain.

It was only the work of a moment or two to warm up the powerful engine and burst out of the snow-floored hangar with a satisfying roar. Circling low over the post, Herb finally straightened out the plane, elevated her nose, and shot northward.

Though the biting wind stung the Mountie's face and numbed his gloved hands, he hardly noticed the discomfort. Bristol's tortured body kept rising up before his eyes, and his quavering voice rang in his ears. A dandy officer, Bristol, or he wouldn't have been entrusted with the job of snaring the wily fur bandit. Then the recollection of what the heartless fiend had done to him made the flying Mountie grit his teeth and jerk the engine wide open.

On and on roared the great plane, the barren seacoast reeling away under Herb's unseeing eyes. His hand quivering on the controls, the Mountie tried to picture the bandit's loot-filled nest in Le Pas as Bristol had described it. And as he recalled its obvious impregnability he longed for a single one of those deadly little HE eggs he had often dropped so carelessly in France. With just one such egg tucked under his wing he felt that he could clean out that foul nest with a single stroke.

Subconsciously noting the jagged peaks of a mountain rushing to meet him, Herb pointed the nose of the flying-boat upward and blinked his eyes as she barely cleared the scimitar-like peaks. Leaning far over the side he stared down at the desolate world below, and realized how easily a man like Dufour could swoop down upon an unsuspecting fur collector and retire to his eyrie without being caught.

Though Corporal Daly had never seen Le Pas before, there was no mistaking the narrow gash in the towering hills of black basalt when he finally came to it. Figuring that he was well out of sight of the stronghold reputed to be at the head of the pass, Herb circled over the entrance like a great hunting falcon, and studied every foot of the snow-piled gulley.

To land anywhere in that narrow pass would simply have been an impossibility, and the Mountie had no thought of committing suicide just then. Then as the flying-boat swung around, Herb's sharp eyes caught a sight of a tiny level plain—a frozen lake probably—in the very top of a steep hill. It wasn't much of a landing spot, that, hardly larger than a pocket handkerchief, from that height. But the sight of it set a mad idea racing through the pilot's head. Savagely juggling the stick, he spiraled downward in graceful curves till he barely skimmed the peaks of the surrounding hills. Could he make it? Could he come to a stop in that desperately small space without smashing his skis on a rock?

He had gone too far to turn back now. Shutting off his engine, Herb held his breath and pointed his nose sharply downward. A thud as the hickory skis hit the snow that came up to meet him, a fearful lurch, and he came to a slithering stop almost on the very edge of the precipice.

Too intent in his undertaking to appreciate the fearful chance he had taken in landing there, Herb leaped out of the plane, thrust his service revolver into his belt, and grabbing his snowshoes clambered down the steep slope.

Herb Cleans Up Le Pas

It was snowing and blowing so hard by this time that the pilot could hardly see a hand before his face. But picking up landmarks that he had taken care to establish in his mind before landing, the Mountie had no difficulty in making his way to the entrance to the pass. It was less windy here, and he made fair progress through the heavy snow.

"Voilà un autre!" growled a hoarse voice out of the mist. And before Herb could reach for his weapon or offer the slightest resistance, powerful hands slipped down over his shoulders and pinioned his arms to his sides.

Though the Mountie wriggled and struggled desperately, he couldn't shake off those clutching hands, and he ceased struggling when he saw other burly figures hurrying through the gathering darkness to his captor's assistance.

"What is it?" demanded an authoritative voice from the gloom.

"Just another meddling fool," cackled the man pinioning his arms.

"Ha, ha," roared the first man "Fetch him along and let Dufour take a look at him."

In the inner room of a ramshackle cabin, clinging to the steep sides of Le Pas, LeNoir Dufour, fur brigand extraordinary, squatted by a roaring fire of pine knots and taunted the tight-lipped Mountie. "You always get your man, eh?" he repeated in his perfect English. "You are the second to get me. I sent the first one back as a warning. But you won't be so lucky."

Herb stiffened at the cruel threat in the man's voice. "We'll get you yet, LeNoir," he snapped, "and put you where you can't steal any more furs."

This threat from his helpless prisoner seemed to tickle the brigand's fancy. Throwing back his head, he roared with deep-throated laughter.

"Enough, enough," he finally gasped, struggling for breath and reaching for a poker. Whereupon, taking this as their cue, the burly rascals beside Herb gave him a push and shuffled out through the door.

"Witnesses are bad things to have around, sometimes," chuckled the brigand, thrusting the poker deep into the coals, "and you people have a bad habit of taking their word for things."

"Torturing me will only make it worse for yourself, witnesses or no witnesses," warned the Mountie, shivering in spite of himself. Then, seized with a sudden idea, he went on, "Why, I have enough evidence right here in my moccasin to hang you outright."

"You have?" screamed Dufour, leaping to his feet and advancing upon him with brandishing poker. Holding the sizzling iron under Herb's nose the swarthy-faced bandit made to reach down into his moccasin top. Quick as a flash, the Mountie's knee whipped up and caught the man square in the chest. Straightening up with a surprised look on his villainous face, Dufour crumpled to the floor like a sack of flour.

His arms free, Herb felt that he could put up a better fight for his life. It was no part of his plan, however, to be caught there by the brigand's men. Shaking a bit from the pain of his flame-licked wrists, he quickly piled the table, chairs, and woodbox against the door. Ripping down the oil lamp from the ceiling, he emptied its contents over the pile. Then throwing up the single tiny window, to be sure his line of retreat was open, the Mountie lit a match and tossed it into the oil-soaked mass. But even as the yellow flames leaped ceilingward, angry voices could be heard in the distance, feet shuffled in the passage, and a heavy fist thudded on the door.

When he at length reached the plane, he had barely strength to hoist his prisoner's limp form over the cowling.

There wasn't a moment to lose. Hooking the unconscious man's arms over his shoulder, Herb swung him upon his back and literally hurled himself through the window.

That old nest on the precipice must have been dry as tinder, because the Mountie had hardly staggered a hundred yards when flames burst through the roof and the whole pass was lit up as by a mighty torch. Swaying like a drunken man, at times actually crumpling to the snow under the weight of his unconscious burden, Herb fought his way down the ravine. Sheer physical exhaustion and the pain of his blistered wrists had made him desperate, and had Dufour been unfortunate enough to regain his senses, it is altogether probable that he would have calmly knocked him out again.

Glancing continually over his shoulder to see if the demoralized bandits had taken up the chase, the corporal finally gained the foot of the steep hill. Grimly determining to sell his life dearly, he shifted his limp burden further forward on his aching shoulders and started clawing his way up the slope.

Herb Daly never remembered just how he managed to reach the top of that steep mountain. The snow would give under his gripping snowshoes and slide him backward. And when he at length gained the plane, he hardly had strength enough left to hoist his prisoner's limp form over the cowling into the cockpit.

From that height Dufour's burning nest looked scarcely larger than a bonfire. But at the very foot of the mountain, following his tracks, evidently, streamed a line of men armed with rifles. The brigand's hordes were at his heels.

Brushing the snow off the seat, Herb warmed up the engine. But a single look at the great drifts ahead brought a groan to his lips. The snow was piled two feet deep, and the skis would never get through it. Snatching up a snowshoe, Herb leaped out of the plane and proceeded to shovel two parallel tracks for the hickory runners. Before he was half through, however, a fur-capped head poked into sight over the rim of the cliff, a shot rang out, and he raced back for the plane as the snow spurted up at his feet.

Breathing a fervent prayer that the skis would keep to the partially cleared runway, the Mountie literally threw himself into the machine. Opening the engine up wide, he rocked furiously from side to side to get her started. A mounting roar, a heart-sickening bump, and the plane shot over the snow like a bird, taking the air at the very edge of the tiny plain just as a dozen other swarthy figures clambered into sight.

Two hours later Herbert Daly swung about in great circles and tried to pierce the impenetrable darkness below him. Dawn was still a good hour away, and he dared not risk a landing anywhere but in his own backyard, as it were. Chafing at the inaction, he pulled the hood tighter about his face and mounted higher into the starless sky.

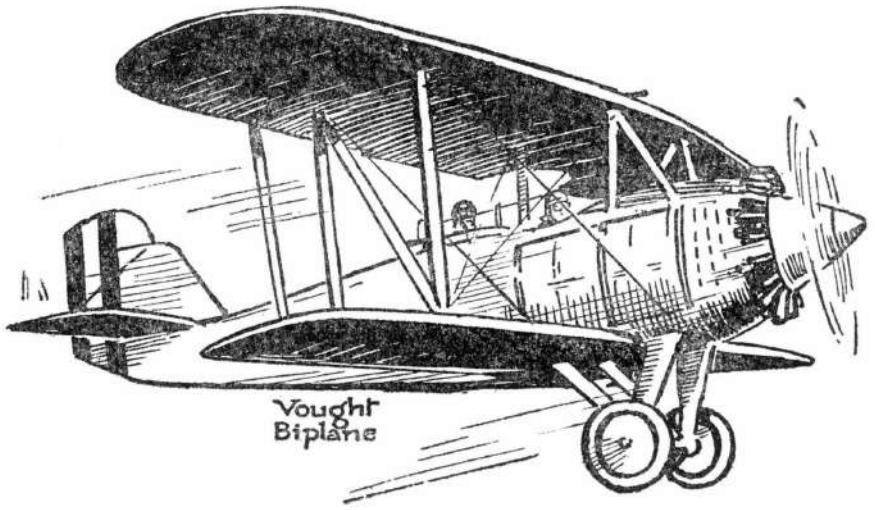
The pilot found it just as hard to kill time in the air as on the ground, and by the time the first signs of dawn streaked the heavens every bone in his body was sore and he could hardly keep his eyes open. The man in the cockpit showed signs of returning consciousness, too, and he had hardly come to a slithering stop before the hangar of peeled logs when Dufour, ripping out a stream of curses, clawed at the edge of the cockpit and pulled himself to his feet.

Shaking off the exhaustion that seemed to bind and paralyze his limbs, the Mountie evaded the brigand's first wild swing, took the next one on his ear, then almost crumpled to his knees from the shock of

his fist meeting the rascal's whiskered chin.

Grabbing the groaning fellow under the armpits, Herb dragged him to the silent post and kicked furiously at the door till it was opened by the amazed Perkins.

"Here's Bristol's man, sergeant," he gasped, reeling in the doorway; "but be careful, because he isn't nearly as dead as he looks."



The Eagle Flaps Its Wings

By Paschal N. Strong

TEN husky students of the State College Gliding Club strained at the elastic rope until it stretched V-shaped from the glider on the crest of the hill. Then, at a wave of the hand from the pilot sitting in the latticework fuselage, the glider was released and shot forward into the gentle breeze that swept upward from the hillside. It zoomed upward with a swishing sound for about thirty feet and then glided swiftly toward the flat meadows that stretched away from the bottom of the hill. The students watched it with painful intentness until it settled safely down in the bottom land; then they piled into two decrepit Fords and bounced recklessly along the cow-trail that wound down the slope to the broad meadows where the glider had made its graceful landing.

"Not bad for the club's first flight," exclaimed Pete Straub to the fellow packed next to him in the front seat of the old car.

"No, it was all right," said Ambrose Pickering a little superiorly. "Now in Germany, where I've lived for the past two years——"

"German gliders are the stuff, all right," said Pete good-naturedly, hoping to interrupt Ambrose's oft-repeated tale of his gliding exploits in Germany. "George and I built a German plane last summer, and she was a dandy. All the same, for the first flight and with a new glider, *I* say George has just made a humdinger of a glide. He handled the kite in great style."

A chorus of approval greeted this remark, and Ambrose joined in with faint praise. Soon the two Fords reached the glider, reposing near a stack of new-mown hay, and a dozen students piled out to congratulate George Ross on the maiden flight of the glider club. George, grinning from ear to ear, laughed them down.

"This straight-away flight," he said modestly, "is as easy as A-B-C. The ship is so stable she'll land herself if you give her the stick. But considering there's hardly a breeze, she traveled quite a distance."

"In the glider club to which I belonged in Germany," said Ambrose, "I once saw a man glide ten miles on a straight-away."

"Sure," said George, "but I bet he wasn't using a primary glider like this with a wing spread of only thirty-four feet. He probably had a ship like the *Seagull* that Pete and I flew last summer. It was a German-designed glider, and there was little that baby couldn't do. Wait till Pete and I get our sailplane finished. We'll show you that an American-designed plane is no slouch either."

"I'll be through building my glider soon," said Ambrose. "It's from the latest German plans, and I'm afraid it'll

rather show up your American ship."

"It may," laughed George. "The Germans do know how to build those kites. And now let's get our crate back up the hill for the next trip. This one will be better."

They passed a towrope from one of the Fords to the glider and began the slow procession back to the summit of the hill. Pete, in spite of his freshman standing, was chosen for the next flight in recognition of his experiences with George. He climbed into the seat, waited until his friends had stretched the launching rope to the limit, and waved the release signal. The next instant he felt himself sailing through boundless space as the glider leaped into the breeze and began its smooth course toward the flat fields at the bottom of the hill.

The glider, while lacking the sensitive response and buoyance of the *Seagull* that he and George flew at the beach, was remarkably stable, and considering its limited wingspread it glided down at very slight angle. With any breeze at all he felt that the ship would soar a little and perhaps do a figure eight. He looked over the side. He was now over the open field and the ground was rising slowly as it swept swiftly by, some twenty feet below him. A hundred yards more and the glider lightly touched the ground as Pete drew the stick back and forced the light machine into a pancake landing to avoid an open ditch at the end of the field. He had hardly released the safety belt and stepped out of the pilot's seat before the two cars bounced to a halt and the fellows piled out to again haul the machine up the hill.

They drew lots for the next flight, tacitly ignoring Ambrose's claims for the control. The student who won regarded the machine rather apprehensively before climbing into the cockpit.

"What do I do if she acts funny?" he asked George.

Before George had time to answer, Ambrose cut in. "Throw the stick the way you want her to tilt," he said. "If you're about to stall, put the stick forward; if you're about to dive, pull it back. You should approach the stalling angle just before landing, as the German school of gliding teaches. Now, when I was gliding near Hamburg——"

"Thanks awfully," said the student politely as he snapped the safety belt together, "but we're not flying near Hamburg, and this is a primary glider, not a German soarer. George, what do I do if she acts up?"

"Just take your hands off the stick," grinned George. "Ambrose knows his stuff all right, but don't try to remember too many things at once."

"You're right I know my stuff," asserted Ambrose angrily. "Just wait till I finish my glider and I'll show you fellows how the Germans do things."

"It's tough on the Germans," smiled Pete as Ambrose left the field in high dudgeon, "to have a fellow like Ambrose take their part. The German gliding pilots we met at Cape Cod were the sportiest chaps in the world."

George warmly seconded this, and gave a last word of warning to the green pilot. Then he put his weight on the rope with the other fellows and a few seconds later the machine was again projected into the air. This time the stick was evidently not being held in a neutral position, for the machine zoomed upward at a dangerous angle immediately after leaving the launching rope. George had visions of the glider crashing back on its tail. A second later, however, the nose leveled off and then pointed earthward as the pilot, appreciating his first predicament, apparently shoved the stick forward.

"Great guns!" exclaimed Pete. "I hope he does something with that stick except hold it forward."

"He has," said George with a large sigh of relief as both of the pilot's hands appeared out of the cockpit.

"He's turned the stick loose."

As he spoke the glider's nose pointed upward and the machine assumed its natural gliding angle as it sailed down the hill toward the open fields. A dozen pairs of eyes anxiously followed its course. Would the inexperienced pilot follow Ambrose's advice and attempt an ill-suited pancake landing? Or would he attempt to bring the machine to a three-point landing, another type which few experienced gliding pilots used?

"He's not going to land at all," said someone who was following the ship with a pair of binoculars. "His hands are still outside the cockpit."

The machine was rapidly nearing the ground. It struck an instant later, a little sharply, but well within a safe angle. It bounced a couple of feet and again settled to the ground, this time very lightly. George and the others piled into the cars and soon tumbled out at the glider. The pilot, although he looked a little pale, was enthusiastic.

"It's the biggest thrill I've ever had in my life," he declared. "And man alive! maybe I wasn't glad you told me to keep my paws off the stick if I got into trouble. At first I thought I was going to join the old woman sweeping the cobwebs out of the sky. And then, when I tried to level her off—the glider, not the old woman—I felt like a skyrocket returning to Mother Earth. So I remembered what you said, took my hands off the stick, and here we are again, sizzling for the next flight."

"Not to-night," laughed George. "We'll just have time to get the kite in its barn before dark. We'll run through the roster to-morrow afternoon and give everyone a chance at the controls."

"If you could persuade Ambrose Pickering that American gliders are beneath his notice, I'd be greatly obliged," said one member of the club. "He rubs me the wrong way, with his hoity-toity remarks on American gliders."

"He'll get over it," prophesied George. "He's going to have a crackerjack glider soon, and we need him in the club when we enter the State glider show."

"If you don't trim him with your sailplane he'll be unbearable," said another. "Will you have your machine ready in time for the show?"

"We hope to," answered Pete, "and then we'll find out what an American-made, American-designed soaring plane can do. The sailplane was designed by the chap who designed the *Spirit of St. Louis*. Now lend a hand, fellows, and we'll get this boat back to the hangar."

With the machine in tow behind one of the Fords the strange caravan retraced its tracks up the hill and back to the college airport where the glider, along with the ships of the Aeronautical School, was kept. As they approached the hangar Lieutenant Gibbs, on duty at the school, came out to meet them.

"Anyone killed?" he asked cheerfully.

"Give us a chance," grinned George. "You can't hurt anyone in a primary glider."

"Maybe not. But if that sailplane you're building ever gets out in the wind, you're in for a long ride."

"That's what she's built for. When she's finished and Pickering completes his German machine, perhaps the college president will admit the glider club as a part of the Aeronautical School."

"He will if my advice counts for anything," said the lieutenant. "If all the underclassmen had to pass gliding tests

before they took up aeronautics, I could turn out some real flyers."

George and Pete, after one more session with the glider club to give them the benefit of their experience, were forced to stay away from the daily flights in order to speed the completion of their sailplane. They were determined to have their new machine in the air in time for the State glider show. They knew that Ambrose would be in the field with a machine of undoubted merit, and they were anxious for the American-designed soarer to match its rival's performance.

"Of course," remarked Pete as he vigorously sandpapered some spars in the college's woodworking shop. "Ambrose hasn't had the experience in building a glider that we got from building the *Seagull.*"

"No, but he has expert carpenters to help him."

"It was rotten luck that the old boathouse had to burn when the *Seagull* was in it. That kite would have given Ambrose a run for his money."

"This crate may do even better," said George carefully mortising a joint in the crosspiece he was working on. "I shouldn't wonder if Ambrose's glider is very much like the *Seagull.* Most of the German soaring machines are that model."

Pete affectionately patted the skeleton of the sailplane. It was now taking definite shape as a creature of the air. A few more days on the framework, a few more days on the internal wire braces, a week for stretching the prepared linen over the fame, and the graceful creation of wood and cloth would be ready to ride the breeze.

Ambrose was constructing his machine in a private carpenter shop, and kept all details a dark secret. The interest of the glider club naturally centered on the machine they could see growing before their eyes, and George and Pete were frequently embarrassed by an over-supply of amateur help.

One evening while the two friends were working on their lessons for the next day Ambrose burst into the room with a newspaper in his hands.

"Here's something that'll show you how the Germans do things," he exclaimed, thrusting the paper under their eyes.

"Tell us about it," said George slyly.

"It's about two gliders in Germany that were towed behind an airplane. Do you suppose we could do anything like that in America?"

"What's to prevent it?" asked Pete.

"The American gliders aren't good enough," answered Ambrose promptly. "They'd break up under the strain."

"Listen here, Ambrose," said George, not a little vexed. "We know that the Germans are experts at gliding and building soarers, but we believe that America isn't going to be left behind long. That's why we're trying out this sailplane. We'll match it against yours at the glider show, and if you win we'll cheerfully concede that we still have a few things to learn from German machines."

"Your machine will do very well for straight gliding," said Ambrose. "But for soaring it takes a real German-designed machine to get up in the air. It takes a machine like the *Adler.*"

"What is the *Adler?*" asked Pete.

"That's the name of my German glider. It means 'eagle' in German. I saw one of them soar near Bremen last summer, and how she could climb! By the way, what are you going to call your kite?"

"The *American Eagle,*" answered George promptly, although he hadn't thought of doing so until that moment. "Is your glider almost finished?"

"It will be in two weeks. Time enough for a few practice flights before shipping her to the State fair for the glider show."

George turned to his books suggestively. Ambrose took the hint and prepared to leave. "I'll let you take a flight in my machine," he promised, "if you'll be careful not to hurt it."

"Thanks," said Pete, "but I'm afraid your machine is too wonderful an affair for a mere American to handle."

"Not at all," Ambrose assured them grandly. "You and George glide very well."

When he left the room the two exchanged glances. "If going abroad for two years has that effect on an American," pronounced Pete, "I think I'll stay at home."

George's resentment faded in a broad grin. "Ambrose passed the three gull test in Germany," he said, "so he feels obliged to run down the American machines. Perhaps he'll change his tune when the *American Eagle* meets the *German Adler.*"

It was difficult to find enough time to work on their machine. Classes and compulsory athletics took up a large part of the day and the gliding club, which contained many upperclassmen, made inroads on their time. The two seniors in the club, however, helped them escape the usual demands made on a freshman's time by the energetic sophomores, and in spite of numrous interruptions the *American Eagle* steadily assumed the appearance of the original sailplane, the most successful soaring machine in America. The instructors in the woodworking shop assisted the two freshmen enthusiastically, and the day finally arrived when the completed machine, with her single wing removed, was taken out of the shop for assembly. The tightly stretched linen, varnished until it was as stiff as fiber, was painted a battleship-gray. The inclosed cockpit was trimmed with blue, and along the entire length of the fuselage in brave blue letters ran the name *American Eagle.* The landing gear, consisting of streamlined struts and two light wire wheels, added so little weight to the machine that a man under the fuselage could lift the entire machine in spite of the fifty-foot spread of the monoplane wing. The controls of the machine were the conventional airplane type, the stick controlling the elevators and ailerons, the foot pedal controlling the rudder.

The full membership of the club was on hand to convoy the club's new addition to the college airport, where Lieutenant Gibbs had allotted them half a hangar. A large moving-van was engaged to transport the glider to the hangar, but although the fuselage was able to fit nicely into the interior of the van, the long wing had to be strapped lengthwise across the top. It was late in the afternoon when they arrived, but the young birdmen, undeterred by possible loss of supper, assisted George and Pete to mount the wing. Before dark the *American Eagle,* completely assembled, rested in all its glory next to the more humble primary glider. George and Pete surveyed their work with justifiable pride, and the others speculated eagerly on the coming trial between the *American Eagle* and the *Adler.*

As they left the hangar to return to the campus another large truck arrived and unloaded three large crates. A casual inspection showed that this was Ambrose's glider, and the students peered curiously into the crates, trying to form some idea of the appearance of the machine. At that moment Ambrose himself appeared in the overdressed roadster in which he rode around. He gave George's machine a look of grudging admiration.

"She looks like she was made in Ger-

many," he said, but his well-meant praise fell on indignant ears.

"Looks to me," said one of the students belligerently, "like she was made in America by real Americans."

"Let's take a look at your kite," said another.

"To-morrow is Saturday," said Ambrose. "If you fellows will help me get her up the hill to-morrow afternoon, I'll give you a treat. If George will have his ship out then, I'll show you the difference between a real glider and a good imitation. On Sunday I'm shipping the machine by truck to the State fair, and on Monday afternoon at the glider contest the State clubs will have an opportunity to see a real glider in action."

George and Pete exchanged a smile, but said nothing.

Rumors of the impending duel between the two soaring machines raced around the campus like wildfire. The next afternoon, when the glider club, with the two gliders in tow, reached the hill, they found half the college on hand to witness the exhibition. Lieutenant Gibbs, intent on having the club taken into the folds of the Aeronautical School, had persuaded the president and the deans to be present. George laughed slyly as the gray-haired president, looking at the frail machines, wagged his head with ominous forebodings.

Everyone was forced to admit that Ambrose's craft, in appearance at least, lived up to the best traditions of German gliders. Streamlined from nose to tail, with the large wing curving back at the ends after the fashion of the wings of soaring birds, the *Adler* appeared to be the embodiment of gliding perfection. Yet the sailplane, drawn up next to the *Adler,* did not suffer by comparison. There was something fresh and clean-cut in the lines of the American machine that suggested the unfettered product of Yankee ingenuity. The *American Eagle,* although streamlined in every particular, seemed to possess fewer curves and freer lines than the *Adler,* and the members of the club, with their hearts set on the sailplane's triumph, awaited the trial with confidence in George's skill and his machine.

Ambrose was the first to take off. Twelve willing students stretched the launching rope over the crest of the hill, the pilot blew a shrill whistle, and the machine leaped ahead into the wind that was rushing up the steep slope of the hill. The crowd uttered a spontaneous cheer as the *Adler,* taking full advantage of the up-wind, soared upward a hundred feet above the hill before it leveled off and began crabbing diagonally across the breeze.

"She's a beauty!" exclaimed George in pure delight at the performance of his rival's craft. "And Ambrose certainly knows how to handle her," he continued, after a moment.

"He's diving," said Pete suddenly, and the crowd caught its breath as the glider, now well over the meadows at the foot of the hills, turned its nose earthward. Every heart skipped a beat until the machine, rushing down at a terrific rate, leveled off and again soared upward. Its momentum carried it up to its original altitude, and the craft executed a perfectly banked turn and sped back toward the spectators. With the wind behind, it raced toward the crest of the hill at incredible speed, but George and Pete knew that the maneuver would cause it to lose altitude rapidly. Indeed, as it approached the crest it looked for a moment as though it might drop low enough to strike the spectators. But as the crowd melted away on either side of the path of the oncoming machine, it caught the up-wind at the crest and lifted

safely over the heads of the spectators as it whizzed by.

Once past the hill, however, the downwind of the reverse slope caught it and the craft, fighting against the double handicap of a descending current and a tail wind, dropped rapidly. It touched the ground near the foot of the hill, bounced once, and settled down gently on the rolling field. The crowd rushed down to congratulate the skillful pilot.

George was the first to reach him and wrung his hand warmly. The president of the college fairly beamed all over, and Lieutenant Gibbs gave him a smile that said, "Well done!" Ambrose, shaken out of his supercilious attitude by the warmth of the felicitations, smiled modestly.

"It's the machine that gets all the credit," he said. "These German gliders can do almost anything."

The crowd, however, had not lost hope that the American soarer would at least equal its cousin from across the sea, and quickly returned to the hilltop to watch the *American Eagle* perform. George climbed into the cockpit with a pounding heart. Would his creation respond to the controls as did the German machine? Would he thrill the crowd by triumphing over the wind as the *Seagull* used to do? The fellows were leaning on the launching rope, stretching it to the limit. He could feel the machine quivering under the strain. He turned his head and saw that Pete was ready at the trigger rope which held the machine against the pull of the elastic sling. Everything looked all right, and he was about to blow the starting whistle when something happened to the trigger rope and the machine, suddenly released, shot forward into the wind.

Though taken by surprise, George instantly tried to pull the stick back to soar upward on the rising breeze. The stick refused to budge! The machine was about twenty feet in the air, and George saw the ground rushing by underneath him as he whizzed through space parallel to the slope of the hill. He tugged desperately at the stick to lift the nose of the craft, but it remained immovable. He knew that when he reached the bottom of the hill and the ground leveled off he would surely crash at a dangerous angle. He tried to work the stick sideways in an effort to free it, but without results. Now he saw the ground rushing up toward him. There was nothing he could do. A feeling of utter helplessness sapped his strength; he closed his eyes and waited for the crash.

He heard a sickening splinter of wood and felt the universe collapse around him. He seemed to be tumbling in all directions, banging up against innumerable objects, and then the ripping and crashing sounds ceased and all was quiet. He opened his eyes. He was jammed against one corner of the cockpit and his ears were singing. He shook himself. No bones broken; he was grateful for that. He laboriously pulled himself out of his jam, opened the cowling, and slowly climbed out to look at the machine.

It wasn't smashed as badly as he feared. The landing gear was demolished—it had received the brunt of the crash, and the splintered struts were lying across the battered wheels. But the fuselage and the precious wing of the machine appeared whole and undamaged. He breathed a prayer of thankfulness.

Pete was the first to reach him. "Any bones cracked up, old-timer?" he asked anxiously.

"Hardly a scratch, Pete. But look at the kite."

"The trigger rope caused it," said Pete, a lump rising in his throat as he looked at the injured craft. "The rope snapped at

my end and got jammed in the elevator. That's why you couldn't move the stick."

The excited crowd was now milling around the machine, and George explained the cause of the accident. "So I guess Ambrose will be the only representative of the college at the State fair," he said with a smile that hid the keen disappointment he felt. "He'll make a good showing, however, with that German glider of his."

"It's really too bad," said Ambrose. "You had a very fair glider there."

George laughed a little bitterly at this, and with the assistance of the other students he and Pete lashed the wrecked glider to the back seat of the open Ford and returned to the hangar. Before they left, the president, more impressed than he would admit by the performance of the *Adler,* spoke encouragingly of the "thrilling, albeit not entirely safe, sport of gliding."

"We'll get the glider club in the Aeronautical School yet," remarked the lieutenant as he accompanied them to the hangar. "The president isn't as old-fashioned as he looks."

Before leaving the airport George and Pete made a rough appraisal of the damage done. "We can't possibly get her ready for the glider show," lamented the former as they started homeward. "It'll take four men all of Sunday and part of Monday to repair the landing gear. And the gliding contest takes place Monday afternoon."

Peter gripped him excitedly by the shoulder. "Remember what Ambrose said about those trailer gliders? Why can't we get the lieutenant to tow us to the fair? He can get us there in a couple of hours."

"Great guns!" shouted George as the suggestion lent new life to his disappointed hopes. "We'll make him do it."

But making the lieutenant undertake a thing of this kind was a large size order. "I know it's been done," he said in answer to their pleadings. "A chap did it in California last month. But the man at the controls of the glider was an experienced airman. You lads——"

"Have had more hours in the air than you know of," interrupted George earnestly. He related the experience that he and Pete had had the past summer. Finally Lieutenant Gibbs capitulated—with reservations.

"Get telegraphic approval from your father," he said, "and I'll try it—if you get the glider repaired by Monday morning."

That was all the two young birdmen needed. The glider club, with the exception of Ambrose, turned out Sunday to help repair the wounded *American Eagle.* Willing hands labored hour after hour, the wheels of the woodworking shop were kept turning all day, and by nightfall the machine was in a convalescent condition.

"Pete and I can finish her up early tomorrow," George told the club. "That will give you fellows all morning to motor over to the fair grounds. Are all the details fixed up, Pete?"

"O. K.," said Pete, who was acting as general manager to the club. "The president has excused the glider club from classes, and your father has just wired back, 'Go to it!' "

George and Pete were at work shortly after daybreak the following morning. It took longer to complete the repairs than they had counted on, but a little before noon the *American Eagle* was once more ready for the air, her unpainted landing-gear being the only reminder of the accident.

"We won't get there in time for the beginning of the show," said the lieutenant as he carefully made the towing rope fast

to the tail of his two-seater ship. "I've wired the show people to put us last on the list. Are you sure you can cut the tow rope?"

George nodded. The rope was fastened inside his cockpit, and he was prepared to sever it instantly in case of trouble. He climbed into the glider, and the lieutenant and Pete took their seats in the ship, whose engine had been slowly turning over for the past quarter-hour. George waved his hand, the mechanic pulled the chocks from the wheels of the biplane, and the frail glider rose into the air, caught in the prop wash of the ship as the lieutenant gave it the gun. George pushed the stick lightly forward and the machine touched the ground. The larger ship gathered headway, carrying its trailer with it, and soon took the air. Simultaneously George put his stick in neutral position and the *American Eagle* left the ground with the lightness and grace of a bird.

This was a new thrill in gliding. As the plane climbed steadily to the heavens George felt shivers of excitement race up and down his spine. His air speed was well over sixty miles, and the usual swish of the glider rose to a siren-like pitch. The controls, designed for an air speed of forty miles, were now so extremely sensitive that George found it better to leave them alone. The inherent stability of the glider kept it on a horizontal keel. True, it did yaw a little from one side to another but it was an easy, gradual motion, without whip or snap.

Pete and the lieutenant cast frequent and anxious glances aft, but George reassured them with an encouraging wave of his hand. He estimated his height at about five thousand feet, but as they passed over near-by towns he calculated their land speed about forty miles. They must be bucking head winds. At that rate it would be nip and tuck whether they would get there in time.

The show was scheduled to begin at two o'clock, but when that time arrived George knew they were still some fifty miles from their destination. The gliding contest had probably just started, but it would take some time to go through the list of entries. Three o'clock arrived, but with it no sign of the fair grounds. George grew anxious, but about fifteen minutes later the lieutenant pointed down toward the right. George followed the direction and caught the unmistakable outlines of the fair grounds, scarcely larger than a pocket handkerchief among the rolling hills of the country. He produced his knife.

The lieutenant cut his motor and began descending. But George was not going to be deprived of the thrill of sliding down a mile of breeze. He signaled Pete and at the same instant cut the half-inch towing rope. Then, kicking over the rudder and banking the glider with his stick, he swerved away from the ship and began his long descent to the fair grounds.

It was his first opportunity to test the machine on its own, and he banked and turned and soared and dived with an abandon that was saved from recklessness by his great height in the air. All the while he was maneuvering the machine toward the fair grounds. Finally the moment came when he could no longer perform acrobatics in the air, and he concentrated on setting the *American Eagle* down on the crest of the steep hill near the State fair where he could see a dozen other gliders and a large crowd awaiting him. An easy spiral, a quick level-off, and the craft settled down on the clear space near the crest of the trial hill.

A tremendous cheer greeted him as he stepped out of the machine. Lieutenant Gibbs and Pete, who had previously

landed in the fair grounds, patted him heartily on the back as they laughed over the successful termination of the trip. Ambrose Pickering, his jaw still agape in sheer astonishment at the arrival of the American soaring machine, left his glider and came over to look at the upstart machine that had given such an exhibition. The fellows of the glider club were on hand, and carried George to the three judges of the State-wide contest.

"I see you dropped in on us," said one of the judges jovially.

"I'll say I did," laughed George. "Am I too late?"

"You're just in time. All of the gliders have performed except Mr. Pickering's and yours."

"What do we have to beat?"

"Eighteen minutes flat," said the official timer. "Can you do it?"

George laughed. Better eighteen minutes in the *American Eagle!* He made a quick study of the terrain while Pete and the others made the machine ready for the test. With an accurate picture in his mind of the surrounding hills, he read over the rules of the flight and returned to his machine.

"The *Adler* will take off first," he was told. "One minute later you may take off. Any flight under two minutes is a delayed flight. Three delayed flights disqualifies you. Time will be taken until the glider strikes anything preventing further flight."

George nodded. He waved cheerily to Ambrose as the latter stepped into his glider. Ambrose, elated at the thought of the soaring exhibition his craft would give, waved back confidently and snapped his belt. The crowd fell back as the two machines made ready to shoot off, but one of the members of the State College Gliding Club stepped up to the American machine as George climbed into the cockpit and stuck a little American flag on the nose of the machine.

"Eagle against *Adler,"* he told George. "We're counting on you to show Pickering that the old American bird still has a flap left in her wings."

George grinned. At that instant a whistle sounded and the *Adler* was catapulted into the breeze that shot up over the rise of the hill. The men at the launching rope of the sailplane threw their weight forward and stretched it taut. The *Adler* was now soaring gracefully overhead, and George looked at the time-keeper. At a nod from him he signaled with his whistle, Pete released the new trigger rope, and the *American Eagle* jumped into the air for its duel with its rival.

George soared upward until he felt his ship losing speed rapidly. A kick of the rudder, a slight bank, and the machine was crabbing against the breeze on its way to the next up-wind, which George knew would be near the next break in the terrain. He was losing altitude rapidly, but his initial soar had given him eighty feet reserve and his ground speed would soon take him to a favorable wind. He turned his head for a sight of the *Adler.* Its pilot had chosen a group of hills on the other flank of the starting place. It was just reaching these hills and on their ascending currents was soaring to valuable altitudes. George was not worried.

He reached his hills with a loss of but half his initial altitude and pulled the stick back slightly as he felt the ship lift under the impetus of the up-wind. He soared to new and exhilarating heights. Now he skillfully worked his ship from one hill to another, banking and turning to avoid the descending currents on the reverse slopes, striving to reach one uprising breeze after another with as little

loss of altitude between them as possible. Soon he reached a safe altitude for a straight-away flight, and turned his ship toward the hills over which the *Adler* was maneuvering. At the same time the *Adler* decided to pay his hills a visit, and the two creatures of the air passed each other two hundred feet over the heads of the crowd.

The two ships had been up much longer than eighteen minutes, and the crowd now appreciated the meaning of soaring flights as distinguished from gliding. George reaching his hills with altitude to spare, repeated his maneuvers and reached an altitude of five hundred feet before he decided to leave this group of hills and try out a larger group on the other side of the fair grounds. Soon after, as he sped over the heads of the crowd with a tail breeze boosting his land speed up to sixty miles, he saw the *Adler* following him across the flat fields to these other hills. Ambrose was paying him the compliment of imitation; the pilot of the German-designed machine accepted George's judgment in preference to his own.

George had just enough altitude when he reached these hills to turn safely and soar upward on the ascending currents. Ambrose's machine, reaching the hills soon after that, had even less altitude, but by skillful handling managed to turn enough to rise to more satisfactory heights. For fifteen minutes the two machines soared and raced over these hills. But George was not satisfied. It was more difficult here to find up-winds, harder to avoid down-winds, and he determined to return to his original terrain. Gaining enough altitude to take him across the fields against the wind, he headed back to his starting point. The *Adler,* closely following his movements, had anticipated his return and was now abreast of him.

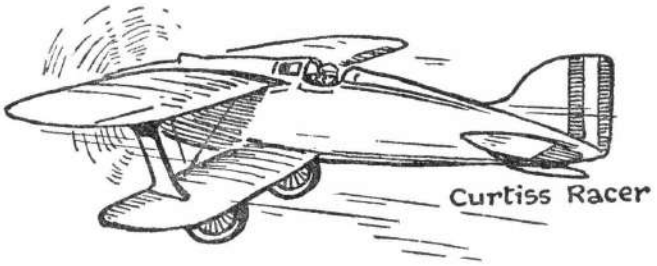
The two ships soon found themselves in trouble. Unsuspected down-winds, probably due to the cooling effects of a large swampy field, relentlessly pushed their machines down as they struggled to maintain enough altitude to carry them to the saving currents of their original hill. George fought grimly to save every precious foot of height. Somehow he had to keep his ship up for sixty seconds longer than Ambrose, if he were to bring that little American flag through to victory. The *Adler* was losing altitude even more rapidly than his ship, but unless the *American Eagle* could hurdle the crest of the hill it would surely come down within a minute of the other machine. George saw the large crowd gesticulating wildly as it watched the two rivals fight to reach the hilltop. He even thought he could hear Pete and the other fellows urging him on. He moved the sensitive controls slightly, trying to stave off what looked like an inevitable landing.

The crest of the hill was now rushing toward them. The sailplane had fifty feet of altitude to clear it, the *Adler* forty-five. But there was that reverse slope down-wind to pass through first! The two ships hit it together and together they dropped. Down, down, George felt the ship fall, while the crest of the hill approached them with tantalizing slowness. The crowd scattered away from the approaching ships and opened a wide lane. George looked over the cockpit; he was not more than ten feet above the ground, and still dropping. A cry went up from the crowd; he heard a slight impact and saw the *Adler* rolling along the hillside. Its flight was over. Now the sailplane *had* to clear the hill if it were to weather out sixty more seconds to better the *Adler's* time. The American ship was hardly more than five feet from the ground; now it was skimming

along the surface. George pulled the stick back—it was an instinctive act upon landing—and at that instant he felt a powerful hand lift his machine upward into the ether again. The *American Eagle,* striking the up-wind in the nick of time, soared upward and onward. George heard a hoarse cheer arise from the crowd and waved back happily.

He kept his ship up for a full moment longer. He had no desire to go out for a record this time, and when his watch ticked away the seconds that gave him the race he turned, zoomed over the up-turned necks of the noisy crowd, did a figure eight, and landed at the precise spot where he took off. Enthusiastic hands pulled him from the cockpit, but George's first thought was for his vanquished opponent. He forced his way through the crowd to the *Adler,* where Ambrose Pickering was glumly regarding his handiwork. George offered his hand. "You got a tough break," he said consolingly.

Ambrose scratched his head. "It seems to me," he said, "as if I had better see America first."



"I Got the Breaks"

The First Boy to Fly Across the Country Tells How He Did It

By Richard E. James

SINCE the finish of my transcontinental flight—and many times en route—I have been complimented by folks who seem to think my flight was of a spectacular nature, and that I deserved great praise for attempting it. I have never felt the flight was one that could not have been made by thousands of other boys of my age, but I am thankful that, of all the boys in America, I was the one to "get the breaks," as they say in aviation circles.

Dick James with his smile of triumph.

In telling my story of the flight—and of learning to fly—I think it is best that I tell a little of my previous history, particularly because a number of people have intimated that I am considerably older than seventeen and therefore was not eligible to participate in the contest sponsored by the American Society for Promotion of Aviation.

I was born in Logansport, Indiana, April 15, 1911. At the age of seven years I fell from a bicycle and sustained an injury which resulted in a double curvature of the spine. For some time the doctors thought I would be permanently paralyzed. I was kept in a brace for three years, and when the brace was taken off my dad sent me to Landers, Wyoming, to visit with relatives and "build up." While there I played on the Landers High School baseball and basketball teams, and returned to my family in Flushing, Long Island, in 1927.

I attended the Flushing High School in 1927 and 1928. Curtiss Field, which is famous as being one of the oldest aviation fields in America, is not far from Flushing. I became a constant visitor at the field and, like all other "kids," was deeply interested in aviation and naturally wanted to learn to fly. Much against the wishes of other members of my family, my dad backed me in my desire, and Captain Fred Becker, one of the best-known instructors in the country, took me under his wing.

I took my early training on a Jenny training machine, and had difficulty, because of my size, in reaching the rudder bar. Captain Becker was mighty fine to me, and took such a personal interest in me that I was ready to solo before the customary ten hours of dual instruction had been finished.

I would like to say that it is my belief, as shown me by Captain Becker, that there is no finer training machine in the country than the Jenny because, when you learn to fly a Jenny, you must fly the wings of the machine and not the motor, as you do in most other ships. Also, if you should have an accident with a Jenny, and are in the back seat, you are less likely to be hurt than in almost any other machine.

After I had finished ten hours' solo flying, Jack Scarpulla, some other boys attending Flushing High School, and I formed the Flushing Flying Club, which was sponsored by the American Society for Promotion of Aviation, and we held weekly meetings at which former war pilots and commercial aviators gave talks.

At that time I heard about the offer made by the society of one thousand dollars to the first boy or girl under eighteen years of age, to fly across the country, and I told my dad that I thought I could make it if I had the right machine. He, who is as great a flying enthusiast as myself, grew interested, and with some business associates, Philip M. Lahn, Frank Grisoli, Harry Lesser, and John P. Allen, secured for me a Travelair machine, powered with a Sieman-Halske motor, which was delivered at Wichita, Kansas.

I took the train to Wichita with Oliver Young, and after getting a little time in and around the Wichita Air Field we flew to San Francisco, where Mr. Frank Flynn, superintendent of Mills Field, was awaiting me.

I neglected to state that before leaving Curtiss Field I took my Department of Commerce test for a private pilot's license, and when I reached the Coast found that I had failed to pass. Mr. Flynn, a war flyer and instructor, took me in hand and gave me a lot more time, preparing me to pass the test which I had to take again. Captain W. B. Voortmeyer mapped out my transcontinental course and gave me great help in navigation. Virgil Kline, of the Maddux Airways, also gave me a lot of flying time, and after a while I became more confident of my ability to make the flight. I took my second test from Mr. E. E. Moutoon, Department of Commerce inspector in San Francisco, and he passed me as being O.K.

Almost every one was splendid to me and gave me all the help and encouragement possible, but, of course, there were also the usual pessimists who told me it could not be done, and that I would never get over the mountains, which they considered the hardest part of the course.

October 30th I left San Francisco for Sacramento and landed safely. I stayed there overnight and left for Reno, Nevada, the next morning. It was between Sacramento and Reno that I had to make my greatest altitude, which was 14,000 feet, and how cold it was up there! I had to sacrifice everything possible for lightness, and did not wear the heavy flying-suit which I would have worn under other circumstances, but put on silk underwear, which I covered with woolens and my regular clothes, over which I wore a "windbreak," which had been recommended by old flyers at the field. I do not smoke, and Mr. Flynn suggested that I take along a box of candy to munch on if I should get nervous, and also to add heat to my system. From 14,000 feet I looked down upon the snowcapped mountains, and should have felt a little wor-

ried, according to the stories I had heard, but the motor was purring like a contented cat, and I must frankly say that I was more interested in the wonderful country below me than in the possibility of engine failure.

At Reno I met Department of Commerce inspector Moutoon again, who paced me to Elko, where I took on gas, and made a hop to Salt Lake City. Coming into Salt Lake City I encountered a blizzard which was just beginning, and had quite a time locating the air field. The temperature dropped to below zero and within an hour after I landed a terrific blizzard was under way which tied up all flying and held me at Salt Lake City for a week. As soon as the weather "opened," I hopped for Rock Springs, Wyoming. I stayed overnight, and left for Rawlins, where I encountered another snowstorm and again was fortunate in just beating the storm to the field. In fact, when I did land my wings were well covered with snow. The storm which ensued held me in Rawlins for nine days. When the weather cleared up I left for Cheyenne, which is on the air-mail route, but missed my bearings and flew south, reaching the city of Denver. I there met Jack Euler, test pilot at the local field, who helped me reservice my plane. This took two days. I then flew directly to North Platte, Nebraska, where I secured gasoline, and started for Omaha, only to be forced down by oil trouble at Grand Island.

After fixing the trouble I headed for Omaha again, where I stayed overnight and reserviced the machine. I headed for Kansas City the next day and again lost my bearings, dropping into a city which I had noted below me, and found it was Leavenworth, Kansas. It was very easy to get my bearings and I carried on to Kansas City, where in making a landing I burst a tire, which was quickly repaired by the boys on the field.

In this city there were the usual "glooms" who predicted that I would kill myself before I reached New York, and told of a Kansas City boy who had planned to make the trip last year and had killed himself while practicing for the flight. This was beginning to get my wind up, so I sneaked out of the hotel early in the morning and got away from the field, heading for St. Louis, before I should have to listen to any more such stories.

The flight from Kansas City to St. Louis was made easy by one of the Department of Commerce Airway inspectors flying ahead of me, but a great many times I thought I saw a city that should have been St. Louis, and could not understand why the Department of Commerce man flew on. I followed him, however, and we reached St. Louis on schedule. This made me determine to study my navigation and cross-country flying a little more, when I should have the opportunity. I stayed overnight at St. Louis, and was entertained at the theater by the boys from the St. Louis Field, and left early next morning for Peoria, Illinois, which I made very easily.

The Peoria Aero Club—one of the foremost civilian aero clubs of the country—was out *en masse* to receive me. They certainly treated me in wonderful fashion while I was in Peoria. I stayed with Lieutenant William Ritter, the instructor of the club, and though I had planned to get away the next morning, rain and low visibility developed which kept me in Peoria for five days.

It had been planned that I should fly to Chicago to appear at the Aeronautical Show, but I received a wire from New York telling me to take the southern route so as to avoid further bad weather.

I accordingly left for Columbus, Ohio, but was forced down, through gas trouble, at Oakwood, Illinois. The trouble having been rectified, I flew from Oakwood to Danville, and from Danville to Columbus, Ohio, where I received a telegram saying that Mother and Dad were leaving New York by airplane to meet me and pace me back. That afternoon Martin Jensen, the second to finish in the Dole flight to Hawaii, flew into Columbus with Mother and Dad. It was wonderful to see them and we made plans for an early get-away next morning. At four A.M. Martin Jensen took off with the larger ship and I followed him. Neither of us had lights on our planes, so we agreed that one of the men on his ship would flash a pocket flashlight which I would try to follow. I had never flown in the darkness before, and in about ten minutes I had lost Martin, who proceeded to Cleveland. After I lost him I swung back and tried to land in the field at Columbus. I couldn't seem to locate it—all I knew was that there was a red light marking the field, but when I flew over Columbus looking for red lights I can tell you I never saw so many red lights in all my life. I flew low, examining every light and the adjacent territory, but none turned out to be the air field.

Finally I saw a light in the distance, and as a last resort I flew toward it, and it turned out to be the field which I left earlier in the morning. We awaited messages at the field and, none coming in, I decided that I would fly to Cleveland alone, and took off at 9:50 A.M. I had flown about an hour when I ran into a heavy fog that was coming down from the mountains, and knowing it would be impossible to break through it, I turned and dusted back as fast as possible to the Columbus air field.

I left the next morning when the fog had lifted and flew to Cleveland, but found that the others had flown to Bellefonte, Pennsylvania, and were awaiting me there. I received a wire from them saying that they would meet me at Clarion, Pennsylvania, and against the advice of those on the field, I took off in the foggy weather that could only be classed with one term, and that is—terrible. I had to go hedge-hopping at about two hundred feet, picking my way by the railroad tracks, and finally had to drop into a field outside Mercer, Pennsylvania. The landing was all right, but I was unfortunate enough to pick a plowed field and in landing I went up on my nose and the propeller was broken. Martin Jensen secured a new propeller and flew with it to Mercer, where, with the aid of his mechanic, Johnnie Kirk, he adjusted the propeller and readjusted the strut, which had been bent. We then gassed up and started for Bellefonte, Pennsylvania, which is an air-mail field, and was to be my last hop before entering New York City.

About twenty miles outside of Bellefonte, and while I was flying over the Allegheny Mountains at an altitude of five thousand feet, my engine started to sputter and kick. I "jockeyed" the throttle, but it was of no avail, and the engine "conked" out completely. It was my first real tough spot, and I knew I had to land. I looked quickly about me, endeavoring to pick a spot to set down in, but all I saw underneath me was the rolling mountains with their line of trees and ragged rocks. Off to the west I saw the only bare spot of any size within gliding distance, and I banked to the left and started my glide for this spot. I saw that by straight gliding I would overshoot the field so I "s" turned and got within gliding distance and then side-slipped to kill my height coming into the field. To take

advantage of the length of the field I had to land cross-wind, and as I neared the ground I had so much speed that I knew I would hit the trees at the far end. I "fish-tailed," which means to move the ship quickly from side to side, presenting the broad side of the airplane to the line of flight. This move will kill flying speed quicker than anything I know. It did kill my speed, but as I landed, there were small shrubs on the field directly ahead of me and an excavation that had been made by people who had been doing some mining. To avoid dropping into the hole left by the miners I kicked my rudder and threw the machine toward a small tree. The wing hit the tree and, as I was going at about forty miles an hour the machine did a "ground loop" which turned it over on its nose, ruined three of the wings, broke a number of the struts, broke the tail skid, tore the engine loose from its mountings, and threw me forward so quickly and forcibly that my shoulder and wrist were slightly injured.

I was way up on top of the mountain, and Martin Jensen and the others flying about looking for me did not discover me until five hours later. After they found out where I was located, it took them four hours to reach me with the Pennsylvania State Troopers and other men who knew the country. After that it was a trying job to disassemble the machine and cart it to Phillipsburg, about nineteen miles away, where Martin Jensen, Johnnie Kirk, and Mr. Hugh Keavney, who was in the party, worked on it with local men, trying to put it in shape so that I could continue my flight.

About this time, after receiving wires of congratulation on my escape, I received other wires telling me to hurry, a bad weather was on its way and the reception planned for me on my homecoming had been delayed twice. As quickly as the machine could be put in shape and reassembled, taking on as little gas and oil as possible, I flew from Phillipsburg to Bellefonte. The machine was in terrible flying condition and would continually do the most unusual stunts, veering so much to the left that I continually had to keep offsetting this motion with the rudder so as to make the machine hold a straight course.

I received a wire asking me to make Philadelphia and then New York, but as the Weather Bureau head at Bellefonte advised that a delay might keep me out of New York for a week, I decided to make the hop at any cost. My next flight was from Bellefonte to Sunbury, Pennsylvania, a hop of about fifty miles, where I took on as much gas and oil as I felt would safely carry me to New York. With Martin Jensen leading the way I started for New York in weather that hung very low over the mountain-tops. Martin led the way down valleys and so close in some places to hills that at times I felt I could almost touch them if I stretched out my hand. I can tell you I was mighty happy when we worked across Staten Island and I saw the Statue of Liberty appear in the distance and knew I was practically home.

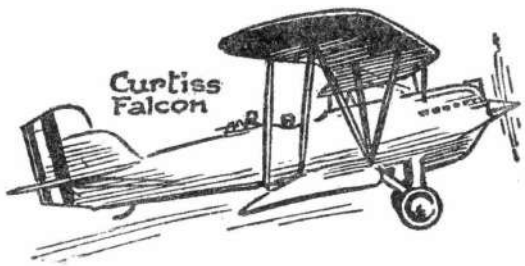
In ten minutes more I was at Curtiss Field, and when I landed the whole Flushing Flying Club crowd with their friends and a reception committee swarmed about the plane, and it was without doubt the happiest moment of my life. A police escort had been provided by Mayor Walker of New York City, and we certainly made wonderful time through all the traffic to City Hall, where I was received by the Mayor's secretary, the Mayor being out of the city.

A few days after the City Hall reception a luncheon was given me by the American Society for Promotion of Avia-

tion at the Roosevelt Hotel, at which time I was presented with the prize of one thousand dollars. I was made very happy at this luncheon by being at the same table with Major George Vaughan, second American ace, Colonel Harold E. Hartney, the leader of America's famous war flyers during 1917 and 1918; Captain Frank L. Hale, with a record of having brought down eighteen planes in two months' flying; Captain Jacques Swaab, American ace, and other noted airmen.

Two days later, with Dad and Thomas L. Hill, president of the American Society for Promotion of Aviation, I flew to Washington and was presented to President Coolidge. I have heard that the President is very austere, but he was certainly mighty nice to me. He asked me to tell about my flight, which I did, and he inquired about the stops I made, and complimented me on finishing so successfully, telling me to keep up my good work. He then signed my card, which I will always hold as a souvenir of a very memorable occasion.

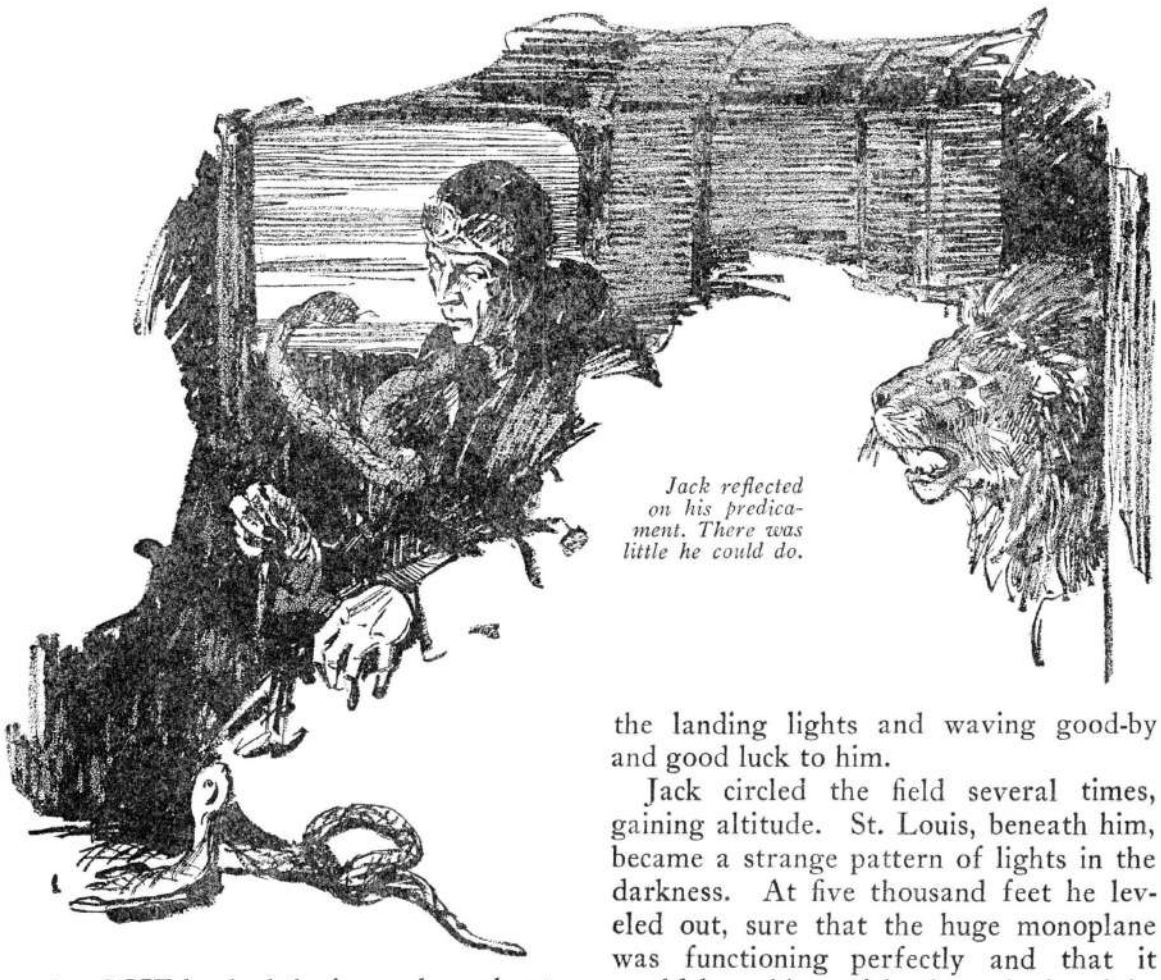
Many people have commended me for this flight, but I must say, in all true sincerity, that "I got the breaks." I got the first break in having the most wonderful dad in the world, who had confidence enough in me to give me flying training. I got the breaks in having my dad's associates have confidence enough in me to finance my trip. I got the breaks in meeting with wonderful support and encouragement all along the way, and my only regret is that thousands, yes, probably hundreds of thousands, of young American fellows such as myself could not make the trip as well as I have only because they have not been financed and given the support that was given to me. I hope that my flight will, in no small way, encourage other fellows to take up what Lieutenant Russell Maughan has said is the greatest sport the world has ever known since the days of King Arthur and the Knights of the Round Table.



Snakes Alive

By T. Victor Shaver

Illustrated by L. R. Gustavson



Jack reflected on his predicament. There was little he could do.

AS HE banked the huge plane about, Jack Kane peered out the window of the glassed-in cabin at the light-flooded field beneath him. He could see his father standing in the glare of one of the landing lights and waving good-by and good luck to him.

Jack circled the field several times, gaining altitude. St. Louis, beneath him, became a strange pattern of lights in the darkness. At five thousand feet he leveled out, sure that the huge monoplane was functioning perfectly and that it would bear him safely through the night to his destination, New York.

Jack set his plane on the compass course for New York City, then he adjusted his earth-inductor compass so that the

needle sat directly above the zero in the center of the dial. Jack did not expect any difficulty in keeping it there. He settled back in his seat for the long hours of flying ahead of him.

He began to reflect on the circumstances that had sent him on this night flight with the queer cargo that was in the passenger compartment back of him.

Jack's father owned the Aerial Transportation Company, operating out of St. Louis. The financial affairs of the company were not in very good conditions. It kept Mr. Kane busy trying to make both ends meet.

Jack, this evening, as he always did, had driven down to the field to take his father home. At nine o'clock the field was usually quiet, but to-night there had been unusual activity. The great monoplane recently purchased was being tuned up and gassed by the mechanics and the landing lights were on.

All this had not surprised Jack, but when he entered his father's office and saw him donning his flying-gear, he knew something extraordinary was going on.

"Dad, where are you going at this time of night?" he exclaimed, springing forward.

Mr. Kane looked proudly at his stalwart young son. They were companions and there was never any subterfuge between them. "I've got to go to New York to-night," he said.

"Who's going to pilot you?" Jack asked.

"That's just the trouble," Mr. Kane answered. "I can't get in touch with any of my pilots, and so I'm going to take the plane myself."

"You can't, Dad. You haven't flown at night since the war; and besides you've never had this new monoplane up and, moreover, you promised Mother you wouldn't make any dangerous flights that weren't absolutely necessary."

"But this one is, son," his father had answered. "I've been offered a five-thousand-dollar bonus by a moving picture concern if I get a cargo to Roosevelt Field, New York, by nine o'clock to-morrow morning. That five thousand will put us on our feet. I can't find any of my pilots, so I'm going to go myself. I guess I'll get through all right."

"Dad, let me take it?" Jack had grasped his father by the arms pleadingly. This was the opportunity that he had been looking for to show his father that he was really a good pilot and he seized it.

"I've been up in that monoplane every day since we've had it. You know 'Trombone' Reilly says I'm as good a pilot as any you have." ("Trombone" Reilly was Mr. Kane's test pilot.)

"But," Mr. Kane had remonstrated, "Mother wouldn't want you to go any more than she would me."

Jack had seen that his father was weakening and so had continued his pleadings.

At last, reluctantly, Mr. Kane gave his consent.

"What am I going to carry, Dad?" Jack had asked.

"A lion and a basket of snakes," his father had answered.

"What!" Jack had cried in amazement.

Then, as Jack had slipped into his coveralls, Mr. Kane had explained to him about the queer cargo and the necessity of getting it to New York by morning.

"It seems that this movie company must retake a scene in which this lion and the snakes are used. The contract of the star who appears in this scene expires tomorrow. The company had thought they were through with the lion and the snakes and had shipped them back to Hollywood. They must have them back in New York in the morning because the star is angry

with the company and will not work after her contract expires. The company expressed the lion and snakes from Hollywood, but they were caught in a train wreck outside of this city and delayed. The only way they can be gotten to New York on time now is by airplane. They offered me a bonus of five thousand dollars and I accepted."

After inspecting his plane minutely, Jack had looked over his charges. The lion was a huge fellow in a cage almost too small for him. A small sign wired to the bars of the cage stated that his name was Leo. The snakes were in a large wicker basket and Jack had not bothered to look at them. This basket and Leo with his cage were placed in the passenger compartment of the monoplane. Some of the seats had been removed to make room for them.

Jack and his father had shaken hands and Jack had climbed into the plane. Then, after a close inspection of his meters, he had taken off.

The first hour of Jack's flight was uneventful. The huge 400-h.p. motor purred contentedly ahead of him. His oil pressure and temperature gauges were registering correctly. His air-speed meter said 115 miles per hour, but he had taken off into a fifteen-mile-an-hour wind. He kept the needle of his earth-inductor compass in the center of the dial unwaveringly.

Jack's ears were trained to detect the slightest change in the vibrant roar of the motor. Any irregularity in its beat or change in its tone and he would be instantly on the alert. Jack, despite his youth, was considered an excellent pilot. He had soloed when he was fourteen, and for the past three years had been in the air almost daily. He had flown almost every type of ship there was. It seemed he was a born flyer and flew almost by instinct.

The darkness all around him, save for the tiny light on his instrument board, and the purring roar of the motor made Jack very sleepy. It seemed to have a hypnotizing effect on him. It was terribly hard for him to keep his eyes open.

Then, suddenly, to his well-trained ears there came a new noise, one that he had never heard in the air before. Instantly Jack's sleepiness was gone and his eyes were on the instrument board. Again came that noise. Jack was worried. He could not account for it.

The noise continued intermittently. Jack would think that he had heard it for the last time, and then suddenly it would break on his ears above the roar of the motor. It was disturbing to Jack's peace of mind.

The noise seemed to come from the cabin in the rear of the pilot's compartment. Again and again it came, a roaring, snarling, nerve-shaking roar. Jack had it now. He leaned back in his seat, a smile of relief on his face.

"Leo, you old divil," he soliloquized, "I bet you're hungry—or maybe cold. I'm sure glad snakes can't roar," he added as an afterthought.

Occasionally the plane passed through a wisp of cloud. These thickened and Jack was in the midst of a heavy storm. The huge ship was tossed around in the air like a small boat in a rough sea. It took all of Jack's strength and training to hold it on its course. The tail whipped about in the gale. Lightning played all about the ship, lighting up the sky with great flaming streamers of fire.

Jack struggled to get the ship above the storm, but could not. Once it was entirely out of control. Caught in a great upward gust of wind, the plane rose several hundred feet and then, as the wind dropped it, and before Jack could regain control, it fell off into a spin.

There was a crash from the cabin in the rear. Faintly, above the roar of the storm and the motor, Jack could hear Leo roaring his fright.

"Gee!" he exclaimed, "I'll bet that lion cage has broken loose."

He could hear the cage bump about the cabin as the storm rolled the ship about. Luckily the storm was blowing itself out. The air was much quieter now. The loose cage in the cabin was apparently not doing any damage. Through it all the motor was functioning perfectly. Not once did it falter.

Jack was complimenting himself on bringing his ship safely through the storm. It was time to have some lunch. He had taken off at ten-thirty. His wrist watch told him that it was now one-thirty. He had been in the air three hours. He expected to reach New York by eight in the morning.

Just before Jack had left the ground his father had handed him a packet of sandwiches and a thermos bottle of coffee. As he reached for these sandwiches there sounded in his ear a terrible snarl. Jack froze in his seat. Slowly he withdrew his hand. He turned his head in the direction of the snarl.

There, monstrous head and one huge paw just emerging from the narrow passageway, the lion. Slowly Leo inched himself forward. His yellow eyes, Jack thought, projected hate. His huge pads contracted cat-like, their sharp claws seeking a grip on the smooth floor boards. Again the lips snarled back from the long fangs. The mouth dropped open hungrily, a red tongue curling about the teeth. The lion seemed to be smacking his lips prior to a meal of, what to him was *rara avis*—an aviator.

Somewhere, Jack remembered, he had read that one could stare a lion down, that one could bring a lion under control by glaring steadfastly into his eyes. He seized on this remembered bit of lore as a drowning person seizes on a straw. Resolutely he fastened his terror-stricken blue eyes on the lion's blazing yellow ones.

For a bit the lion paused, arrested by the fierce glare of Jack's frightened eyes or by some tremor of his innards caused by the rocking ship.

Jack thanked his lucky stars for his good memory. But he had given his thanks too soon. Again the lion advanced. His head was only a few inches from Jack's.

"If he makes one snap now, I'm a gone bird," Jack lamented inwardly. Gamely he held his gaze, flying the ship by sense of feel alone.

The lion sat down on his haunches. Jack was greatly relieved by this action on the lion's part; nevertheless he kept his eyes fastened on Leo's. The lion raised one paw and laid it on Jack's shoulder. His long red tongue flicked out and caressed Jack's face.

"Gosh! He's tastin' me," moaned Jack, and gave himself up for lost.

But the lion made no further hostile demonstrations. Finally it dawned on Jack that Leo was trying to be friendly.

"Leo, old pal," he cried joyously, "let's be friends! I'm sure glad to know you," and Jack advanced his free hand to meet a huge paw extended by Leo, his deadly claws concealed in their soft mittens of flesh.

Solemnly they shook, binding their friendship.

"Sit here," ordered Jack, removing the lunch from the unoccupied mechanic's seat. Leo was a well-trained lion and obediently he climbed to the seat and sat on his haunches.

"Hungry?" queried Jack.

In answer Leo snarled back his lips in a gesture that Jack knew now was a friendly

one. His jaws opened and his tongue drooled out expectantly.

Setting the controls so that the ship would fly itself for a bit, Jack unwrapped the sandwiches.

"Share and share alike between pals, Leo," said Jack, offering Leo half of one of the sandwiches. It disappeared with a flick of the red tongue before Jack could wink his eye.

"Well here's the other half, Leo, old boy. I don't how much of a full-grown lion's appetite three ham sandwiches will fill, but you are welcome to them. I'll take the coffee for my share of the lunch."

Jack uncapped the thermos bottle of coffee, but as he lifted it to his lips the lion snarled again and stuck out a paw preventing Jack from even tasting the coffee.

"But you can't drink out of a bottle, Leo," remonstrated Jack, "and besides you've had your half of the lunch."

Again Leo snarled. Perforce, to keep peace in the family, as he explained to himself, Jack held forth the container of coffee. Leo engulfed the upper half of the bottle in his mighty mouth and tipped back his head permitting the coffee to gurgle down his throat. When he lowered his head the thermos bottle was empty.

"Well," gasped Jack, "you certainly are a trick cat."

Luncheon over, Leo curled himself up on the seat and evidently prepared to take a nap. Jack thought that he could almost hear him purr above the motor's roar. He put out his hand and stroked the great head as he would have done to some old tabby.

"Be good until we get to New York and I'll buy you a nice juicy steak," he promised.

He glanced at his wrist watch. He would be flying into the dawn in another hour or so and then he would be able to verify his compass course from familiar landmarks.

Jack was watching the earth beneath him. The lights of a passenger train; the sleepy street lights of the country towns. Leo was forgotten.

"What's that?"

He had been rudely interrupted in his thoughts by a moving something on his wrist. He had felt something cold and clammy, something scaly, something snake-like. The cold sweat stood out on his brow. Fear tensed his muscles. He could not turn his head to look. The scaly movement continued slowly across his wrist. He could feel now that there was something twined about his arm.

Exerting all of his will power, Jack forced himself to turn his head. He was peering into two tiny, bead-like eyes set in a wedge-shaped head. The head, standing erect on an elongated body elevated from his arm, was even with his own. A forked tongue darted in and out of the wicked-looking mouth. The body was ringed with alternate brown and white stripes.

Snake after snake emerged from the passageway. They were of all sizes and kinds. One of them spiraled itself around the joy stick; another coiled around Jack's right leg. The one that was on his arm had by this time reached his shoulders and now hung around his neck like a lei. Most of them, however, followed the huge one into the darkness behind the instrument board.

Jack reflected on his predicament. There was little he could do. He did not care to land the big ship in the darkness on an unknown field even if he could find one, which was doubtful. If he did his fix would be changed but little. He would still have the snakes on his hands. Besides, he must get them to Roosevelt

Field on time, or they would lose the bonus. So Jack carried on.

He did not mind so much the snake around his boot leg, nor the one around the joy stick, but the one around his neck persisted in thrusting its head in between the buttons of his coveralls and into the pocket of his shirt.

Again and again Jack pulled its head forth gently, but each time the snake burrowed its way back into his pocket. Finally Jack became so exasperated that he seized the snake behind the head with thumb and forefinger and jerked it from his neck. He held it at arm's length. The snake viciously coiled and uncoiled its body around his arm, but Jack maintained tight hold of the snake's head. He thrust his arm through the window of the plane and when the snake uncoiled its body from his arm he dropped it, hoping that it landed safely.

With the break of day things became more pleasant. Leo yawned and raised his head from between his paws. He sat up and looked out of the window on his side of the plane with every evidence of enjoying the view. The snakes, outside of a few squirming movements, maintained their places.

"They're cold," thought Jack. "I hope they stay that way until I get to New York. And you, Leo, be good. I've been told on good authority that aviators make poor breakfasts."

As it became lighter and Jack could see farther into the depths of the darkness back of the instrument board, he saw a new danger—one that blanched his face and made his blood run cold.

The huge snake that had taken so long to go across the floor boards had one loop of its body around the rudder bar and another around a fuselage brace. If the snake should contract its body it would throw the heavy ship out of control and crash Jack and his charges. As long as the snake did not move they were safe.

"Talk about Damocles and his sword, and life hanging by a thread and such," thought Jack—"mine depends on the caprices of a snake."

Jack considered landing, but decided against it. It was foolhardy to go ahead, he knew, but he must get to New York on time. He did not want to fail his father on this, the first important thing that he had ever done for him.

The mail field at Bellefonte flashed beneath him. It wouldn't be long now until he would be safe on the ground and free of his charges. As yet, the huge snake had made no move. It seemed to be in a lethargic sleep, and Jack was glad of that.

Leo yawned and growled indifferently at Jack. "Just hold your appetite for a few minutes longer, Leo, and you're due for that steak," Jack reminded him.

They were flying at an altitude of three thousand feet when Jack spied the hangars of Rosevelt Field. He circled the field, noting carefully the wind direction, and started down. In his happiness at arriving safely and on time, Jack had forgotten for the moment the snake twined about the rudder bar.

Suddenly he felt the bar move under his feet. The ship lurched over to the right and he could not straighten it out. It went into a flat spin.

"Oh! That snake!" Jack gasped between his clenched teeth.

The expected had happened. The snake was moving its body and throwing the ship out of control. Bit by bit the snake relaxed its body and Jack finally got the plane under control. Had he been seconds more they would have crashed, for they were only three hundred feet off the ground when Jack finally got the monoplane leveled out.

Jack cut the gun and proceeded to land,

fearful lest the snake should again send the plane out of control. Luckily this did not happen, and Jack made a perfect three-point landing. He taxied the monoplane up almost to the crowd of spectators and cameramen who were, apparently, waiting for him.

"The movie company's publicity department is on hand to welcome me," thought Jack as he climbed from the monoplane followed by Leo. "Well, they'll certainly get an eyeful."

Leo, the minute his feet touched the ground, let out a great roar and started for the crowd, all but one of whom turned tail and ran. That one advanced to meet Leo.

Jack stood horrified, expecting to see the man bowled over by one of Leo's paws.

Leo advanced to the man, reared up on his hind legs and placed his forepaws on the man's shoulders, evidently delighted.

"His keeper, thank goodness!" said Jack.

Again the camera men and reporters advanced to photograph Jack and get his story for the afternoon papers.

The man whom Leo had greeted began removing the snakes from the plane. "Say, boy," he interrupted Jack, "didn't you bring Minnie?"

"Minnie? No, I brought only Leo and the snakes," answered Jack.

"Minnie's a snake, boy. She was supposed to be in the basket with the rest of them. She's the most affectionate and best-trained snake in captivity."

Jack had forgotten the snake he had dropped from the window, but now as he turned to help the man hunt for Minnie, his eye brightened.

"Say, was Minnie alternately brown and white striped?" he asked.

"Yep! And she was the prettiest snake you ever saw," the man answered.

"Well, there she is then," Jack said, pointing to the undercarriage of his plane where his quick eye had spotted Minnie's brilliant body wrapped around the landing gear.

Shortly Jack broke away from the crowd and made his way to a telegraph office where he sent the following message to his father:

"Arrived safely. Snakes all present and accounted for. On the best of terms with Leo. Starting back to-morrow."

A Pathfinder of the Skies

By Theodore Roosevelt

THIS country exists now because of the courage of its people. It was built by the daring of the men and women who came to it as settlers when the continent was a wilderness. Life then was not only dangerous but filled with discomforts and hardships. After gaining a foothold on the eastern coast the Americans pushed west and opened up the great plains and mountains where millions of our people live to-day.

Through the cloth of our national character is woven this thread of worth-while daring. The nation-builders were the pioneers—Miles Standish, Daniel Boone, Kit Carson, and a thousand like them. Life was to them an adventure, but the adventure at all times had its worth-while side. When they took chances, they took chances because the goal they wished to attain was worth winning. That is the great difference between them and the fool who is smashed up doing something of no value to himself or to anyone else. Too many boys do not realize this difference. They rank the man who for a bet tries to walk around the coping of a building ten stories from the ground, with the man who does the same feat to save the life of some person in a fire. This is wrong. One deed is foolish, the other is fine.

A representative to-day of the fine type of pioneer American is Captain Charles A. Lindbergh, who has just made the transatlantic flight. He dared and dared greatly—but he dared for a worth-while end.

There are those who have called him "The Flying Fool." It is a gross misnomer. He is a trained and skillful aviator, who knows his business of flying as well as any man alive to-day. Luck, of course, he has had to have, because luck plays a part in practically every achievement from the election of a president to the winning of a battle. But luck played only a small part in his success. He never would have reached Europe if it had not been for the most careful and conscientious preparation on his part. For years he studied the science of aviation, mechanics, aerodynamics, and all the hundred and one things that go to make the equipment of a trained aviator.

His whole flight bore witness to this. He studied the various types of planes and decided on the Ryan. After his decision he went to San Diego, where the factory stands. There, in company with the staff of that establishment, he worked for two months. The plane was built under his direction. When finished, he himself made the tests.

When the plane was proved he started at once for the east coast. In one flight he reached St. Louis. On the inside pages of our newspapers a short paragraph announced, "A Captain Lindbergh has flown from San Diego to St. Louis. He hopes to compete in the transatlantic flight." That was all. One night he spent in that

great city on the banks of the Mississippi and hopped off for New York.

Hours before the time he was expected, he circled down and landed on the flying field of Long Island. Even then the newspapers paid but little attention to him. For a week weather held him storm-bound on the Atlantic coast. During the entire time he was modest, quiet and efficient. His manner impressed the newspaper men so much that he began to feature more and more in the news. His very reticence attracted them.

Suddenly one morning early it was flashed over the United States, "Lindbergh has hopped off!" At once the thoughts of the entire nation turned to him. The story of his departure was spread across the front page of every paper of the land. Nothing marked his character more than an incident they carried. A kitten was handed to him for a mascot as he settled himself in the cockpit. He refused to take it, saying, "It will be too cold for little animals."

All over the United States all day long people waited in suspense. On everyone's lips there was one word, "Lindbergh." In everyone's heart there was one hope, that he would get across safely.

Bulletins were received with frenzied eagerness. Cheering crowds greeted the announcements of his passage from point to point as he whirred up the Atlantic coast. Finally, just at dusk the news flashed over the country that the small plane had been sighted over Cape St. John and was driving out into the night that hung over the broad Atlantic.

That evening at a prize fight in New York City, forty thousand spectators rose as one and stood in silent prayer for the success of the venture.

With dawn the rumors began to arrive. All day messages were flashed, only to be contradicted within the next few minutes. Excitement was at fever heat. Finally, at five-thirty, word reached the waiting people of the country that he had landed safely in Paris.

The pathfinder had come successful to his goal. Another great deed of daring had become history.

Lindbergh took his triumph as simply as he had taken the other problems in his life. It is splendid to realize that such cool and skillful daring was rewarded with success. It is doubly splendid to know he is clean, unassuming, and modest.

The picture would not be complete without mention of his mother, Mrs. Lindbergh. Throughout the days of suspense she carried herself with unfaltering courage. In the hour of triumph she stood in quiet dignity and pride. She is as much a part of the picture as her son. Both are striking examples of the finest traditions of America.

A Flying Model of the "Spirit of St. Louis"

By Elmer L. Allen

MANY airplane builders and aviators agree that the next best thing to building and flying real airplanes is the building and flying of models of real planes. Accurate models, made to duplicate in miniature the large machines they represent, and having to a great extent the same constructional features, provide the finest possible opportunities for experiment and study. And when they can be made to fly in the air their value is greatly increased. They not only instruct in the principles of aeronautics, but also provide pleasure and entertainment in their construction and flight.

The first requirement of a good model airplane is an accurate plan. The plan of the *Spirit of St. Louis* is known as a "scale-reduction" plan; that is, it is the actual plan of the large machine, scaled down to model size. It is, therefore, true and accurate in every detail. A key to parts and material is also included with each plan, the lettered indications corresponding with the letters on the various views.

The list of materials required to build the *Spirit of St. Louis* is as follows:

Wood
- 1 piece, 5/16" square, 21" long.
- 5 pieces, 5/32" square, 24" long.
- 1 piece, 1/8" square, 24" long.
- 2 pieces, 1/8"x1/4", 20" long.
- 2 pieces, 3/16" x 1/4", 20" long.
- 1 piece, 5/32"x3/8", 6" long.
- 10 pieces, 1/16"x3/16", 12" long.
- 5 pieces, 3/32" diameter, 10" long.
- 1 piece, 1/16" diameter, 6" long.
- 1 piece, 3/16" x 3/4", 5" long.

Reed
- 2 pieces, 1/8" diameter, 36" long.
- 2 pieces, 3/16" diameter, 6" long.

Sheet aluminum, No. 34 gauge; 2 pieces, 6" x 12".

Sheet aluminum, No. 34 gauge; 1 piece, 6" x 6".

One large spool tinned wire.

Nine small corks, 1/2" long x 3/8" diameter.

Wood propeller, 10" size; carved or blank.

Rubber strands for motive power.

One pair 2" wheels.

Bamboo paper for covering, 1 sheet, 24"x33".

Bamboo varnish; 1 can. Wood glue: 1 can.

Small screws: 1/4" 3 doz.; 3/8" 1/2 doz.

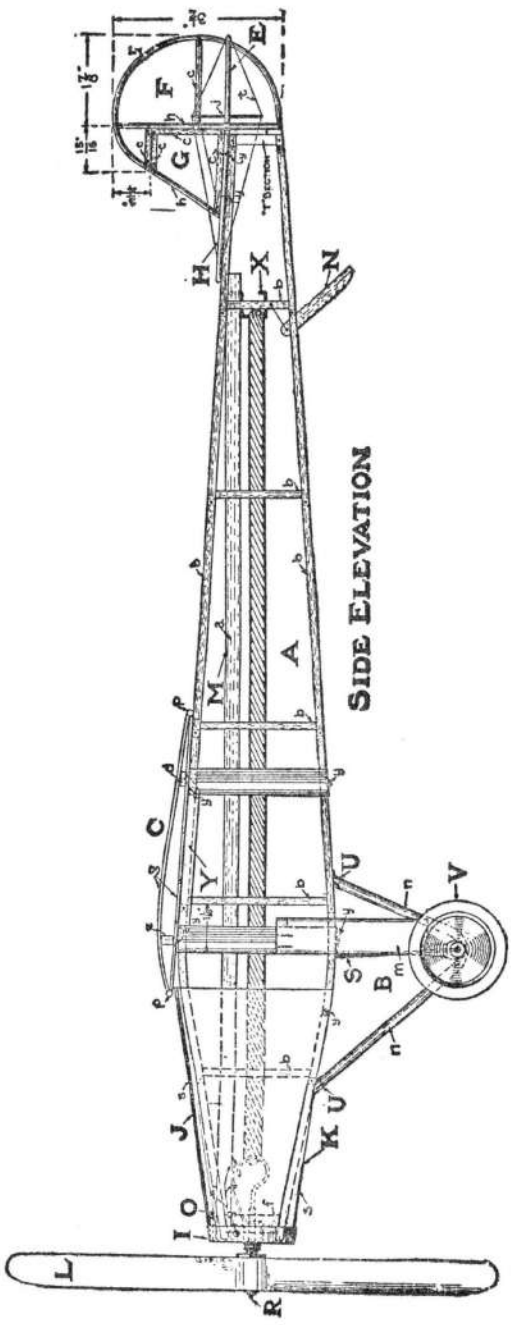
Small nails: 1/2" long.

Piano wire for forming propeller hook, shaft, etc.

Small tools: Drills, screw driver, etc.

Study the plan carefully before starting actual work. Figure out where each size of wood is to go; where reed is used and how the various parts of aluminum and wire are to be formed into shape. Build the fuselage first. Arrange nails in a flat board the exact shape that the four long pieces of wood (5/32" square), which form the frame of the fuselage, must be shaped. Put these pieces in a flat pan and cover them with water. Let them boil for at least twenty minutes.

A Flying Model



Key to Parts and Materials as noted in the Diagrams

A—Fuselage
B—Landing gear
C—Main plane
D—Aileron
E—Elevator
F—Rudder
G—Fin
H—Stabilizer
I—Nosing
J—Upper cowling
K—Lower cowling
L—Propeller
M—Motor stick
O—Propeller hanger
P—Plane struts
R—Propeller shaft
S—Landing gear axle
T—Spar sleeve
U—Terminal fitting
V—Running-gear wheels
X—Rear rubber hook
Y—Plane holder
a— Wood...5/16" x 5/16"
b— " ...5/32" x 5/32"
c— " ... 1/8" x 1/8"
d— " ... 1/8" x 1/4"
e— " ...3/16" x 1/4"
f— " ...5/32" x 3/8"
g— " ...1/16" x 3/16"
h— " ...3/32" diameter
j— " ... 1/16 "
m— " ...3/16" x 3/4"
n— Reed...3/16" diameter
p— " ... 1/8" "
r— " ...3/32" "
s—Sheet aluminum, No. 34 gauge
t—Tinned wire, No. 34 gauge
y—Screws

These diagrams are reduced to one-fourth actual size and are reproduced by courtesy of the Ideal Aeroplane and Supply Co.

Take the pieces from the water and immediately place them in the form made with the nails on the board. Bend them carefully so they do not split. Leave them there until thoroughly dry.

When dry, arrange them in position and tack the vertical crosspieces in position as shown on the plan. Make the two sides separately; then put them together, using the horizontal crosspieces. Drill 1/32 inch holes through the long pieces (called longerons) in the proper places; use 1/2 inch nails and reinforce the joint with plenty of glue. Be careful to get both the vertical and horizontal crosspieces in proper position as indicated on the plan. Next place the tail skid in position, using wire and glue.

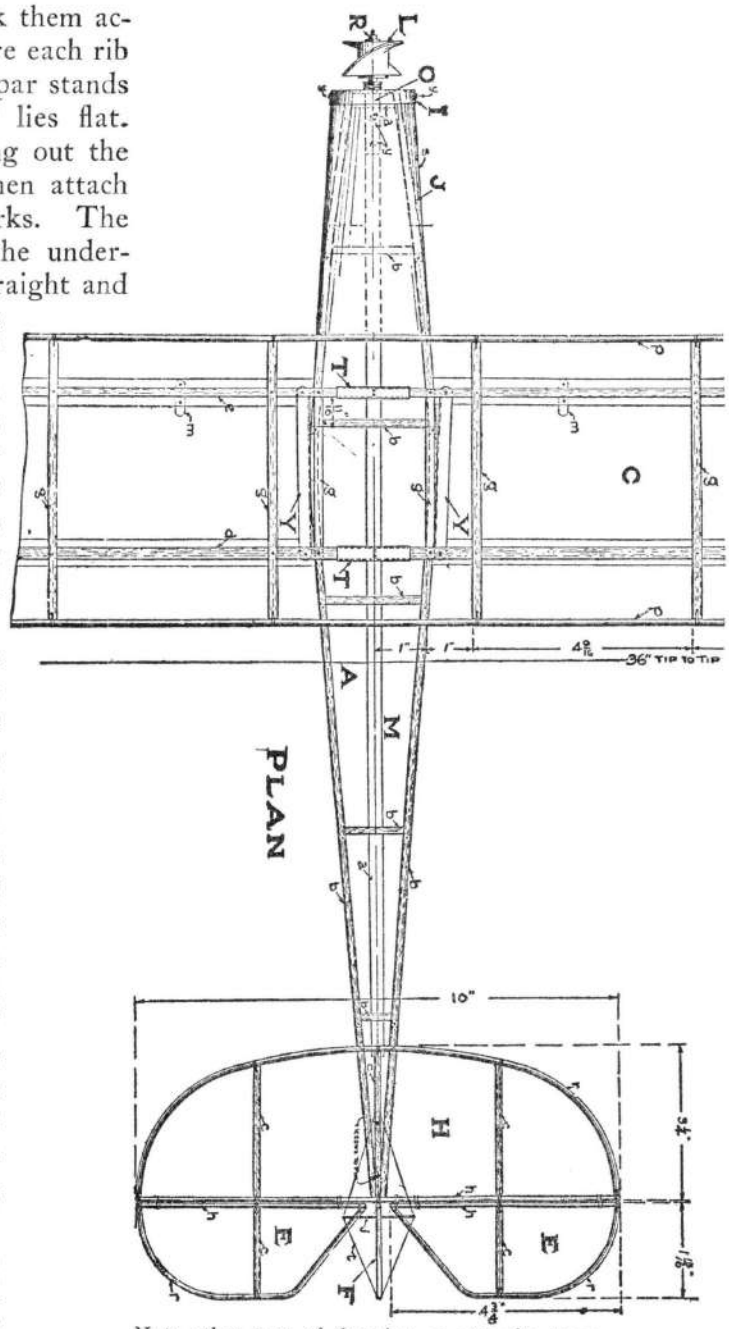
Now put in the motor stick, indicated as *a* on the side-elevation plan. This is the 5/16 inch square piece of wood. Cut it off carefully to the length required. Form the propeller hanger from a strip of aluminum cut from the large sheet, drill holes as required and attach in place on the end of the motor stick. Drill a 1/16 inch hole about 1/2 inch from the rear end of the motor stick and fasten the rear rubber hook as shown. Make this hook from a short piece of piano wire. Also make the propeller shaft from this wire, shaped as indicated, and insert it through the holes drilled in the propeller hanger. The rubber strands are simply hooked over each of these hooks on the propeller shaft and the motor stick. Be sure the motor stick is securely fastened into place; this must bear the whole strain of the motor when the model is in flight.

Now cover the whole fuselage with bamboo paper, excepting the front panels on the top, bottom and two sides, and the next-to-last panel on the under-side at the rear end; the panel immediately under the rear rubber hook. Cut the paper roughly to size. Apply glue to the fuselage, not on the paper, and work the paper over the fuselage so it is smooth all over and as tight as possible without tearing it. When the paper is on, trim it to within 1/8 inch of the frame; then apply glue a little at a time on the end of the finger and work these edges down smooth. Arrange the paper so the rough edges come on the under-side of the model. Coat the paper with bamboo varnish. Put it on smooth all over. It will loosen and wrinkle the paper at first, but when dry will shrink it tight. To hold the fuselage in correct shape, place weights on the sides and leave it until the glue and paper are thoroughly dry.

Cut and shape the top and bottom cowling from the sheet of aluminum. Drill 1/16 inch holes for attaching to forward end of fuselage. Place the lower cowling first, and fasten it into position. Then place the upper or larger cowling, and fasten it securely. Make two plane holders (see *Y* on plan) and attach them to the fuselage at exactly the same position on each side. One edge will be flat against the side of the fuselage and the other will extend outward at right angles. The main plane will be fastened to these extending edges.

The frame for the main plane is made in two halves. These halves are joined and fastened with spar sleeves before the front and rear edges of the plane are attached. Select the proper wood; cut it to size, including the long pieces for spars. The main plane must be made one-half right and one-half left; this is important; watch the plan. The two pieces of wood 3/16"x1/4", each 20" long, are for the front spar. Cut them the exact size in length according to the plan. The two pieces 1/8"x1/4", each 20" long are for the rear spar. Cut them also the exact length. Select one piece of each size and lay them together perfectly even and

straight, ends even. Now mark them accurately to indicate exactly where each rib is to go. Note that the front spar stands on edge, while the rear spar lies flat. Mark them carefully, measuring out the distance between each rib. Then attach the ribs according to the marks. The lower ribs must be straight; the under-side of the plane is perfectly straight and flat. The upper, or top, ribs are curved. The 1/16"x3/16" wood is used for these ribs will curve naturally into shape as the ribs are fastened together at the ends, but care must be taken to see that the lower ribs do not also curve. Tack the ribs in place with very small nails.

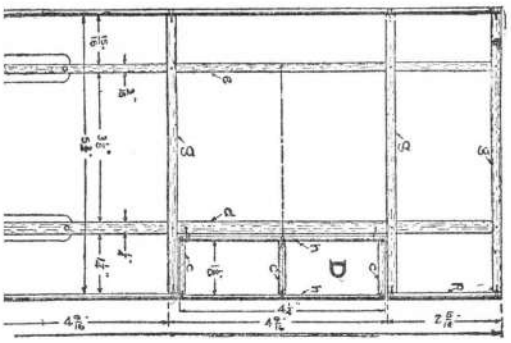


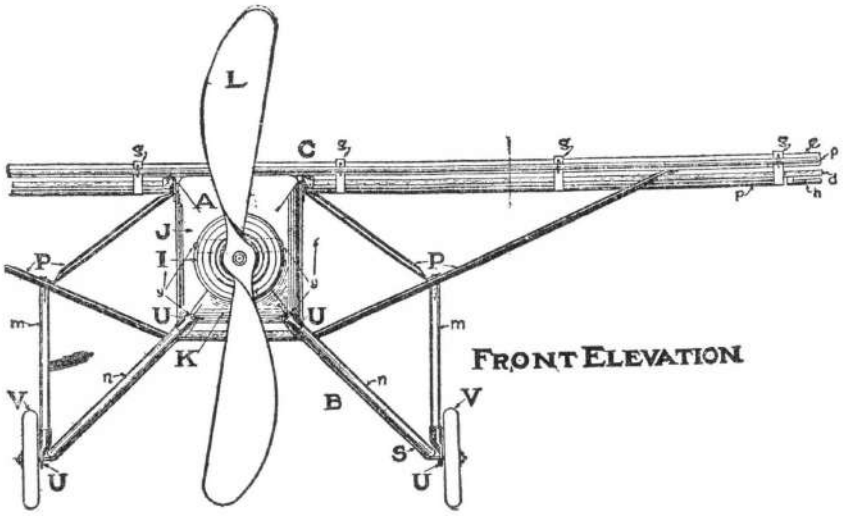
Note other part of drawing on opposite page.

Make both halves of the main plane, putting ribs in place on each half, then join the halves together with spar sleeves made from aluminum. Fasten the sleeves around the spars with small nails. See that the spars are perfectly straight and true. Drill 1/32 inch hole in the ends of all ribs, through both top and bottom pieces. Then attach the 36-inch long pieces of 1/8 inch reed at each edge. The ailerons (see *D* on plan) must be arranged in the ends of the plane as shown. Build these into the plane before attaching the reed. Then attach the reed in a continuous piece from end to end. After it is in place and securely fastened, the movable ailerons can be completed by cutting through the reed at the places indicated. Next cover the under-side of the plane with bamboo paper, using glue as with the fuselage covering. Then cover the top-side the same way. Coat the paper with bamboo varnish and set the plane aside to dry. Prevent warping by laying light weights on the plane until it dries.

Next make the landing gear. Boil and bend the 3/16 inch reed into shape as in-

dicated at *n* on the side-elevation view. Two pieces are required, both exactly alike in shape and length. Attach these to the fuselage by means of small nails or screws in exactly the position indicated on the plan. Make an axle of strong wire bent into shape indicated at *S* on the front-elevation view, and attach to the underside of fuselage and to the bottom of the





FRONT ELEVATION

curve in the reed supports. The plane struts, *P* on the front-elevation view, must be made by folding strips of aluminum into proper size and shape and flattening the ends for about ½ inch. The part indicated by *m* on the front- and side-elevation views must be made from the pieces of 3/16"x3/4" wood. Cut it to shape and size and round the edges. Make two pieces, both exactly the same.

Now make the stabilizer, elevators, rudder and fin. Use wood and reed in sizes as marked on the plan, wiring the pieces together in the shapes and sizes indicated. Make each separately, cover with bamboo paper and bamboo varnish as described previously. Drill 1/16 inch holes where necessary in the ailerons, elevators and rudder, to accommodate the wood levers which operate these parts. Push small round pieces of wood through the holes so they project evenly on each side. Parts of round toothpicks are excellent for this purpose.

Now comes the assembling. Hinge the elevators to the stabilizer with fine wire. Drill two 1/16 inch holes through the center rib of the stabilizer and screw the fin (*G*) on the side-elevation view to the top-side of the stabilizer. See that the rear ends of both are even. Next wire the completed tail unit to the top of the fuselage, as shown. Brace the fin by running wire from the top of the fin to one outer rib of the stabilizer, underneath to the bottom of the fuselage, up again to the other outer rib on the other side, and then back again to the top of the fin. Drill 1/16 inch holes through which to run the wire. Pull the wire tight to brace the parts and wind the ends together. Then hinge the rudder to the rear end of the fuselage near the bottom and to the upper part of the fin. Drill holes in the fuselage and the fin, but pierce

the paper covering of the rudder so the wire will pass around the reed framework. Attach the elevators the same way using fine wire.

Now lay the main plane flat on the table, bottom-side up. Turn the fuselage upside down and lay it on the main plane. Place the plane absolutely square with the fuselage and exactly even on each side; the plane must extend equal distance on each side of the fuselage. If it is in proper position, the aluminum plane holders, mentioned previously, will come in line with the center of the spars on each side of the fuselage. Mark the holes and then drill 1/32 inch holes for screws to hold the plane to the fuselage. Be sure this operation is tight and secure, otherwise the model will come apart in flight.

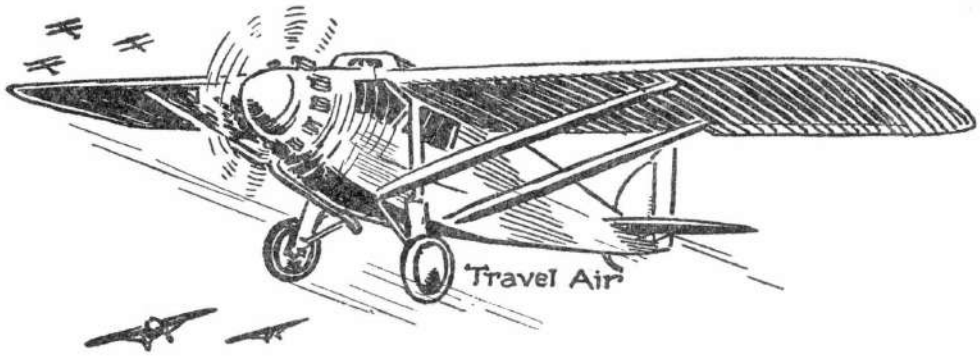
Attach the plane struts in place, fastening the flattened ends to the under-side of the plane and the lower edge of the fuselage. Keep the main plane perfectly level. Place the short center struts in position, one end against the center of the longer struts, and the other against the top edge of the fuselage. Place the two wood parts, the shock-absorbers, in position with the top ends against the long struts and the lower ends against the reed landing gear braces. Use nails at the top and wire at the bottom. Attach the propeller, bending over the end of the wire on the outside and forcing it into the wood to hold the assembly rigid. Mount the wheels so they turn easily and turn back the ends of the wire to hold the wheels in place. Drill a strip of aluminum with nine 1/32 inch holes equally spaced. Place a small screw through each hole and screw on each one of the small corks, large end against the aluminum. Screw them up tight. Bend the aluminum around into a circle, to form a ring, and fit it over the nose of the fuselage immediately behind the propeller. Fit it tightly and fasten in position with the corks sticking straight out all around. With black ink, color the corks a solid black. These represent the cylinders of the famous Wright Whirlwind motor.

Now the model is completed. Before flying test it carefully. Put it on a smooth runway and push it gently away from you. See if it runs straight and true. Correct any sideways motion. Then see that the rudders, ailerons, elevators and fin are straight. To wind it up, hold it firmly at the fuselage with the left hand and wind the propeller from left to right with the forefinger of the right hand. See that the rubber is not twisted at the start of winding. Count the revolutions of the propeller. Do not wind more than fifty times at the start. Face the direction from which the wind is blowing, hold the propeller with the fingers of the right hand, lift the tail skid off the ground with the left hand. Then give the model a slight push forward and release it quickly. It will not rise much, if at all, but should run along the ground in a straight line and perfectly level. If it doesn't, adjust it until it does. Then wind the propeller about 100 times and try a short trial flight. If everything seems proper, wind the propeller 150 turns and let the model take off as explained. Then it should run along the ground for a few feet and rise into the air for a flight of from 75 to 100 feet.

The plans reproduced here are reduced to one-quarter size, but can be used by taking careful measurements and enlarging the parts accordingly. Larger plans, of the *Spirit of St. Louis* and Commander Byrd's *America,* giving all details of construction, may be obtained by writing to Elmer L. Allen, 15 East 26th Street, New

A Flying Model

York City, and enclosing twenty-five cents for each plan desired. There are also several manufacturers of model airplane supplies, parts and materials who can furnish any materials required by the model builder, and who also supply all the parts required for either the *Spirit of St. Louis* or the *America,* all arranged in sets so all the model builder need do is assemble the model.



The World's Record Model Airplane

By Joseph J. Lucas

THE Jaros world's record duration and distance model airplane is an outdoor type, designed, built and flown by Robert V. Jaros (a pioneer model builder), of the Illinois Model Aero Club. The Jaros duration and distance model made the world's duration record for a hand-launched model record; 10 minutes and 14⅕ seconds; and distance record of 7,920 feet; breaking the previous Jaros world's duration record of 4 minutes and 25 seconds, and the world's distance record of Thomas Hall of 5,337 feet in the 1924 International Air Races at Dayton, Ohio.

The Jaros model airplane is interesting to build and fly, and is worth the time and effort required to make and fly it.

You do not need very many tools, and if you have not those required, they may be purchased at small expense. The tools needed are a sharp knife, long-nose pliers, small block plane, razor blades, a candle, ruler, pencil, and several pieces of fine sandpaper.

The materials are simple and inexpensive—bamboo, pine, and balsa wood, piano wire, tissue paper, banana oil, ⅛-inch washers, rubber, ambroid, silk thread, and two small nails for hangers.

Frame

First build the A-frame motor base, composed of two semicircular balsa longerons 39¼" long, ⅜" deep, and 3/16" wide. The longerons are shaped in section as shown in Fig. 6. They must be sandpapered very smooth and coated with banana oil. When longerons are coated the inside front ends are tapered off to a wedged shape and put together with ambroid and bound temporarily with silk thread. When putting wedged longerons together see that the rear end of longerons are spread 11 7/16 inches apart, and that the semicircular sides of the longerons are facing outward, so that longerons rest on their edges. When ambroid is dry at the wedged-shape joint remove the temporary silk binding thread. The front hook, which is shown in Fig. 9 of drawing, is bent to shape out of .031-inch piano wire. The front hook, or nose hook, is fastened in place to the outside of wedged-shape longerons' joint with ambroid. If the nose hook is not held on securely use a few wrappings of silk thread for binding.

The longerons are separated and braced by two X-shapes and two straight pieces of bamboo. The rear bamboo X-brace is ⅛"x1/32" in section, and the middle X-brace and the two front straight pieces of bamboo are 1/16"x1/32". The "X" and straight pieces of braces are cut out and shaved down with a knife from a large piece of bamboo. They should be cut so that one of the wider surfaces is of the glossy outside. This is because the greatest strength of bamboo is in this part. Then mark off longerons with ruler and pencil for proper placing of "X" and

straight braces as shown in plan view of drawing. Make slits at the proper marking on longerons. It is easiest to make these slits while the longerons are held in a vise. This will prevent the balsa wood from splitting while being cut. Then the "X" and straight braces (which are made to their proper lengths) are fastened to the longerons by forcing the ends of braces through the slits so that they extend on the other side. Before ambroiding the frame should be trued up so that the longerons are straight. To do this, slide the braces one way or the other in the slits. Then ambroid and bind with silk thread, and after ambroid has dried and hardened, cut the protruding parts flush with the longerons. If bindings are not necessary to make brace joints strong, remove them with razor blade.

The bearings or hangers for the propellers are made by flattening nails to their proper shapes, as shown in Fig. 7. The six "cans" are bent to shape out of .026-inch piano wire. See Fig. 10 of drawing. Fasten the cans to their proper places with ambroid (as shown in plan view of drawing). If silk threads are necessary to hold "cans" use them.

Main Plane

The main plane or wing used in the Jaros model is known as a built-up wing. By that is meant a double surface with a wing section. See Fig. 1. The main wing is the important part of the model and great care must be taken when building it. The wing has a span of 29 inches and chord of 5 inches. The wing beams, which consist of two pine strips, one (5/8 inch from the entering wedge) 27"x3/16" x 1/16", and the other (1 3/8 inches from the trailing edge) 28"x1/8"x1/16". Both of these beams are sandpapered smooth and coated with banana oil. Then the two beams are cut and spliced in their centers, as shown in the wing-beam splice, Fig. 2.

As will be noticed in the drawing, the wing has a dihedral angle of one inch; that is, the beams bend upward at the center so that the wing tips are raised one inch from a level surface. Set wing beams to the dihedral angle of one inch, and at their splices cement with ambroid. Let wing beams set at required dihedral and dry.

The ribs, eleven in number, are made of balsa wood cut to shape of Fig. 1 of the drawing. To get the correct shape of the wing section make a brass or aluminum template of the rib section. Then when the template is made you can cut out the exact rib section by using the template for your guide. Be sure that the rib sections are cut out correctly and that the slots for the wing beams are big enough to fit. Make the thickness of rib section 1/20 inch.

The ribs are spaced 2 11/16 inches apart along the wing beams, starting away from the center of the wing. The ribs are inserted in the wing beams' edges at their proper places. The entering and trailing edges are made out of bamboo, with triangular section, as shown in Fig. 3. The width and thickness of the triangular bamboo section should be 1/16"x1/32". The entering and trailing edges are ambroided on to each of the extreme ends of the ribs with the exception of the end or outer ribs of the wing. Make the entering and trailing edges out of one piece of bamboo if possible. The entering and trailing edges can be made out of balsa, and if balsa is used, make these edges also triangular shape with width of 1/8 inch and thickness of 1/16 inch.

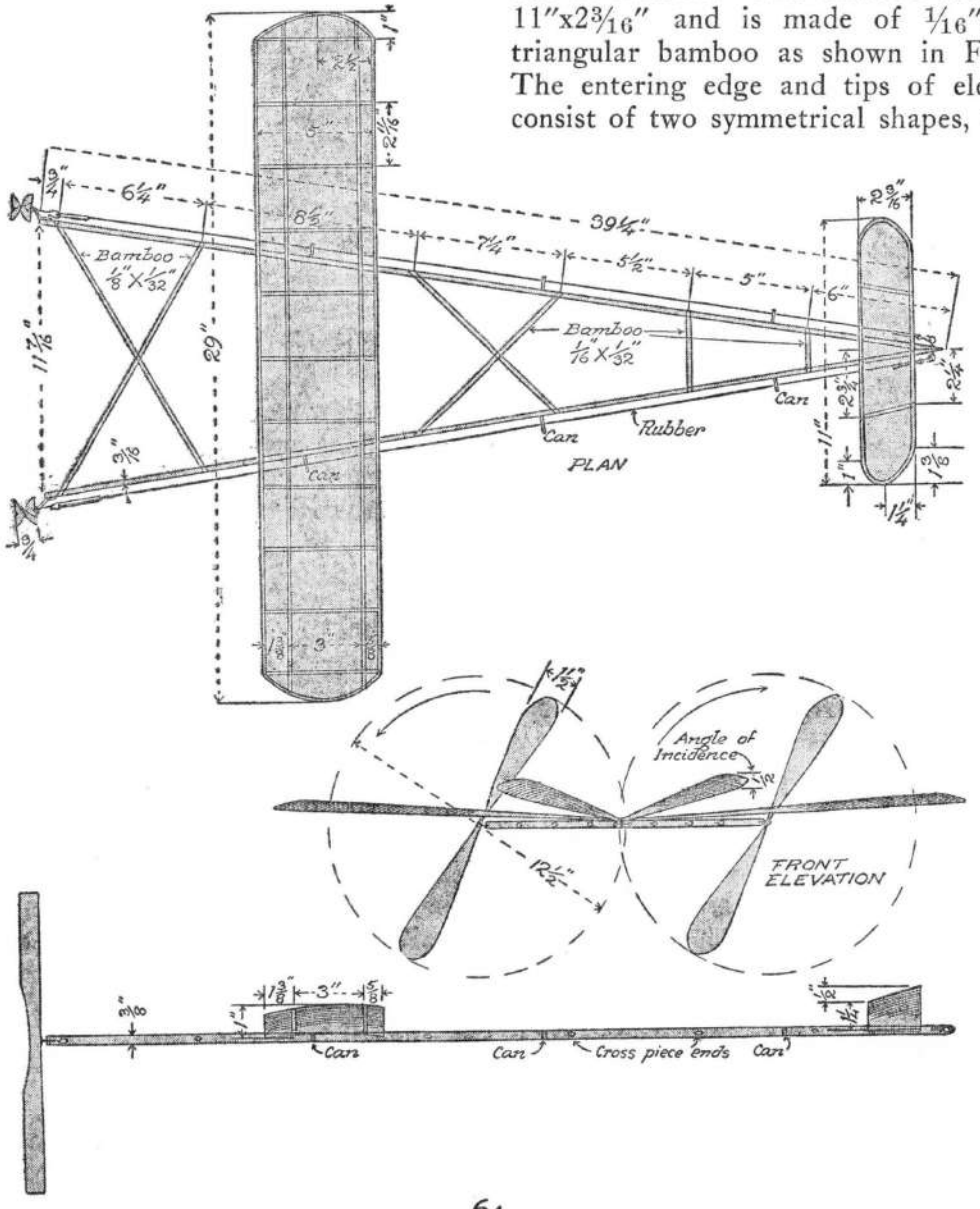
The wing tips are made of one piece of bamboo 8"x3/16"x1/32" and bent to shape (as shown in Fig. 5) over a flame and then split in two and shaped in tri-

angles. By splitting the bended bamboo in two you have your wing tips symmetrical. Then fit the bamboo wing tips to the extreme ends of the wing beams and to the entering and trailing edges. In jointing the wing tips to the entering and trailing edges, make splice joints as shown in Fig. 5. When wing tips properly fit to the wing put on ambroid and set to dry. If silk thread wrappings are required on spliced joints, use them.

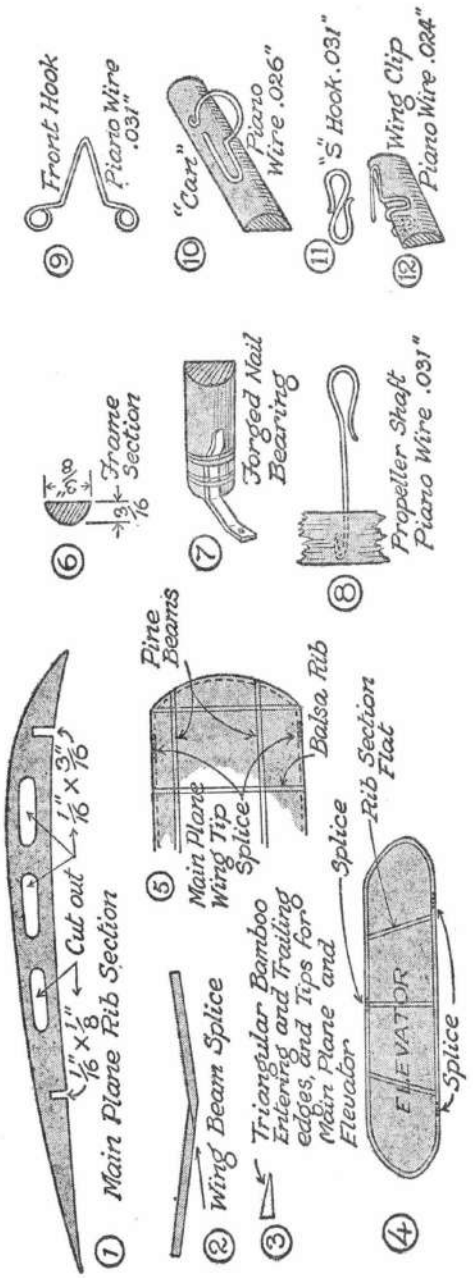
Study Figs. 1, 2, 3, 5, and the plan view of drawing before building the main plane.

Elevator

The elevator, which is sometimes called the front wing, is constructed completely out of bamboo. The elevator measures 11"x2 3/16" and is made of 1/16"x1/32" triangular bamboo as shown in Fig. 3. The entering edge and tips of elevator consist of two symmetrical shapes, which



The World's Record Model Airplane



MATERIAL REQUIRED FOR BUILDING THE ORIGINAL ROBERT V. JAROS MODEL

Frame

Longerons, 2 balsa semicircular beams, 39¼" long, ⅜" deep, and 3/16" wide.

1 strip of bamboo, 2" x 1/16" x 1/32".

1 strip of bamboo, 3½" x 1/16" x 1/32".

2 strips of bamboo, 8½" x 1/16" x 1/32".

2 strips of bamboo, 12" x ⅛" x 1/32".

1 foot of piano wire, .031 inches for nose hooks and S hooks.

1 foot of piano wire, .026 inch for "cans."

1 foot of piano wire, .024 inch for wing clips.

2 small nails for forged nail bearings.

1 small can of ambroid.

Main Plane

1 pine beam, 27¾" x 3/16" x 1/16".

1 pine beam, 28" x ⅛" x 1/16".

11 main plane balsa ribs, 1/20" thick.

2 strips of bamboo of triangular section for entering and trailing edges, 25" x 1/16" x 1/32"; if balsa used, make wide end thickness ⅛" x 1/16".

1 strip of bamboo for wing tips, 8" x 3/16" x 1/32".

Elevator

1 strip of bamboo for entering edge and tips, 10" x 3/16" x 1/32".

1 strip of bamboo for trailing edge, 7" x 1/16" x 1/32".

3 strips of bamboo for ribs, 23/16" x 1/16" x 1/32".

Covering

2 sheets of Japanese silk tissue paper.

2 ounces of banana oil.

4 ounces of doping solution.

Propellers

2 balsa propellers blanks, 12½" x 1½" x ¾".

½ foot of piano wire, .031 inch for shafts.

Motors

2 four-strands, 38" x 3/16" x 1/32" rubber, or 2 six-strands, 38" x ⅛" x 1/32".

are made out of one piece of bamboo 10"x3/16"x1/32" bent to shape (as shown in Fig. 4) over a flame and split in two equal parts. Use a razor blade or knife to cut down the bamboo parts to triangular shape of the required dimension, having one of the wider surfaces of the bamboo of the glossy outside part. Have also the under-side of elevator framework made of this glossy part because of its strength. Then put together the symmetrical pieces of bamboo, which consist of the entering edge and tips of the elevator, by using a splice joint. In putting together be sure that the end of the entering edge has a dihedral angle of 1¾ inches, which means that the end of the entering edge is 1¾ inches above a level surface. If you cannot make the splice hold well with ambroid, wrap silk thread around the joint. The trailing edge is a triangular piece of bamboo 7"x1/16"x1/32" and bent over a flame at the center of a dihedral angle of 1¼ inches. The trailing edge is put together by splice joints with ambroid near the elevator tips. Use silk thread for binding splice joints if necessary. The bamboo ribs have no camber and are perfectly flat, 3/16"x1/16"x 1/32". One rib is ambroided on the center of the entering and trailing edges, and the other two ribs one on each side of center rib are ambroided at a distance of 2¼ inches from the center on the entering edge, and at a distance of 2¾ inches from the center on the trailing edge. Note that entering edge has a dihedral angle of 1¾ inches while the trailing edge has a dihedral angle of 1¼ inches. The difference in dihedral angle is ½ inch. This ½ inch is called the angle of incidence, which is the elevation to make the model fly well, and thus eliminating the elevation blocks. Before constructing the elevator, study Fig. 4 and elevator plan view of drawing.

Covering

The main plane is double-surfaced covered with Japanese silk tissue paper on top and bottom of wing, while the elevator is single-surfaced covered with tissue paper on the top only. A very good method of gluing the tissue paper on is by applying banana oil. Cover the top of wing plane first with a piece of tissue paper large enough to overlap at least one inch on the edges starting from the center rib outward to the tip. Apply banana oil to the top of center rib of wing and lay the paper on it immediately. Allow this to become thoroughly dry and fast before attempting to proceed with the covering. Then apply the banana oil to entering and trailing edges, section by section, between the ribs, and stick the paper to them. Before the banana oil has evaporated draw each section of the paper taut and work out the wrinkles in the paper, particularly along the wing, rather than across it, in order to preserve the section. When doing this keep the paper flat against the entering and trailing edges. Then put tissue paper on the other top half of wing by the same method. Trim the paper off around the edges and dope the entire top surface three or four times with a weak doping solution. The bottom surfaces of main plane and top surface of elevator is covered, trimmed, and doped the same way.

Propellers

The last parts of the Jaros model to make are the two propellers, and carving them is not an easy job. Great care should be taken in carving these propellers for reason that the success of the model's performance depends upon how well they are made. The two propellers, one right and one left hand, turn in opposite directions to each other; this keeps the model stable in flight. The propellers

are carved out of solid blocks of balsa wood, ¾"x1½"x12½". Diagonals are drawn with pencil on the 1½-inch faces from corner to corner, and sawed along the outside of the lines, allowing enough for the hubs at their intersections. Then fine true holes are drilled at the intersections of diagonals for inserting the propeller shafts. The propellers are now ready to be carved. With a sharp knife carve the leading faces of the propellers first to flat surfaces and slightly camber them with fine sandpaper. The other sides or under-sides of the blades of the propellers are now carved rounding to a curve of the cambers of the leading faces of the propellers with a uniform thickness throughout the blades.

Carefully shape the blade tips of propellers as shown in front elevation of drawing. Then start cutting down on the leading faces toward the centers of propellers (including downward) about 2½ inches on each side of the hubs to a thickness of ⅜ inch at their hubs, as shown in the side elevation. Sandpaper the blades and hubs of propellers to the proper thickness. The blades should be sandpapered down so that sunlight can be seen through the wood. After the final thickness of blades has been obtained, the tips can be rounded off with sandpaper to a more graceful shape. Then finish off the propellers with very fine sandpaper. Balance each propeller on a knife or razor blade edge at the center. The heavier blade of the propeller will hang downward. Sandpaper the heavier blade until the propeller is perfectly balanced; when balanced dope them with banana oil. Now bend the propeller shafts into shape, as shown in Fig. 8, using .031-inch piano wire, and insert in the hubs with ambroid; bend the ends over to anchor, but do not indent. Be sure the shafts are ambroided securely and that the propellers are again perfectly balanced. If another coat of banana oil is required on propellers balance the propellers once again, and be sure that the shafts of propellers are true. Then put a few copper or brass washers on the shafts for bearings to reduce friction. Dress spangles, which may be bought in the fancy-goods department of a dry-goods store, serve well as washers.

Power

The required power to fly the model is obtained from two four-strand motors of 3/16x1/32 inch, or two six-strand motors of 1/8x1/32 inch flat rubber. The strands should be strung between the two hooks so as to have a sag of ½ inch when laid unwound in the cans. In the rear end, the rubber motors should be attached to the hooks of the propeller shafts; while at the front end the rubber motors should be attached to S-shaped hooks, bent from .031-inch piano wire, which permit the rubber motors to be detached from the front-nose hooks when winding the motors. The winding is done with a converted egg-beater.

Flying the Model

Flying this model is half of the work. In flying this model, remember that it is a pusher type, and, unlike large airplanes, the small wing is in the front. When the parts are all made and the set of motor strands are made up, you are ready to assemble the model. No elevation blocks are required as the elevator has an incidence angle of ½ inch, which serves the same purpose as the blocks in making the model fly well. The elevator is held in place to the model frame by a rubber band 1½ inches back from the nose of the frame. The main plane is placed between the two "X" braces on the frame, and are held in place with four wing clips. The wing clips are fastened on and held in

place to the longerons with tied rubber. The wing clips are made out of .024-inch piano wire and bent to shape as shown in Fig. 12 of the drawing. The propellers are put on next, and the rubber motors hooked to the front nose hooks and to the propeller shafts, passing through the "cans."

Glide the model three or four times to get proper adjustment before winding up rubber for the trial flight. The initial gliding and flying of the new model should be attempted only on a fairly calm day. If the glide is too steep, the model has insufficient elevation. To remedy this, move main plane forward a little and glide it again. If model stalls while trying to glide, it is over-elevated and can be adjusted by moving the main plane backward a little. Glide the model a number of times until you have the right adjustment for the proper glide. Your proper glide should be four or five times the distance you hold it above the ground when launching it. In order to get the right glide or gliding angle make all adjustments to correct under and over-elevation by moving only the main plane forward or backward as required, and do not touch elevator as it is in a fixed position. Be sure to glide the model with the wind always.

When the model glides well, wind up rubber motors about 500 turns with an egg-beater winder for the initial flight. Before winding be sure you have some one to hold your propellers and some one to hold the nose of the frame a little above the rubber motors, so that the frame will not be in the way, and lastly, be sure that you are winding carefully. Wind rubbers until you have about 500 turns in motors near to the front nose hooks of frame. Unhook rubbers from winder and attach motors to the nose hooks. See that the rubbers are properly placed in "cans" and that the elevator and main plane are well secured to the frame.

In launching hold the propellers one with each hand, and point the nose of model upward at an angle of 5 to 10 degrees. Launch the model by releasing the propellers and giving a gentle thrust forward at the proper launching angle. If model climbs too steeply or stalls, the main plane needs to be moved back a little; and if the model does not climb very well it means that the main plane needs to be moved a little forward. The adjustments to improve the flight are the same as for the gliding tests. Remember gliding a model is very necessary before you fly it. You can make better model flights and have less breakage than flying a model without first gliding it. Do not be discouraged if it does not fly well at the first trial, the trouble is probably in the adjustment.

After you have obtained good steady flights with the model, the rubber may be wound up to about 1,200 turns for a much longer distance and for duration flights. Under fair-weather conditions the model should remain in the air for a very long time. Study the drawing of the model, the instructions for building, gliding, and flying, and if you take care of your model in assembling, gliding, winding, and launching, the writer believes your chance of equaling or even bettering the Robert V. Jaros, of the Illinois Model Aero Club —distance record of 7,920 feet and duration record of 10 minutes and 14⅕ seconds—is good.

The Spirit of Windy

By Armstrong Perry

Illustrated by Francis J. Rigney

TWENTY planes were on the line, each in the hands of its builder. Each twin-propeller pusher represented six weeks of hard work, plus a lot of spending money.

The big idea was to win the silver cup offered by Hon. Robert Marvin, the mayor. The sun was bright, the wind had calmed to a zephyr. The crowd that watched from the edge of the athletic field was waiting expectantly.

On the end of the line was "Windy," silent, alert, conspicuously neat in a white sweater, well-pressed trousers and carefully polished shoes. The nickname had been wished on him for the same reason that fat boys are called "Slim" and human beanpoles "Fat." He was dubbed "Windy" because he wasn't. He talked little, but he certainly could watch, listen, and make things.

"Everybody ready?" asked Lieutenant Avery, World War ace, who had taught them how to build their models and who was running the meet.

Everybody was, including Windy, but he checked up his plane once more to make sure that the Japanese tissue on the wings was taut, the rubber motors properly lubricated with glycerine, the skids plumb and the rudder straight. He had named his plane the *Spirit of Windermere,* in honor of his town, but everybody else called it the *Spirit of Windy.*

This was something more than a joke. Windy had a spirit that had challenged admiration. Otherwise, he would have had no model airplane. Misfortune picks on some folks and she took a swat at Windy early and often. Infantile paralysis floored him at ten, and the fight that had brought him at last into the senior class at high school, so sound in body that no one would have suspected that he had once been a cripple, was a battle of courage against forces of nature that seemed pitiless.

Windy had to work, too, for the family fortunes had been mostly misfortunes. He knew intimately the interiors of most of the furnaces in town and the location of the ash heaps that they fed. He had mental statistics on the distance from every front gate to every front door, and his performance as he threw morning papers accurately into dry and sheltered spots, one after another, without even slowing down his bike, was worth rising early to see.

But Busy Windy had found time and saved money to make a model airplane. He was not satisfied merely to assemble one from ready-made parts, either, but started with raw material and shaped every piece from the slender, sturdy frame elements to the well-balanced balsa propellers.

"Time will be counted from the moment the plane is launched to the instant it touches the ground," Lieutenant Avery announced. "Your names will be called in alphabetical order. Albee up!"

The egg-beater double-winders churned. Windy watched Albee, Atwater, Charlie Brown, Carew, and two or three others as they flew their models. His own surname was Waters, and he was the last on the list. Between flights he glided his plane, adjusted and balanced it, inspecting it with the critical pride of a mother trimming her infant for a baby show.

"Will you please wind my motors for me?" asked Trumbull as his turn approached.

"Sure!" said Windy, laying his plane on the ground. He unhooked the "S" hooks, attached them to the double-winder, stretched the rubber bands and turned the handle.

"Simpson next!" called Lieutenant Avery.

Simpson had to pass Windy and his plane to get to the starting line, but he didn't have to walk over them. Maybe it was just excitement and awkwardness. Anyhow, he stumbled against Windy, working on one knee, and the next instant —*crunch—snap!*—his heavy foot came down on Windy's wing.

Windy dove and grabbed, but too late. Six inches of the left wing were smashed.

"I beg your pardon!" said Simpson over his shoulder, without stopping.

"Oh, that's all right," Windy answered, though the white line around his lips showed how hard he had been hit.

The remarks of the aviators who gathered around Windy indicated that it was not all right. Simpson had cut bases in baseball when the umpire was not looking. He had slugged in football when he thought that he could get away with it. He had a plane as good as anybody's, unless it was Windy's. He was evidently afraid of the *Spirit of Windy*.

Was it all right?

"You ought to punch him in the nose!" declared Trumbull, who had seen the whole accident.

"That wouldn't win the meet," said Windy.

Simpson's model stayed up twenty-one seconds, which was better than anyone else had done so far. Trumbull flew next, but his machine, off balance, made only eighteen seconds.

"Waters!" called Lieutenant Avery.

Windy showed him the disabled plane.

"How did that happen?" asked the Lieutenant.

"It was stepped on," Windy answered.

The Lieutenant, busy and tense with the strain of running the meet, spoke sharply: "I should think that after spending six weeks on a model you would be more careful!"

Windy swallowed hard, and his eyes reddened around the edges, but he kept a grip on himself. He had several alibis. He was helping Trumbull. There was no place to lay a model except on the ground. The damage was due to Simpson's carelessness or something worse. But what he said was: "I realize that now, sir. Does missing my turn put me out of the contest?"

Lieutenant Avery had been bawled out by superior officers often enough while he was in the service to know how it felt. He had handled men long enough to know that self-restraint under excitement and disappointment is a mark of real character. His eyes and tone softened. He slapped Windy on the back.

"We'll give you two trials next time, if you can fix your plane soon enough," he said.

In a moment Windy was on his knees back of the line with his repair box open. He knew every fiber of his wood, every atom of his dope, the intimate texture of his paper. No pilot in an air race ever worked with more intensity or with much

greater skill over a disabled plane. When his turn came again, the repairs were finished, but there had been no time for adequate gliding and flight tests.

The crowd gave him a cheer as he came to the starting line. All except Simpson. His offering was; "Hard luck—they never fly quite as well after a smash!"

Windy's hand shook a little as he launched his plane. That may have affected the hop-off, or it may have been a sudden downward swerve of the breeze. Whatever it was, the plane went only fifty feet before it went into a nose-dive with the full push of the propellers behind it. It was a heartbreaking crack-up.

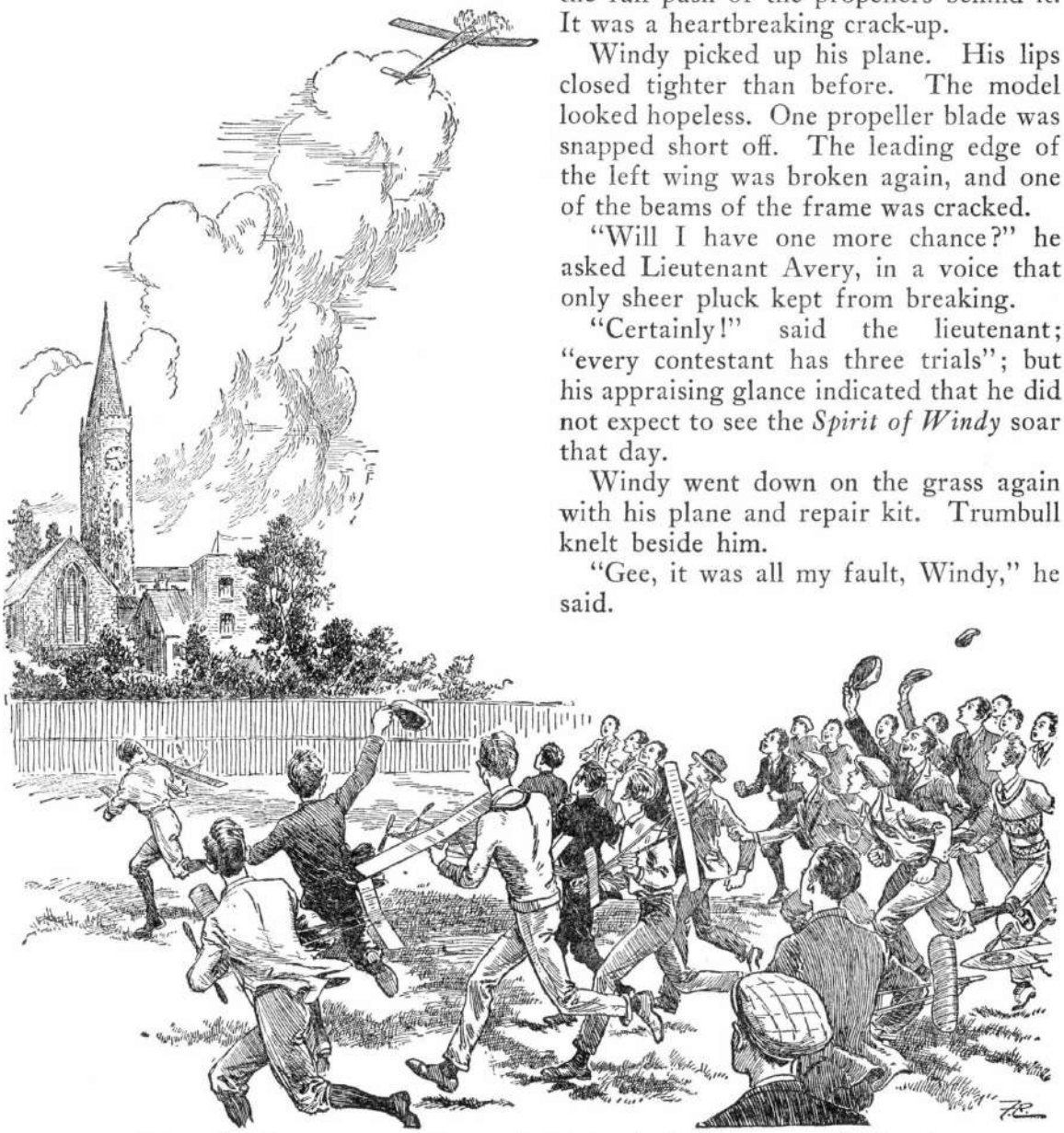
Windy picked up his plane. His lips closed tighter than before. The model looked hopeless. One propeller blade was snapped short off. The leading edge of the left wing was broken again, and one of the beams of the frame was cracked.

"Will I have one more chance?" he asked Lieutenant Avery, in a voice that only sheer pluck kept from breaking.

"Certainly!" said the lieutenant; "every contestant has three trials"; but his appraising glance indicated that he did not expect to see the *Spirit of Windy* soar that day.

Windy went down on the grass again with his plane and repair kit. Trumbull knelt beside him.

"Gee, it was all my fault, Windy," he said.



With yells of encouragement flyers and spectators broke into a run and followed.

"Wasn't either—forget it!" Windy shot back. "Wait till I get this spare prop on and the broken spar and beam fixed, and we'll show 'em yet."

In the meantime the final flights of the competing planes were proceeding. Whoops of joy and groans of despair floated back to Windy and Trumbull as the planes soared to new records or came down in disastrous crashes.

"Quick!" said Windy, his repair work finished. "He's calling the P's. If your plane is all ready, watch mine while I test it out. I've got to balance it right this time."

He glided the plane against the wind, down the wind, across the wind, making slight adjustments after each trial. Then he held the model while Trumbull gave the motors a hundred turns with the double-winder. Finally he launched the plane carefully for a short test flight.

A prolonged cheer from the crowd showed that something unusual was happening. Windy glanced over the field. Far up in the air a flash of orange showed where Simpson's plane was climbing toward victory.

Like a bird it soared, balancing gracefully, spiraling beautifully. It seemed as though the motors never would run down. When at last their force was exhausted, the plane glided gently down to a perfect landing far beyond the edge of the running track.

"Fifty-nine seconds!" called the timer, and every flyer on the field was convinced that Simpson had copped the cup. All except Windy.

Trumbull was called to the line and made a flight that was good, but not good enough. Lieutenant Avery was about to declare the meet closed, believing that Windy's last mishap had put him finally out of the contest, but he turned, and there was Windy, five feet ten, calm and collected, a grin full of hope and determination on his face and a perfectly good plane in his fist.

"Hello—got another plane?" asked the lieutenant.

"Nope, same one!" Windy answered, indicating the repairs with his fingers.

The lieutenant looked it over. "Good work!" he exclaimed. "Go to it!"

Windy toed the line. In one sweeping glance he took in the flutter of the grass, stirred by a gentle ground breeze, the drift of the clouds aloft, and the curl of the smoke from the house outside the field. His extended left hand balanced the tip of the plane and his right hand held the rear end with the propeller blades resting against two fingers. The rubber motors were like two taut strings of beads after their thorough twisting at the hands of the double-winder.

Gracefully Windy drew back his hands until his right was well behind his shoulder. Then he thrust the plane forward with a push of his arms and body that would have been too much if he had not calculated to a nicety the angle of launching. It left his hands like an arrow.

The *Spirit of Windy* climbed easily up until its red-tipped wings shone brilliantly against the fleeciness of the clouds. At seventy-five feet she seemed to enter a steady, favorable air current, for she settled down to her work as though starting on a transatlantic hop. On and on, up and up she went, past the running track, over the fence, above the house in the lot beyond.

With yells of encouragement, flyers and spectators broke into a run and followed. The fence stopped most of them and it was just as well, for it was as good as any place to see the rest of the flight.

Beyond the house a tall church spire pointed skyward. In the spire was a clock, whose heavy hands marked the

passing of time into eternity. Toward this clock the *Spirit of Windy* winged its way as though to count the fleeting seconds.

One moment it seemed to hesitate before the bulk that blocked its way, the next it struck the face and settled back with its wings in the position for a steep banking turn and its skids holding it astride the minute hand, which was just entering the last quarter of the hour.

Cheers and laughter broke from the crowd. "Yea—a—a Windy!" sung out Trumbull, and the crowd took it up with such gusto that cars passing on the highway two hundred yards away stopped and their occupants looked out to see what kind of a game it was that was played by poking several hundred noses through a ten-foot wire fence.

Only Windy was silent. Somebody saw his jubilant, expectant face and interpreted the expression thereon.

"Wait till that minute hand gets around ten minutes farther!" came a voice, and with one accord the crowd watched and waited.

Fourteen minutes to five, thirteen minutes, twelve minutes—Nobody seemed to have realized before how long minutes can be. Eleven—ten—nine—eight——

At seven and one-half, the hand would be at an angle of forty-five degrees from horizontal. Not all could have explained that that was the critical angle at which free objects are likely to start sliding down an inclined plane, but they all knew that something was due to happen soon.

Seven—six—The *Spirit of Windy* still clung, seeming to calculate its chances as carefully as would its pilot, who could hardly have been more thrilled if he had been at the joy stick of a Curtiss or Fokker.

Five—a breeze lifted the wings slightly and the plane started. Its first movement was acclaimed by the crowd with noisy enthusiasm. The clamor grew as she slid down the minute hand, hopped off at the center of the clock face, dove to gather flying speed, skimmed a cornice, flattened out and sped toward them.

The motors, which had stopped when the propellers rested against the face of the clock, seemed to have something left. The props were turning. The plane came back over the house, on toward the starting line, helped along by a shift of the wind that had taken place while she perched on the hand of the clock in the spire.

Lieutenant Avery ran ahead to make sure that the plane had a clear space for landing. Halfway from the fence to the starting line Simpson grabbed his arm.

"This won't count!" Simpson cried furiously. "You said the flight ended when a plane touched the ground, but it don't count when it lands up in the air and starts again!"

Windy's red-winged plane was twenty feet from the ground at the moment and almost over them. The excited Simpson wanted the Mayor's cup so badly that he had abandoned observation of the flight in order to press his argument with Lieutenant Avery.

Suddenly the airplane paused, turned downward, and in a swift and almost vertical nose-dive landed with a resounding whack on Simpson's head.

"Jimmy-cripes! Who soaked me on the bean!" yelled Simpson, caressing the spot from which the plane had bounced to the ground behind his back.

"Something that will never penetrate your thick skull," said Lieutenant Avery. "It was the *Spirit of Windy*. Incidentally, the time from the start to the church spire was one minute flat."

Block-head

By Lawrence M. Guyer

"THAT guy going to France?" A grimy-faced mechanic was incredulous. "*That* guy?"

His companion answered witheringly. "Yeah, that guy's going to France. That block-head that doesn't even know a joy stick from a rudder bar. That's the guy I mean, and he's going to France."

"Why, it's criminal, Joe. It's a waste of good planes."

Joe put down his wrench and wiped an oily palm across his forehead. It was a hot day to be tuning up a motor, and only the airman's unswerving sense of duty kept him conscientiously at his task. A wire here, a bolt there, a spark plug, a valve—one slip or bit of carelessness might mean death for another. He began tracing out the ignition.

"Sure it's a waste of good planes," he agreed, "and we haven't enough of them now. And this bird—well, being dumb is all right in some kinds of fighters, but it's a sure smash in the air service." He nodded sagely, and glanced out on the field.

Quite plainly the other mechanic had already seen the advance of two khaki-clad pilots. He raised his hand in warning. "Don't reckon he heard you, do you, Bill?" he asked anxiously.

But it was not likely. The two were in an earnest and heated conference of some kind, and were walking slowly. One of them, too, a small heavy-set man, was doing most of the talking. He was gesturing to indicate some movement of a plane's joy stick, and from the serious, grim expression on his face there could be no doubt but that the explanation was an important one. The two entered the hangar, and not until then did the smaller man cease his tirade.

"Anything more to be done on that?" He glared at the mechanics almost fiercely, and pointed to the plane, a two-seater of the training type.

"No, sir. All fixed and runnin' fine, Captain Crary."

"Wheel her out then and get the motor warmed up. Lieutenant Blake's running off another solo before inspection, and he's got to hurry to do it."

The mechanics saluted. Two men from the gasoline truck were called in to help, and a two-wheeled dolly or "buggy" was placed under the tail skid of the plane. Then, with a man on each of the wing struts, another on the dolly, and the fourth near the rear cockpit, the great, golden bird was trundled out of the hangar onto the field. There were hoarse cries to "get away from them guys" and "lay off the stick"; the "buggy" was removed and wheeled away clattering; there were more cries of "contact"; and finally, with a gasp, the motor roared into action.

Captain Crary turned again to the junior officer at his side.

"Now look here, Blake," he said, gruffly. "I want to see you show some signs of life to-day. It's been a tough

road teaching you to fly; I'm not trying to throw that at you again, or bring up the stuff you've pulled off since you've been here. I'm just giving you a bit of last advice for your own good. You've got to start thinking, and thinking right. Those orders you got to-day mean France, and if you can't improve you're simply going to be an easy verification for some Albatross or Fokker. And that's that!"

The youth looked at his instructor frankly. There was a new light of determination in his eyes.

"I know, Captain Crary," he admitted heavily. "I know all that; but I can't seem to keep clear in my head sometimes —or at least, I couldn't before. To-day I'm going to show you I can, though. It's been hard for you, too, and I'd like to leave here having you know I'm fit to do my part, Fokkers or no Fokkers."

He lowered his goggles over his eyes, and adjusted his helmet. Then, as an afterthought: "Stunting barred to-day?"

"Do anything you want. Just keep your head!" The captain answered with emphasis.

Blake climbed lightly into the cockpit. He pulled back the throttle and gave the motor a few furious spurts. It hummed faultlessly, perfectly. The wedge blocks were jerked out from under the wheels, and the plane rolled forward. Blake pointed down the field into the wind, gradually increasing the speed. Then he moved the stick forward to raise the tail, and when the ship became almost a golden streak through the air, straining eagerly like a live thing on a leash, he pulled the stick back toward his body, and the great bird rose gracefully skyward.

For a few minutes he contented himself with circling about, assuring his mind that the motor was functioning properly under its load. He recalled suddenly his first ride like this, easy, smooth, level sailing which his instructor had given to let him "feel" the air, and help him relax. That was the occasion of his first bonehead stunt. Crary was piloting him, and the captain had pointed lazily to something on the ground below, another gesture, likely, to rid him of any possible nervousness. And Blake had trembled. To him it seemed as if that outstretched hand was pointing to the step on the wing. A guy wire was vibrating in the wind with terrific intensity. His frantic mind could not realize that its dancing flash was entirely normal; he thought only one thing. Something was wrong! The wire was about to tear away, and it was his job to crawl out there and fix it! With a sudden nausea hitting him in the stomach, he began crawling over the edge, too terrified and dizzy to dare even a glance down. But if this were to be an early test of his courage, he'd go through with it! The safety belt, forgotten in his excitement, jerked him back into the seat, and almost at the same instant Crary shut off the motor with enthusiastic profanity.

"Get back there! What'd you think I was doing, telling you to hop out or something?"

Blake grinned now to recall that. What hadn't that man said after they landed! But then he frowned; he'd failed in a way. He was a laughing joke among all the war students. And he hadn't stopped with that. Every time he flew he pulled something stupid, and he knew in his heart that only the pressing demand for men with "air senses" had kept him from being "washed out," or rejected. His hand tightened slightly on the stick, and a dangerous glint came into his eyes. To-day he was coming across. Soon he'd be in France. He *had* to show them he was fit.

Down, down, down he sent the plane into a dive. Then back hard on the stick.

Up, up, and over. A loop, a perfect loop! Then a barrel-roll, followed by another dive and another loop. Far below, Captain Crary watched eagerly. The boy was showing his stuff! And handling the plane flawlessly, with all the skill and cunning of an old-timer!

The golden bird began to circle down. Blake was landing slowly, maneuvering to head into a wind that had sprung up with increasing stiffness. Crary looked at his watch, and realized it was lacking only twenty minutes until the Saturday inspection. High time the youngster was returning! Along the edge of the field, lined in front of the hangars, the planes were already out and prepared. There were some twenty or so of them, with engines pointing away from the sheds, and each only a few feet from the wing tips of its neighbors. In the sun they glistened like huge jewels. The general would be more than satisfied.

But as Crary continued to watch the floating ship above, he was gripped by a sudden nervousness. The plane was low now, and dangerously close to the hangars. Blake wasn't even coming down into the wind! A sudden gust drifted the ship almost directly above the long line of its companions on the ground. A pocket, a lurch! Crary groaned aloud. The tail skid of the descending craft tore into the line of shining rudders. There was a staccato series of crashes as each rudder was ripped and smashed away. Blake was working at the controls frantically; he swooped upward, only to sink swiftly again and once more plow into the alignment. Seven more rudders were cut to shreds. Then the landing gear of Blake's own plane crumbled, and he passed over the end of the line falling like a lead leaf—falling with terrible directness, but still horizontal—and now, very close to the ground. He landed like a pancake, skidded a hundred feet, swerved sharply to the right, and stopped just as the entire fuselage separated from the wings and collapsed in a cloud of dust.

Crary helped pull the youngster out from the wreckage. Blake was scarcely half-conscious. He opened his eyes, saw his instructor, and moved his lips weakly in an effort to speak. "I thought——"

"Yes, that's the trouble! You thought again!" interrupted the captain furiously. To him Blake was obviously only dazed, and he was too frenzied to relent. "And what did you think this time?"

"I thought—that is—I knew it was late, and I could save time by landing near the hangars. Thought the wind wasn't so strong. I saw it too late, couldn't get out of it. Tell me, did I hit many of them?"

"Many of them?" echoed Captain Crary. He swept his arm toward the line of shattered rudder frames, and the tattered remnants of fabric. "Many? You only missed five of the twenty-three! And look at them! Just look at them! It'll take a week to fix them up, much less an inspection by the general in four minutes now! You did it up right! You've ruined us both for good!"

Blake moaned. Attendants put him in an ambulance and rushed him to the hospital for an examination. The post was in an uproar. News came out that Lieutenant Blake was merely badly shaken up, and entirely unhurt otherwise. Before they could see him again he was gone, an early morning train for a port unknown. His orders were urgent; men were needed badly. The investigation would have to come later, and without him. For the present a colonel swore, and one Captain Crary heaved a sigh of relief.

Somewhere in France, on a flying field twelve miles behind the infantry lines, Lieutenant Blake stood sullenly watching

a painter at work on his plane. It was a single-seater, a pursuit fighting plane of the English Spad type. But it was not its sturdy grace, and swift stream lines that held Blake's attention. It was the letters the painter was initialing on the fuselage. "B.B." They were red, and were centered in the grinning mouth of a clown's mask.

"B.B.? Who the deuce told you to put all that stuff on there, and why?" demanded Blake. But he knew the answer; the clown-head was all too obvious, and the initials—well, some sort of added insult. His face crimsoned.

The workman was sympathetic. "Orders, sir. The design came through channels from headquarters. Major brought it. I wouldn't have known, only I heard him say this here bus was a 'Blunder-Buss,' and something had to be done about it to spot it from formations."

Blake bit his lip and made no answer. So they were singling him out for their own supposed safety? Branding him? His heart was heavy, for he knew the step was justified. It was dangerous for them to be near him. Skilled flyer though he was, yet always the block-head who made dangerous mistakes. For a while after his arrival here he had enjoyed a glorious obscurity. Then he began flying again, messing things up again, and with the final spreading of the news of his last terrible blunder at the field back home, his fame was complete.

He crept away, back to the old French château where the officers were quartered. Ted Wilkins, a lieutenant who had been at the aerodrome for several weeks, spied him as he entered, and accompanied him to his room upstairs.

"You needn't tell me, Bob," he consoled. "I know; it's a rotten trick, too."

Blake fell heavily into a chair. "No, it's just fair, Ted," he answered. "I deserve it, and they've a right to protect themselves. It's bad enough having the Boches to handle without always watching a dangerous bone-head in your own squadron. It's a wonder I haven't crashed a couple of them already."

"Well, it *isn't* right!" Wilkins insisted. "Look here, man, I'm not blowing off steam when I don't mean it just to cheer you up. I tell you, you've actually got more real stuff than any other pilot here. You just haven't gotten the breaks; you're meant for working your own way, not tagging along in formations."

"At least it'd be only my own neck then," Blake observed humbly.

"Have it that way, then, if you insist," retorted Wilkins, half angry and half sympathetic. "Have it that way, but try it, anyhow. Get the colonel to let you do some patrolling on your own. Then go at the Fokkers the way they least expect. Do you see? If they persist in chiming in that you're a block-head, put it to use. They won't be expecting much; give them all you've got, and in your own way!"

Bob winced. The words evoked a cutting memory of three days past, when a Fokker had swept over the field and daringly dropped a scribbled message: "Where's the blunder boy? I need one more verification to be an ace!" It was an insult without equal.

"Well, I'll try it, Ted. It couldn't be any worse."

And that night the plan struck forcefully. He wondered. Perhaps—perhaps. A bit of daring, a bit of surprise. Alone. Redemption. Wilkins had hit it right! He dropped off into an excited, restless sleep.

Morning took him to the colonel early. Eagerly he outlined his scheme, and asked permission to try it out. The colonel reflected in silence. "Some men were like this Blake; just couldn't function in the formations. And, indeed, had not the

famous Frank Luke been a lone eagle who deserted the group work?" The wrinkled face smiled good-humoredly. "Three more days in the V formation, Blake. Then go to it!"

In those three days the clown-head assumed new fame for stupidity; once even a Fokker had caught him straggling home late and had deigned to take a shot at him. Scurried away. Blake was furious. He gritted his teeth. The clown-head had an early retort!

It was a desolate day. Fall, and the winter cessation of hostilities were rapidly approaching. The sun was cold and aloof, and great disconnected banks of black clouds swept the sky like an enormous broom. Above two thousand feet the winds were terrific; there were air pockets everywhere; and the low clouds, with their many sudden and varied openings, offered treacherous hiding places for enemy planes.

Blake waited until afternoon to get the uncertain sun behind him. Interposed between the blinding rays and the hostile lines he would thus be almost invisible. It was an old dodge, used by both air forces. He took off then, climbed high, and headed toward the German lines to get what information he could. That was his principal mission, but in his heart he was determined to search out any and all enemy planes, and give them instant battle. He was supremely confident again. Forgotten were his failures; he was as cocky as he had been the day he had started that last solo flight back home, vowing "he'd show 'em." He had forgotten, too, the long line of smashed rudders. And the fact that the competition of war was different. Here a single misstep meant death.

Still considerably behind the front-line trenches in his own territory, unexpectedly he came to an opening in the cloud banks. He was unprepared for it. As far ahead of him as he could see, the drifts were piled up like an angry ocean, and here this vertical clearance suddenly opened out, broad enough to drive an entire squadron through. He caught a glimpse of a column of infantry marching along a road far below. Tommies or Yanks? He looked down again, hardly realizing the impossibility of identifying them at such a distance. And the sight that met his eyes made him gasp. Tearing out from the under-side of the cloud strata were four Fokkers!

Breathlessly Bob wondered if they had seen him. They were apparently just cruising and were in no particular formation. It was not likely, either, that they had been keeping watch above, for the clouds over them were almost perfect protection. Only an extraordinary break of good fortune had revealed them to Bob, and in another instant he had passed over the opening and was cut off from view.

"Mischief all right!" he muttered, grimly. "What the devil are they flying so low for? Why aren't they up here? It's a bet they're after something." He banked sharply to the right about and started back in pursuit. But no sooner had he faced than he saw the four planes climb into view above his own cloud screen. They were at least a mile ahead of him, and even though he opened the throttle wide, he seemed scarcely to be holding his own.

The four dived then, and without hesitation Blake followed. Down through the heavy curtain that shut off every chance of vision; he prayed he wouldn't meet an unknown ship in that dense fog, there'd be no hope for either of them. But suddenly he was out, and now the Fokkers were not so far ahead, though they were much lower and still diving.

Below them and to the front, Blake saw a column of infantry, American doughboys trudging the dusty trail to their bivouacs. Even as he watched, the leading Fokker swooped down with a spray that scattered the column wildly, and left a score of khaki figures lying inert in the dirt.

Blake knew they little dreamed of his presence; and surprise in the attack will go a long way toward equalizing superior numbers. He opened the throttle as far as it would go. The engine quivered violently. Guys and struts sang with vibration. Heedless of their warning he swept down, pointed his nose at the trailing Fokker, and opened his machine guns. The German plane, taken so completely by surprise, had no chance; it burst into flames and fell fluttering and spinning like a leaf. Blake saw the pilot frantically trying to get out. But he was done with this one. He zoomed up. The pack would be on his trail with a vengeance.

Rapidly he climbed. The leading Fokker had already swung back from its fire on the infantry, and seeing the fate of its comrade, began climbing above the Spad. Try as he would, Bob couldn't beat him. The plane was over his head, pointing at him, now. Any second he expected that withering rain of lead.

The logical and accepted procedure would have been to dive away. Bob knew that. He almost moved the stick forward to perform the maneuver when he thought of the grinning clown painted on the fuselage, so close he could have reached out his hand and touched it. "Blunder-Buss!" "Block-head!" His hand hesitated, then pulled back, and the nose of his ship went up. It was a daring thing to do; it was almost suicide! The two plane were thus headed directly at each other Blake jerked the trigger, and then dove down again just as the Fokker swept over his tail, faltered and dipped. The collision was averted by a bare half a foot! And behind him now the German was tumbling in a nose dive, dropping like a plummet.

Again Blake climbed, and this time he shot into the clouds. He had no idea where the other two Fokkers were. In the excitement he had lost them completely. He thought, and an inner voice simultaneously cried to him, "Yes, that's the trouble; you thought again." He thought they were behind him and lower. But he was hidden from them now, and as he burst above the layer of screening he realized the advantage must be his.

What to do? Even a "block-head" like himself would hold to this greater altitude if he could. That was fundamental. Then would they expect him to deliberately give it up? Had the last German expected his preposterous climb that threatened for a minute to send them both down in flames? Why, the man had been too astonished even to use his guns!

Bob smiled tensely. Ahead and to his left he saw another large gap in the clouds. For a few seconds he circled about. The two Fokkers climbed into view close behind him, and after being assured he had been seen, Bob went down again, not through the broad and obvious opening, but straight down into the thick mist!

Clown-head! Would they follow through that blind screen? They would not! There wasn't a man in the sector that would so trust himself with this idiot. And Blake knew it, and laughed. "Follow *me?*" he cried to himself. "No, they won't follow me; they'd jump first! They'll head down the opening where they can see, and watch for what crazy stunt I'll try next!"

Out of the layer again, and once more in sight of the ground! He swung toward the opening, reached it, and then

began traveling around its circumference in a long circle, alternating nose in and nose out to be sure of a better chance to point at them when they came through. But only one appeared, and Bob had a point-blank fire for one instantaneous flash as it swept by. He pressed the trigger; a white streak burst forth; then the gun jammed. But its work was masterfully done, and the Fokker, like the first of its comrades, blazed down in flames.

Victory! But only for a split second. By pointing his nose toward the opening in order to fire, Bob had guided himself directly in the path of the second Fokker, unseen at first but now tearing madly down in pursuit. And to the man above the Spad had suddenly appeared from nowhere! It all happened with such paralyzing swiftness. The German was diving at a terrific rate. He made a frantic effort to check his speed and level off; a single futile gesture that did nothing except point himself farther to the front of the enemy's path. He covered his eyes with his arm, his face twisted in horror.

No human eye could have predicted the miraculous outcome. The Fokker's tremendous speed almost saved it. It swept across Blake's path, and had nearly gotten clear when the Spad's propeller clipped its tail surfaces. There was a sudden swift, sickening cracking that severed the rudder and elevator of the Fokker as cleanly as if it had been sliced by a knife. The Spad propeller flew into splinters. The planes lurched earthward.

Stunned, half-terrified by the unexpectedness of the disaster, Blake recovered gradually. His plane was spinning wildly in a rapid, nosing dive that sucked away his breath. He fought to clear his mind, and right himself. The stick seemed like a wax rod in his numb fingers, motionless, powerless. He put the controls in neutral and waited breathlessly. For a seeming eternity he dropped on unchecked. Then suddenly the plane quivered, faltered, and the engine once again rose to an even keel, obediently responding to the pulling-back of the stick.

Bob's lips moved in silent gratitude. He had almost every chance in the world now. If only he could reach an open field he could make a "dead-stick" landing, the only descent possible with a dead motor, or a cracked propeller such as he had now. He cut off the throttle and went into a long, circling glide.

A quick glance assured him that his landing gear had escaped completely. And almost directly below him he saw the last Fokker, hopelessly out of control, go crashing into a clump of trees.

Ahead a single smooth clearing appeared. He prayed he could reach it. He nursed the Spad with every bit of skill and cunning he had, occasionally increasing his glide to almost a dive. In such a way he regained precious speed by sweeping back up under the momentum. Slowly, slowly, he approached his goal. The distance seemed to be lessening only by inches. But "Block-head" was estimating the space with a coolness and deliberate accuracy of thought that would startle his comrades.

The wheels skimmed the ground smoothly. The plane slackened and came to a halt scarcely a hundred feet from the road where a column of American doughboys had witnessed and cheered every move of the battle. A great cry greeted his plucky landing. Lieutenant Bob Blake was lifted from the cockpit by eager hands.

"Block-head" had at last come into his own!

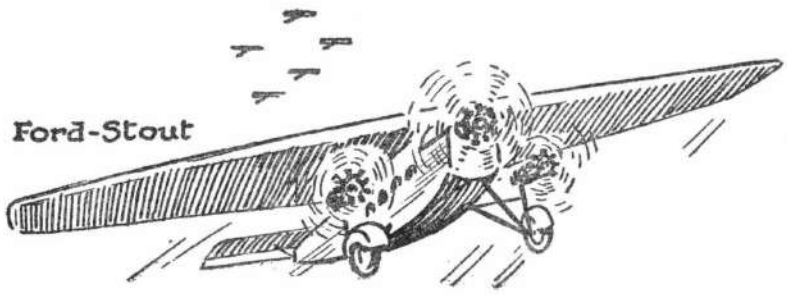
Captain Crary sat chatting with some fellow officers back in the club at the home training field. A newspaper lay

open on his knees. He tapped the black columns with his thumb nail.

"Remember the Blake that stormed this place a few months ago?" he asked, half idly.

A pair of officers grinned. "Bird who ruined all those planes just before inspection with the dumbest landing ever heard of? Called "Block-head' or something, wasn't he? Gad, man, he'll never be forgotten!" Then, with the faintest trace of sly sarcasm: "Pupil of yours, too, wasn't he, Crary?"

Crary tossed the paper at them. "Yes, he was a pupil of mine. Just been awarded the D.S.C. for 'heroism, skill and courage in action,' and so on. Made a pretty sweet landing, too. That boy was *good*—yeah, he was a pupil of mine!"



The Kick of Blind Flying

By Edmund T. Allen

Edmund T. Allen has flown many routes, including the Transcontinental Air Route. The odd photo above shows this pilot getting ready to "Hit the ceiling."

I TOOK off one night from the landing field at the edge of Cheyenne, Wyoming, with a heavy load of air mail and express. Among the express packages was a little crate containing an Airedale puppy en route from New York to Los Angeles. As it was very cold, we had covered the crate with sacks and piled mail on top of it to keep the little fellow warm. Although we did not know it then, he was destined for a narrow escape that night.

It was snowing, and conditions were none too favorable for flying. I believed I could get through to Rock Springs, because radio messages from points along the line gave promise of clear weather at some places between Cheyenne and Rock Springs. I took off by the aid of the 500-million-candle-power flood-light, and circled in the field several times so as to find out how far up I could go and still see the ground, and also how far ahead of me I could see objects which I might hit. I didn't want to fly out into the dark till my eyes had become dark-adapted. Many a pilot has crashed for this very cause—unable to see the ground because of coming too quickly from a brightly lighted field.

As long as I flew around over the city lights it was easy to keep the airplane

level and in a straight line. But when I turned west and left the lights behind, it was a different matter entirely. For the aviator is not, like the motorist, just a two-dimensional creature, having only his front and rear, left and right to watch. Like those of the birds, his movements are three-dimensional, and he must pay due regard also to his ups and downs. When the pilot dives, zooms, stalls, climbs, glides, and lands the airplane, he is maneuvering it in the longitudal plane which needn't worry the motorist at all, since presumably he always stays on the ground.

Swiftly, then, I left the suburbs and near-by farms—passed the few scattered points of light along the railroad yards, and entered blackness—the blackness of a snowy night in the wilderness. I looked behind to see the beacon I had just left, but saw nothing. The snowstorm had swallowed it up. The ground below me was snow-covered and showed up dimly as if in a magic world. I dove slightly in order to see it more clearly. An automobile passed on the highway with its headlights a blur in the snowstorm. I followed the highway, flying at a height just sufficient to clear the telegraph poles. I was traveling at 100 miles per hour. This means that I was approaching obstacles I might hit at a speed of 146 feet a second. Since I could see only about 150 feet ahead, one second was all the time I had to avoid them. This would soon have been disastrous, of course, if the route had not been perfectly memorized, and the location of every house, every silo, windmill, hill, and water tower known exactly.

I passed the first emergency field and flew on into the darkness again. I expected the weather to improve between here and the next emergency field, twenty-five miles distant, for the radio weather report had told of stars shining at the second field. But I was to discover something quite different before I reached it.

The ground rises rapidly at this point —so rapidly that the railroad trains going west usually take on an extra engine in climbing over the "hump." Often the clouds from which the snow is falling lie nearly level, and the ground rises up into the clouds and often above them into the clear starry sky. Snow is bad enough to fly through at night, but clouds—or fog as we call it when it is close to the ground —make it impossible to see the ground at all. Pilots avoid fog as their worst enemy, because although it is often possible to climb "blind" up through it, it is often impossible to come down through it before one's supply of gas has given out. If one has twenty or thirty hours' fuel supply instead of four hours' supply, as the air-mail planes have, and if one hasn't a heavy pay load of mail and express or passengers, it is comparatively safe to fly above fog, or even through it for short periods of time, relying upon an almost sure chance that it will be clear at some point farther on. But if the engine fails or the gas gives out before one has reached a clear region, and a landing must be made in the fog, the result is almost always a crash with small chance of surviving. This has been our experience in the air-mail service where attempts to come down through fog have cost the lives of many air-mail pilots.

On this snowy night I had only three and a half hours' gas supply. When I saw the ground getting dimmer, though I was still but thirty feet above it, I realized that I had entered the fog-cloud layer from which the snow was falling, and that I was in for it. I could not stop. I could not turn around with any assurance that I should ever find the road again, I dared not bank steeply to make

a quick turn because the low wing might hit the ground. There was just one thing left—to climb blind. I pulled the nose of the airplane up and opened the throttle to full power. All traces of the ground disappeared and the entire sphere in which I was enveloped gave not the slightest indication which direction was down. I concentrated upon my instrument board. The trusty old turn indicator, which had saved my life on several previous occasions, was doing its duty. It showed a right turn, and I pressed the left rudder until the indicator came back to zero. This did not mean that I had turned back to my original course, but only that I had stopped turning. Now I had to turn to the left till the compass indicated my correct course of 285 degrees, something not easy to accomplish with the constantly swinging compass needle. And in turning I had to bank the airplane properly and not climb too steeply or the ship might stall and fall into a spin. There is no difficulty when one can see the ground, or a star, or a horizon with which one can orientate oneself. But when this information comes at second hand, through instruments which must be interpreted in relationship to one another, it is not only extremely difficult but dangerous. The banking would be a great help in blind-flying if it really showed the "bank." But it doesn't; it shows acceleration. Used in connection with the turn indicator and interpreted in the light of the turn indicator's readings, it gives the pilot useful information, but not the information he really needs.

I finally got turned back to the proper course without mishap, and I then glanced at my aneroid altimeter to see how much I had climbed since I went blind. I was astonished to discover that I had risen but two hundred feet, and I was sure the ground under me had in the meantime risen at least the same amount. This meant that I was still dangerously close to the ground. I searched the instruments to find out why I wasn't climbing faster. If I kept this up I should soon hit the rising ground without seeing or knowing what I had hit! The tachometer showed that the engine was not quite up to its normal full power. Nevertheless, even with my present heavy load, the airplane would have climbed faster. I thought of the possibility of ice collection. At certain temperatures when there is moisture in the air ice collects and freezes solid on all parts of the airplane, building up on wings and struts a load of hundreds of pounds in a few minutes. If it were ice collection, I should probably never climb out above the storm. I might never see the earth again—except in a crash. I reached for my flashlight and turned it upon the wings and struts, and, sure enough, there was the icy coating, about half an inch thick. No wonder I could not climb—with five hundred pounds of added weight.

The emotional strain of the situation was terrific. As I thought of my friends who had lost their lives in similar emergencies I found my mind losing the necessary nimbleness in watching and interpreting the instruments and manipulating the controls. It seemed that I must be side-slipping, though the instruments did not indicate this. Surely I must be diving and side-slipping! I felt the wind on the side of my face and heard the engine speeding up. The end seemed fast approaching. I knew that rocky ground was very close, and that rocky knolls, on a higher level than myself, were on each side of the course—peaks I would hit should I turn or drift to one side or the other. The impulse to straighten out the airplane in accordance with my sense of level was irresistible in spite of the different story

the instruments told. Which were correct, my senses or my instruments? Instruments are not always infallible. My mind was in a panic.

Then I thought of the little Airedale puppy up there among the mail sacks. It occurred to me that *he* was quite oblivious to the danger. Then I smiled at the very strangeness of the thought, and I began to see the whole situation as if I were at home telling a friend about it. This sense of detachment from the danger cleared my mind, and I realized that at present there was nothing for me to do but to obey my instruments and get all I could out of the engine.

I adjusted the mixture control to give more air to the carburetor, and noted a slight gain in engine power. I had climbed six hundred feet. I searched the blackness for some sign of the ground, some star, some streak of gray in the night—anything outside the airplane itself, but nothing appeared. I forced myself to take a deep breath and lean back in the cockpit. It was very difficult for me to keep the airplane flying exactly on its course. Every minute I noticed that it had turned a bit to the north or south. Each time it had to be turned back again, stopped at the proper angle, and leveled out.

I was most apprehensive about the ice. Fortunately it was not collecting so very rapidly, and I hoped I should come out into the clear before I had enough ice aboard to weigh me down to the ground.

Poor little pup up there in front! He must have been awfully cold. But he wasn't half as frightened as I.

It seemed interminable, this fog; but I looked at my clock and found I had been flying blind but twenty minutes. And just at this moment my eye was caught by a point of light above me. A star! Thank the heavens for their stars. No more blind-flying for me. That is what we always say whenever we get caught and have to find a way out of a tight place blind.

Presently other stars appeared and soon I emerged above a sea of fog, showing white in the starlight. A few miles farther the fog ended and I found luckily that I was about two hundred feet above the ground and very close to the second emergency field.

The ice melted in the clear air, and two hours later I reached the terminal and took out the pup, shivering but happy for a friendly voice after his solitary flight over the mountains.

Blind-flying is still extremely dangerous, even for those who are skillful in this particular technique. It is dangerous largely because of the conditions in which it is undertaken. We do not know what the future has in store for us in the way of practicable devices for making flying safer in bad weather and at night, but we can easily imagine that years hence we may look back upon the flying of these present days as, in the realm of sea navigation, our sea captains now look back upon paleolithic sailors who fearfully skirted the coast line in their canoes.

Frenzied Flying

By Noel Sainsbury

Illustrated by Harry H. A. Burne

I'LL bet you Steady doesn't do it."

"Why shouldn't he? It's a good dare!"

From the direction of Cape Henry two specks had appeared in the sky; gradually, as they flew nearer Hampton Roads Naval Air Station, they took on the shape of seaplanes flying at an altitude of about fifteen hundred feet.

"That's Clark, in the *N-9,* leading," announced Charlie Taylor. "I can make out the wing-tip floats and single pontoon. Steady is flying the *HN-1.*"

"Now see what they do," interrupted Jackson, another student aviator, as the beach watch in charge of a C.P.O. made its appearance. "There they go!"

First one and then the other of the humming seaplanes made a flipper turn to port and then nosed sharply down as if for a cross-wind landing outside the basin arch. For a minute or two they were lost to view. Then the *N-9,* flying about four feet above the water, could be seen below the crescent of the arch headed straight for the low opening beneath.

"Jumping spiders!" sang out Jackson. "He's going to do it!"

"He'll probably crash and kill himself!" cried Charlie. "All he has to do is to graze that concrete, and it'll be all over but the funeral. His wing spread will give him less than two feet leeway on either side. Why, it's hard enough to taxi through, with a cross-wind like this. Perhaps he will land first, anyway——"

But the oncoming plane did not land. Instead, its pilot nosed slightly downward to level off with his pontoon step barely a foot above the waves; then, straight as a bullet from a gun, it passed under the arch.

As the group of student aviators in front of the pilots' house stood watching in breathless silence, the daredevil pilot shut off his motor and made a perfect landing. They could see him plainly now. He had turned in his seat and was gazing aft.

The second plane now appeared beneath the arch, taxiing smoothly in.

"Clark's got nerve," commented Jackson, "and Steady——?"

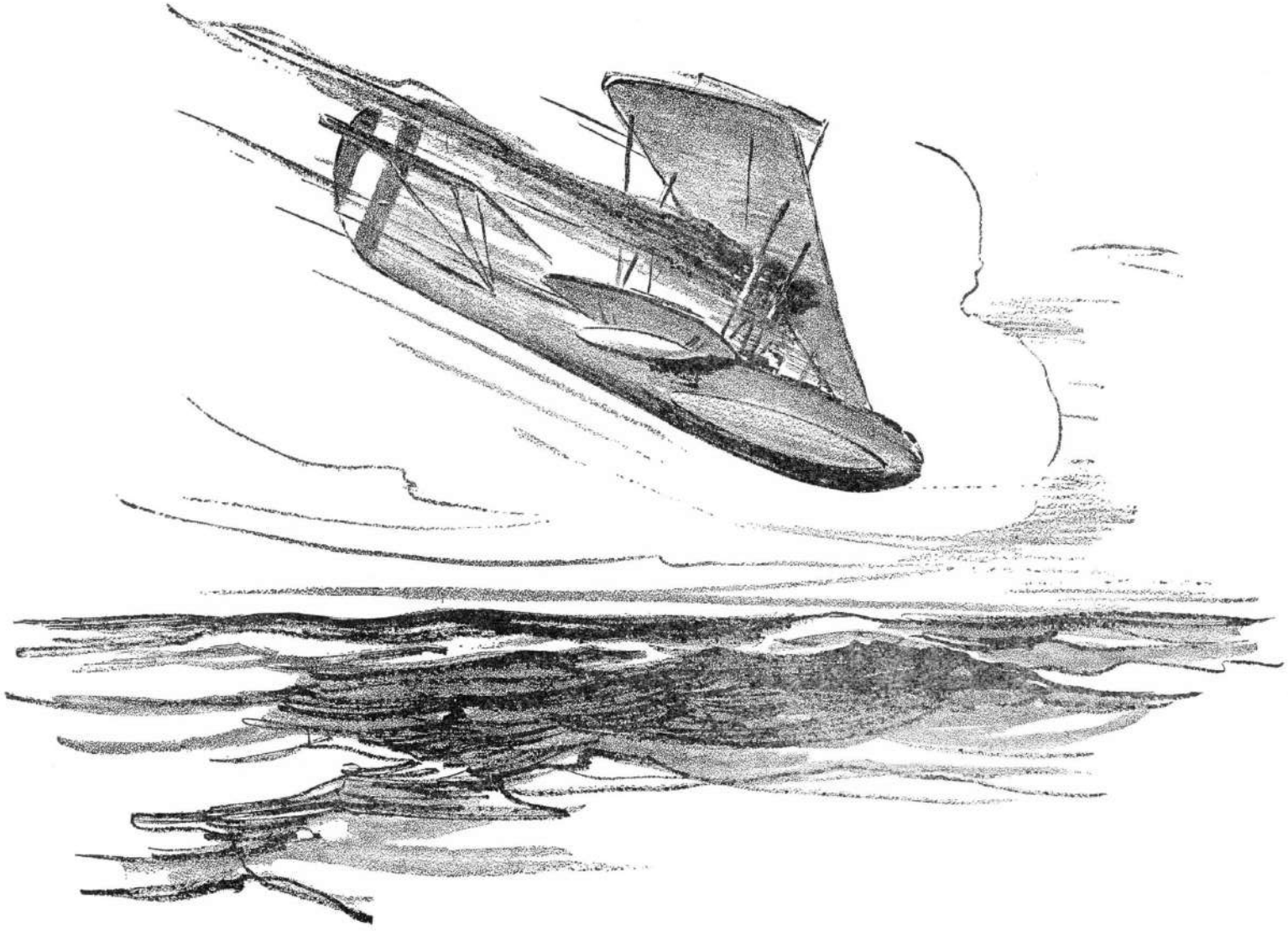
"He didn't take the dare," finished Charlie, watching the two planes making for the beach. "But it wasn't a question of nerve—he had better sense."

"Some people might call it that," jeered Fat Jones.

"But you aren't going to call it anything else!" Charlie glared at Fat belligerently. "Steady's been my pal since we started ground school together, and all through this flight training as well. And if a big fat stiff like you wants to get his face pushed in, just intimate again that Steady funked it!"

"Shut up, you fellows, and let's hear what Clark and Steady have to say for themselves."

As they hurried down the beach Steady's fellow pilots saw him greet Clark



The plane blazing overhead hit the water with a terrific crash.

with a nod and smile, as, having finished his chat with the C.P.O., he started toward the pilots' house. But Clark, in a couple of strides, caught up with Steady and placed himself in his way. He was a powerfully built chap, towering head and shoulders above the slight figure of the younger boy.

"Lost your nerve, did you, Perkins? And I suppose you'll blab in your report and tell what a good little boy *you* were not to take chances with government material."

Perkins looked up at him without any apparent malice.

"What you do on patrol, Clark, or off of it, for that matter, is none of my business," he replied easily. "And that goes two ways. What I do is nobody's business but my own. I guess you can consider yourself lucky that none of the instructors were on the beach. But, if it does get out that you flew under the arch, it won't be through me—understand?"

He walked past the astonished Clark and disappeared inside the pilots' house with Charlie Taylor at his heels. And Clark, irritated at his failure to rub it in, turned vindictively to the little group about him.

"I suppose you fellows think Perkins got the better of me," he growled. "That chap's yellow clean through. If he had any guts he'd not taxied through—he'd have flown! Hides his color under the old 'efficiency' gag—never breaks a rule——"

"While you go on report every other day," grinned Fat. "Cut it out, Clark. Everybody knows you're a hero, now, let it go at that."

"Razzberries!" the big chap shot back, and sauntered off to the pilots' house.

Privacy is an unknown quantity aboard a naval air station, and news or rumor travels fast. Within an hour every living soul on the station knew that Clark had flown under the arch after daring Steady Perkins to follow him. At mess that evening the station officers laughed about it. Officially, of course, they knew nothing, so Clark was safe. Several of them told stories of their own escapades during flight training, and then forgot the matter.

There was a different state of affairs, however, at the student officers' mess. Steady, who had been out on gunnery practice and was late for the meal, found the room buzzing with conversation, which died down suddenly as he slipped into his place at the long table next to Charlie Taylor. Charlie immediately commenced talking about a new Curtiss triplane he had flown that afternoon.

Steady didn't talk much during the meal, answering most of Charlie's remarks absently. He knew the rest of the crew would wait until he had finished and left the table, before discussing the morning's episode further. And he had noticed in those first few moments that fellows who had always chirruped a greeting merely nodded or even turned their eyes away when he happened to meet their gaze. Could it be possible that they, too, thought him "yellow"? Was it in their eyes a proof of cowardice—his refusal to do a stunt that might have cost him that coveted prize, an ensign's commission and his naval aviator's designation—refusal to take a dare from Clark, who had a reputation for foolhardiness?

As soon as he could decently do so, Steady left the table and went to the quarters he shared with Charlie Taylor. For a time he tried to study, and presently went to bed.

When Charlie came in the room was dark, and thinking Steady asleep, he undressed without a light, and getting into bed was soon slumbering peacefully. But Steady lay wide-eyed, going over and over

in his mind the events of the day, and it was not for some hours that the sleep of exhaustion overtook him.

Awakened next morning by a stream of sunshine pouring into the room, Steady realized that in some miraculous fashion the heavy burden had been lifted, and that it would be difficult to feel anything but cheerful on such a glorious day. The whole affair of the arch seemed much less important, and he started off whistling to an early breakfast.

But as the day wore on (it was stand-off patrol day with him, and he was busy with ground work), he noticed a continued, if furtive, coldness among his flight mates. Charlie, of course, remained the same, but others with whom he had been on genial, intimate terms, like Spud Jackson and Fat Jones, had begun to treat him with an uneasy evasion whenever they met. And Steady felt that this coldness of manner had spread among most of the men on the air station.

"Cheer up, old sport," greeted Charlie one evening a day or so later. He had missed Steady after mess in the ward room, and found him sitting on his cot with an unopened book in his hand.

"I can't help feeling bad," Steady admitted as his roommate pulled up a chair facing him. "You know the way those fellows have been acting since Tuesday——"

"Forget it, old man. The whole thing will soon blow over. It's ridiculous, anyway!"

"I don't know about that—" Steady's voice was low and not quite firm. "Give a dog a bad name, you know!" And then, in response to a muttered "Rot!" from Charlie, "To make matters worse, we go out on patrol together to-morrow —H. S. instruction. Clark's almost certain to pull something else—in fact, he's said he would. I'm not going to take a chance on losing my commission by playing the fool for him or anyone else. In the meantime the rest of the chaps snicker and think me a coward. But—what can a fellow do?"

Charlie shook his head and remained silent.

Next morning early Steady was busily checking up on the mechanic who was responsible for his plane, when Clark appeared on the beach.

"Hello, Steady!" he grinned. "Want to play 'follow-the-leader' with me in the lead?"

The fellow addressed did not so much as glance up but his reply was sharp and to the point.

"You know the answer to that, Clark."

"What is it?"

"I'll follow you when necessary; otherwise, not! Sorry, but I'm busy now—we shove off in two minutes!"

"Meaning that you'll play safe again to-day, eh?"

With a disparaging laugh Clark turned away, and walked over to the mechanic who was idling the motor of his flying boat.

"Everything O.K.?" he asked.

"Aye, aye, sir," responded the sailor, clambering down from the cockpit. "This here Liberty runs like a charm, sir. You'll have no trouble with her to-day."

With a mocking wave of the hand at Steady, Clark climbed into the main cockpit, and taking his place behind the starboard wheel, signaled to the chief petty officer in charge of the beach watch that he was ready to start. The rope joining the seaplane cradle to a small tractor forward grew taut. The carrier and its burden moved ahead until they reached the edge of the concrete where it inclined down to the water. Here the tractor slued to one side, permitting the cradle to roll down the steep and disappear be-

neath the waves, while the seaplane floated clear.

Another tractor had pulled Steady's flying boat to the water, and a moment later he was floating beside Clark. Then Clark held up one finger, indicating that he would take the lead, and taxied forward with Steady's plane following in his wake.

Their tail planes had no more than cleared from beneath the arch with the basin behind them, and the smooth water of Hampton Roads curling to foam beneath the noses of their aircraft, when both pilots gave their engines more gas. The two planes sprang ahead as if alive, and went speeding along the water at between twenty-five and thirty knots per hour.

As the two pilots, now racing one behind the other, speeded up preparatory to the take-off, they pulled their wheels sharply backward, thereby jerking two thousand-odd pounds of flying boat onto its step. Now, instead of taxiing through the water, they fairly skimmed along, the lower extremity of their steps just resting on the surface.

Once more the skippers "gave her the gun," and this time, full strength. Their speed increased visibly; the roaring drone of the twelve-cylinder motors and their spinning propellers would long ago have proved deafening had the two pilots not had cotton in their ears. Then one after the other, as gently as rising seagulls, though far more gracefully, these heavy wood and metal air boats, like giant birds, soared upward into their natural element, the air.

As they rose higher Steady, following Clark, banked to starboard. To port he could see Old Point Comfort and Fortress Monroe far below across the roads, while slightly ahead and to his right Willoughby Spit poked a long and crooked nose into the water.

It was a muggy morning, nothwithstanding the sharp wind from the Northeast. Pointing his plane toward Cape Henry, Steady could see, some thousand feet below him, the heavy gusts tear the face of Chesapeake Bay into shreds of white foam.

A few minutes later he passed Cape Henry Light and headed out to sea, following a zigzag course marked on the patrol chart. The air, disturbed and "bumpy," seemed to knock sharply on the bottom of the hull, giving him the sensation of traveling over cobblestones.

Although the young pilot patiently figured his mapped course, one hand on the wheel and the other holding a pencil, his thoughts were with Clark in the plane ahead.

Still musing, he flew into a cloud bank. All about him the fog loomed, a blank wall. Now and then a sudden rift sent eerie shadows over the plane, now above, now below, as a dimmed sun caught the reflection. It grew chill and damp, and Steady, who like every other flyer, detested fog, shot the plane higher in order to escape this gray area of mist and shadow.

Clark and his plane were nowhere to be seen. Steady knew that on patrol it is the accompanying plane's duty to keep the leader in sight when possible. But the altimeter registered forty-two hundred before he climbed into clear air to find Clark sailing before him.

Suddenly Steady's eyes widened in horror. That was not mist drifting back from Clark's motor—it was—*smoke!* In a flash he realized that something must have broken on the Liberty severing the gas lead from the gravity tank on the upper-wing section. As the motor in an

HS-2 rests on struts just aft and above the main cockpit, Clark, unless he happened to glance upward and toward the tail, could know nothing of it.

Instinctively Steady shot his plane ahead, but Clark, noticing the shadow of the second plane creeping nearer on the cloud belt below, speeded up his own flying boat. Then the lad behind him saw him turn to his seat and wave his hand in derision.

"Good Lord!" muttered Steady. Then —"Fire! Fire! Your plane's on fire!" he shouted in desperation, although he knew the other could not possibly hear him.

They were only a short distance apart now, and the younger pilot anxiously watched the heavy smoke streamers snaking back from the burning motor. Would Clark never look up? What could he do to warn him?

Then came an idea—*the Very pistol!* Frantically, he wrenched it loose from under his seat and in another instant its star-shaped light went skimming over Clark's plane.

It brought Clark's head around and he stared back at Steady in astonishment, while Steady kept pointing the pistol at the Liberty.

It seemed an age to Steady until Clark caught on and raised his eyes. Then with a yell of fright and rage he shoved his wheel over, and the big flying boat dove into the fog below, its motor belching smoke and flame.

For the younger boy, there was but one thing to do. To land near a burning seaplane whose gas tanks might explode at any moment was a risk sufficient to chill the heart of any pilot; let alone the danger of landing on a rough ocean and crashing forty miles from shore.

All this shot through Steady's mind in a frenzied second—then over went his own wheel, and he, too, disappeared into the gray of the fog beneath.

The plane's speed was terrific, and as Steady felt the grinding jar of the wind-strained wings, the cold lash of the mist, he wondered whether Clark's gravity tank would explode before his seaplane landed.

Fog blinded him, and he could barely distinguish the nose of his ship. The air pressure was agony to his eardrums, yet hemmed in by the cloud banks, the active needle of the altimeter was the only visible sign that the plane was moving at all.

Then, as Steady watched, his eyes straining to pierce the veil of smoke, the plane hit the water with a terrific crash, and a moment later he saw Clark spring from the side of the ship into the sea.

Realizing that to be of help he must take no risks with his own plane, and having not a moment to lose, Steady decided to land to leeward of the swimming pilot and taxi toward him in the teeth of the off shore wind. He knew that no seaplane built could live more than a few minutes in that sea with half a gale abeam. Hurriedly he cut his motor, gradually brought the nose of the flying boat up and leveled off at about two hundred feet. Then, with a sharp flipper turn to port, he went sailing off before the wind, leaving a half-spent swimmer gazing vainly after him.

"Bet he thinks I funked the landing," groaned Steady. "But where will we both be if I crash?"

A slow bank to starboard and once more Steady headed his plane toward the half-drowned Clark. Bringing the motor into action again, he leveled off for a power landing, at the same time allowing the tail to drop slightly. Twice, three times the big ship bounced, and so hard that Steady marveled that his eight-hundred-pound Liberty remained on its struts above his head.

And now came the most difficult feat

of all. Deluged by angry seas, the *HS-2,* pounding through each oncoming wall of water, fought like a runaway speedboat; it was almost impossible to keep her to the course. As they topped each wave he could just glimpse Clark's bobbing head, and fifty feet beyond, the blazing seaplane wallowing in the trough of the combers.

Using every ounce of muscle he possessed to keep her head straight the younger pilot drove his plane forward. One more comber and there, just a point to starboard, he caught sight of Clark, making desperate efforts from the water to warn him off. He fancied he could hear him shout: "Keep away—she's goin' to blow!" But Steady kept straight on.

And in another instant, down went his foot on the right rudder bar, a quick hand over the side, a heavy tug and a haul, and Clark lay sprawling half over the seat, half over the starboard wheel. For another second Steady was very busy keeping the plane nose into the wind, then he dragged the exhausted pilot over the yoke and onto the cockpit floor, where Clark collapsed, totally oblivious of his surroundings.

Dead ahead was the burning plane they must pass, a flaming, water-logged mass bound to explode before it sank. Sheering away as far as possible, Steady smashed along, giving the old Liberty every ounce of gas there was. They came abreast, they were past, and just as he began to feel they were safe, came a deafening explosion aft, its concussion forcing him to swerve, and sending a geyser of foam-flecked water over his craft.

For the next few minutes he fought the tenacious pull of the sea, doing everything humanly possible to keep his plane from foundering. She was half water-logged and pulled like a truck, but gradually he got her into the wind again.

Presently, Clark stirred and Steady saw that he was coming to. "Crawl forward under the decking!" Steady shouted, and Clark, by a mighty effort, managed to do as he had been ordered.

For an hour of more Steady forged the plane onward. It was the hardest kind of work. The leg strain of steering was frightful. His aching feet no longer seemed to press the steering bar but a rod of red hot steel. The plane was shipping water through the forward cockpit, but he could not leave his seat to batten down the cockpit cover. His whole body throbbed with pain and he wondered how much logner his endurance would last.

Then, when he felt he had come to the end of his strength, Clark's helmeted head appeared from beneath the decking. He looked pale and haggard, but he slipped under the yoke and into the seat next to Steady and immediately took over.

Another hour passed, while the two boys kept on taking fifteen-minute tricks at the steering bar. As they drew nearer land, the wind lessened, and gradually they taxied into calmer water.

Just as soon as it became possible, Steady took off. Flying through the air was a much easier and faster matter than pounding through Atlantic combers. A bare half-hour later they passed over Willoughby Spit.

A short spiral down and they landed just outside the arch. Clark leaned forward and shut off the motor, while Steady rid himself of his flying helmet.

"How d'you feel? Are you badly hurt?" he asked Clark, pulling the wads of cotton out of his ears.

"Not hurt, old man, just sore," returned the other. "Believe me, Steady, I'll never say anything again about your playing safe! I——"

"Oh, cut it!" begged Steady.

"No, listen to me, Steady. There are few fellows who'd have done what you did for me to-day. You rate the Congressional Medal for this, and if there's any justice in the Navy, you will certainly get it!"

"Both of us will probably land up on a crash board instead," laughed Steady.

"That's not worrying me," declared Clark, and his face colored.

"Forget it," said Steady, "I have." He held out his hand.

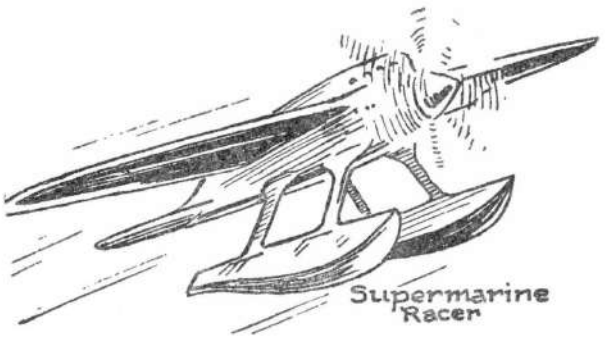
Clark grasped it. "You're a brick," he choked.

Steady flushed with embarrassment. "Let's get along to the beach," he suggested.

Clark drew a long breath. "All right, go ahead and *taxi* through the arch."

"Taxi!" exclaimed Steady, before he thought.

"Yes, taxi!" repeated Clark. "But don't think it's because I'm not ready to admit you haven't the nerve to fly through it! I know," he continued, as Steady started to protest, "a lot of people have been thinking things about you, but just as soon as we get ashore I'm going to correct a few wrong impressions. So give her the gun, old man!"



The Lefker Duration Model Plane

By Joseph J. Lucas

THE Jack Lefker outdoor hand-launched duration-record-holder model was designed by the writer. This model was designed and scale plans drafted especially for Jack Lefker, who built and flew it at the National Playground Miniature Aircraft Tournament. Jack Lefker, who is a member of the Illinois Model Aero Club, and who is only twelve years old, caused a sensation at the tournament by winning first place in the outdoor hand-launched contest and creating a new junior world's duration record of 5 minutes and 37 seconds. The model is a very consistent flyer. Its design follows the standard twin-pusher type model with the exception of the Lucas tail plane, which is inserted in the rear of the craft. The Lefker model is very light weight due to the club's developments of "cans," bracing, single-wire bearings, propeller shafts, elevator, main plane, A-frame, propeller and wiring design; and is therefore a very good and representative type of model of the Illinois Model Aero Club developed in sixteen years of model-designing, building, and flying.

Frame

The first part of the model that should be built is the A-frame motor base with the tail plane inserted in the rear of the frame. The longerons are of balsa I-sections, and the length of them is 39½ inches. They have a cross-section ⅜"x ⅜" with a thickness of the flange and web 1/6 inch and ⅛ inch respectively. The longerons are sandpapered very smooth and are doped with banana oil or airplane dope.

The front wire hook is bent from piano wire of .035 inch to form as shown in the drawing of the front hook, and cemented and bound with fine silk threads onto the nose of the frame.

Small balsa blocks are ambroid glued in as shown in the drawing of the frame-joint section. These balsa blocks are placed and slotted for inserting the bamboo as indicated in the sketch.

The two rear bamboo cross braces are ⅛"x1/32", while the front bamboo brace is 3/32"x1/32".

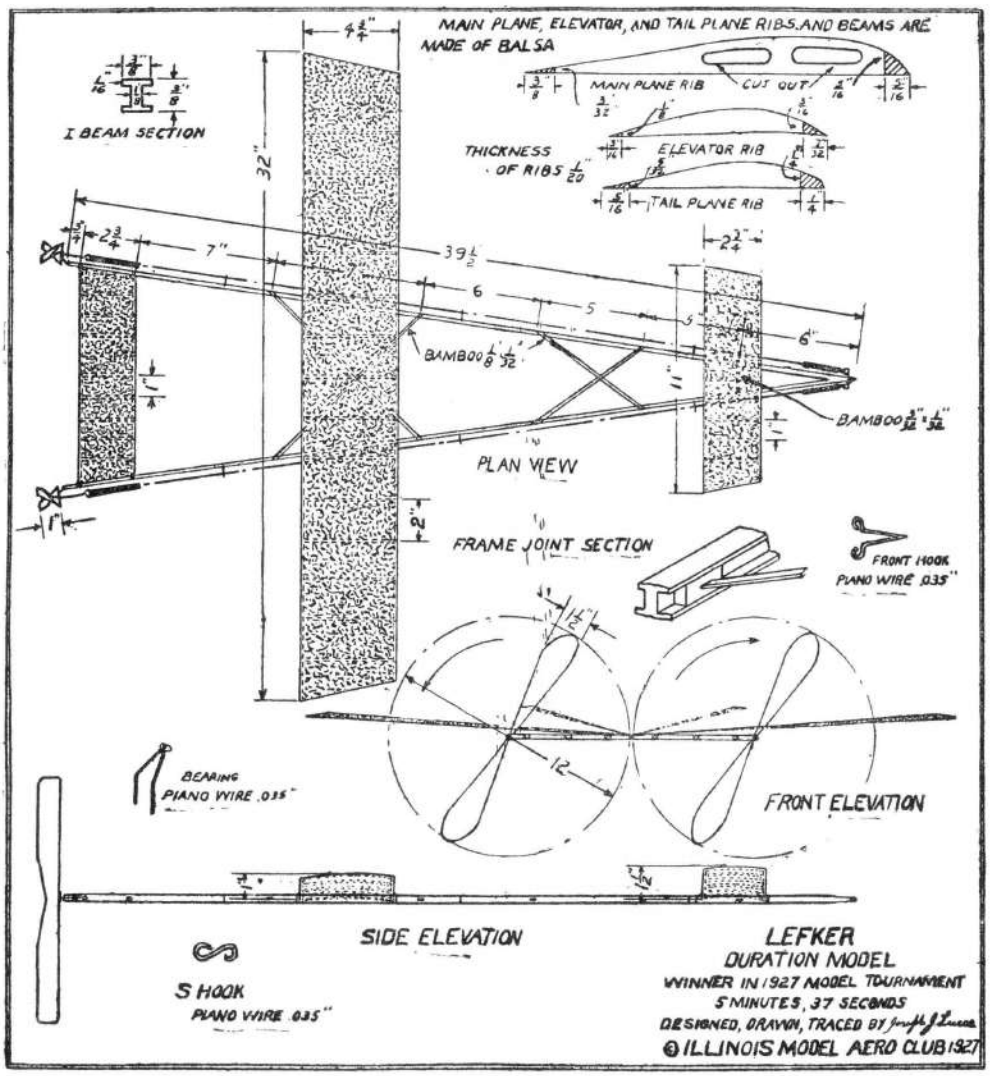
If these joints are ambroid glued and done very carefully they will not require binding.

Tail Plane

The next part of the frame to make is the tail plane. The tail-plane ribs and entering and trailing edges are made entirely of balsa wood. The entering edge is ¼"x¼" and the trailing edge is 5/16"x5/32". Both are sandpapered very smooth to shape as shown in the drawing. Then they are doped with banana oil or airplane dope. The ribs—there are nine of them—are made exactly as shown in the drawing. They should have a thickness of 1/20 inch. These are also doped. Then the ribs are spaced one inch apart in between the entering and

trailing edges and ambroid glued in, leaving about 1½ inches on each end of the tail plane open.

Then balsa blocks similar to those illustrated at the frame-joint section are ambroid glued so that the slots can be made 2¾ inches apart to fit the ends of the entering and trailing edges of the tail plane. Then the ends of the entering and trailing edges are inserted and ambroid glued in as with the braces, and the ends that are projecting beyond the outside of the longerons can be cut off and sandpapered smooth. Three cans on the outside of the frame longerons help the motor base to stand the pull of the rubbers, and are put on with ambroid glue. They are placed as indicated in the drawing. The cans are bent to shape from piano wire of .035 inch as shown in the drawing. The rear bearings or hangers are bent to shape out of piano wire of



.035 inch as shown, and ambroid glued with binding of silk threads to hold them in place.

Main Plane

The main plane or wing is the next thing to construct. The main wing is the important part of the model and great care must be taken when building it. The wing has a span of 32 inches and a chord of 4¾ inches. It is constructed of two balsa beams, one (the entering edge) 30″x5/16″x5/16″, and the other (the trailing edge) 32″x3/8″x3/32″. Both of these beams are sandpapered smooth to shape, as shown in the drawing, and coated with banana oil or airplane dope. Then the beams should be cut in half.

The ribs, fifteen in number and made of balsa wood, are cut to shape as shown in the drawing with a thickness of 1/20 inch. Cut out parts of the section of the ribs for lightness as shown. Then they are sandpapered and doped. The next thing to do is to put the front and rear wing beams together at the required dihedral angles.

These beams are jointed by two 1″x1/32″x1/32″ pieces of bamboo (which are bent to the required dihedral angles as shown in the drawing), and bounded with ambdoid glue. To get the required dihedral angle you can check it by balancing the beams, after they are put together, at their centers on any level surface; if the ends of the wing beams are one inch above the surface, the angle is correct. The next operation is to put the ribs two inches apart in between the entering and trailing edges with ambroid glue. Then the wing tips should be put on. The wing tips are also of balsa wood and have the same section as the ribs with the exception that the chord of them is slightly larger; so that the tips can be ambroid glued to the ends of the wing beams in position. The thickness of these wing tips should be 3/20 inch.

Elevator

The elevator beams, ribs—there are nine of them—and tips are also made of balsa wood. The entering edge beam is 10″x7/32″x3/16″, and the trailing edge beam is 11″x3/16″x1/8″. The construction and assembly of the elevator are similar to the main plane, with the exception of the dihedral angle (which is shown in the drawing as 1½ inches), and the thickness of the elevator tips (which is 1/10 inch).

Covering

The tail plane, main plane, and elevator are double surfaced with Japanese silk tissue paper. A very good method of gluing the tissue paper on is by applying banana oil. Cover the top first with tissue paper, cementing on with dope to the ribs and beams and drawing each section of the paper taut, particularly along the wing, rather than across it, in order to preserve the section. Then trim the paper off around the edges and dope surface with a weak doping solution. Cover the bottom the same way as the top and also dope.

Propellers

The propellers come next, and the success of model performances depends upon how good you make them. The propellers are cut from 12″x1½″x1″ balsa blanks, with diagonals made on 1½ inch faces from corner to corner, and sawed along the outside of the lines, allowing enough for the hubs at their intersections.

Then fine true holes are drilled at the intersections of diagonals for inserting the propeller shafts. The propellers are now ready to be carved. This is a difficult operation, and you can obtain instructions in the correct way of doing it. Space will not permit of a detailed description here.

When through carving the propellers, see that they are perfectly balanced.

If so dope them. Bend the propeller shafts into shape out of piano wire .035 inch and insert in the hubs with ambroid blue, and bend the ends over to anchor it, but do not indent the hub. Be sure the shafts are ambroid glued in securely, and see that the shafts are true. Then put a few washers on the shafts for bearings. These propellers are the Wright true pitch type, and have a theoretical pitch of about 25 inches. For the required power to fly the model put eight strands of 3/16 inch flat rubber. If you follow the instructions carefully and study the drawing on the model you will have no trouble in duplicating Lefker's feat.

My Record Airplane

By Jack Lefker

MODEL aviation is very fascinating, and that is why I became interested. My first experience in seeing a model airplane fly was about a year ago when I saw an indoor contest of the Illinois Model Aero Club. The way the models were flying made me jump and shout with joy. As a result of this meet I joined the club to learn how to build and fly models. I didn't realize that I could learn so much about them in so short a time.

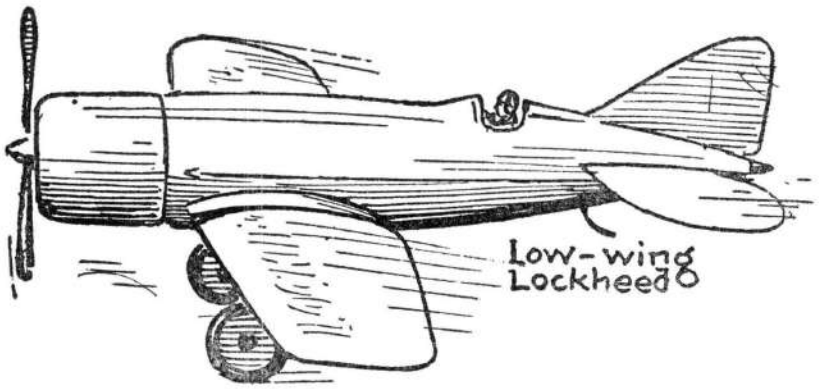
When I heard about the National Model Airplane Tournament to be held at Memphis, I entered the elimination contest at Chicago and qualified with a model flight of 1 minute 12⅕ seconds. Right after the meet Mr. Lucas (a pioneer model designer, builder, and flyer) of the club designed for me a hand-launched duration model airplane especially for the event at Memphis. I followed the design carefully and listened to all the instructions that were necessary for constructing the model and started right to work building it.

I got my balsa I-beams and other pieces of balsa wood from a carpenter shop cut up, bamboo from a fish pole, piano wire from a piano company, ambroid from a sporting-goods store, banana oil from the drug store, and my rubber from a rubber-supply house. First I made the front-nose hook, hangers, cans, and propeller shafts out of piano wire. Then next I made the tail plane, and cut up pieces of bamboo for the braces. Then I assembled the frame. The wing I built next and made the beams, ribs, and wing tips out of balsa wood and then put it together. The elevator I made the same way as the wing. I carved the propellers last, which was sure a job. After I finished the model I tried it out before going

My Record Airplane

to Memphis, and was satisfied with the results I got in flying it.

When I got to Memphis all I thought of was flying my model at the tournament and winning. When the contest started and my turn came to fly my model airplane, I had the rubber motors wound up and then launched my model for the official flight. After I launched my model it climbed very steeply for about two hundred feet, and then gradually made big circles. I ran after my model for a couple of minutes, but it was in the air very high and still climbing. I was then afraid the model would never come down, or I might lose sight of it. I ran about a mile from the starting point and found the model had landed in a back yard. When I got back to the official starting point, I was very surprised to be told that my model made an official flight of 5 minutes and 37 seconds, and also that it had broken the world's junior hand-launched outdoor duration record. Gee, I was happy.



The Glint of Wings

By Marie Barton

Illustrated by Frank Spradling

GLINT WARREN wanted something. But what?

"Ranching ain't what is used to be, by a long shot," his father had admitted the previous evening when Clint had come home with his high-school diploma. "An' this old house ain't like it was when your mother was livin'—to sorter cheer things up. But it won't do any harm to swing a job here till you figger out what you want to tie up to for life."

The boy, clattering up the rock-worn trail on his knock-kneed pinto, watched the sun's long yellow fingers snatch purple shadows from the hills ahead of him. Beyond their greenness rose the gray-shouldered mountain range, an inscrutable barrier.

Clint drew in deep breaths of pine-pungent air. "The open for me!" he exulted. "No jostling of elbows here."

All the morning he pressed up the fence line on the ludicrously slow little pinto, stopping to mend a break, to tighten a wire, to dislodge a menacing bowlder, or halloo to a somberoed Mexican herder trotting after the snowy Angora goats.

His noon snack he ate under a twisted juniper. "It's good to be home," he told himself for the fiftieth time. Yet his brown eyes, restless with the pent-up energy of youth, scaled the heights. "Wish, though, I was up there. Clear on top. And then some! Higher the better!"

An eagle circled the summit, great-winged and sure of flight. Clint's questing eyes followed it to the upper air, to a mere speck, to nothing. He sprang to his feet. "Come!" he whistled to his pony. Let's climb, too!" He swung into the saddle and dug his heels into the straining flanks. "The fence can wait. The top calls. I've got to go!"

Some three hundred yards of this, and the panting little beast was pulled to a sudden turn. He looked around inquiringly.

"Nope! Nothing doing. Dad's counting on me. Let's beat it back." Clint's eyes tore themselves from the heights, his jaw squared, and soon a determined arm was jerking a fallen fence post into position.

The sun had perched on the highest peak ready to slide over when Clint's alert ear caught a far droning. Louder it swelled, and louder. His gaze leaped toward the oncoming roar and met the glint of wings that far outshone those of the eagle in bigness and might.

Proudly the great man-bird curveted through the Saddle of the West Range, swooped then to a steady whir as though to graze the boy's upturned head, and drove into the lower horizon, straight and swift and beautiful.

It was the nearest Clint had ever been to an airplane. He thrilled at the sight, to the sound, to the power of it. His fingers tigled to get hold of the throbbing motor. His heart pounded for release. His spirit longed to soar. Wings! That's

what he wanted. Yes, wings! He, too, would fly with the sureness of an eagle, with the daring purpose of a mail courier.

"Dad," he said that evening, and waited for the graying head to lift and for the calloused fingers to loosen their grasp on the stub of a pencil which somehow would not figure satisfactorily.

The older brown eyes looked a question into the younger.

"I've decided. I'm going to be a mail pilot. An air school's what I want—not regular college."

The experienced eyes searched the eager youthful ones a long, appraising minute. It was as though the man was seeing his son for the first time, no longer a child, but a potential man. The nobby fingers tightened on the stub of a pencil. But the voice was matter-of-fact.

"Are you sure—*plumb sure?*"

The boy nodded.

The man chewed the pencil. Another long minute he weighed the answer.

"Very well, Son. You may never be a Lindbergh. But character's what counts —flyin' or ranchin' or what not. If you can keep as straight as him, go to it!"

Electrified, Clint jumped to his feet. "Oh, Dad! When?"

The broad shoulders shrugged noncommittally. The troubled eyes returned to the obstinate figures. The tan brow furrowed.

"There's the hitch. I'm in a hole, plumb deep. I'll pay you, though, same as the other hands. An' it's up to you. But," he warned, "It'll take a mighty stiff course in savin' before your wages pile up much."

Clint's summer went by on wings, wings shining with hope, wings heavy with waiting, great droning wings beckoning him into the world of action.

From before sunup till past sundown the big silent lonely man and the eager silent lonely boy would cram the hours with work. Then after supper the two would drop onto the creaky old plank steps, talking a little sometimes, oftener simply resting, neither probing into the thought of the other.

For Clint the bright spot in ranch routine was the now regular zooming over the Saddle of the air mail. How he watched for that glint of wings. And how he thrilled to that sound of conquest. "Some day," he would promise himself, "I, too, shall fly!"

Twice during the summer the people of the Mountain Side met for an all-day picnic and barbecue. On these occasions Mr. Warren as master of ceremonies was the center of the middle-aged group. Clint gravitated to the younger set. Here he learned that he was not the only Lindbergh enthusiast. All the boys wanted to fly, or thought they did. But Clint knew he wanted to fly, knew it more deeply every day. Of course he could not earn enough to go into training this fall. Perhaps the next. Or surely the year after. So he worked and saved. He subscribed to a technical journal and read up on aircraft till he knew every detail of airplane anatomy.

The last of September came the belated shearing. Fifteen days of gruelling labor filled the mohair bags to bursting and turned loose a thousand naked goats, their clipped skin showing pink and shivery in every cooling puff of air from the mountains.

"If the price should be good," Clint conjectured, "maybe, just maybe, part of the mohair money will go to swell my aviation fund. Dad always went halves with his last dollar to put me through High."

But Mr. Warren did not mention money prospects. Apparently he had forgotten about his son's ambitions. "Must

His spirit longed to soar. Wings! That's what he wanted.

be studying over troubles of his own," the boy concluded, and dutifully paid for overalls and shoes and even a new saddle blanket out of his own scant hoardings.

It was the first of November when the mohair sold. "Price is up. Ought to pull me out of the hole and then some!" chuckled Mr. Warren as he spruced up that morning and rushed off to town in high spirits. "Look out for the goats, if a rain should blow up," was his parting admonition. "They're still too short of hair to stand a wet norther."

Clint's hopes tingled afresh. All day his thoughts winged high. And all the following day. Toward evening the phone rang. "Dad at the Half-Way Ranch!" Clint flew to answer.

"Be home in a couple of hours," his father said.

"Yes. Top price!" A pause. Then, "Er—er—got a surprise for you!" The voice was jubilant. "You couldn't guess in a hundred years! So long."

Click went the receiver.

"Couldn't I, though!" grimaced Clint, and hurried about his night work. "There's only one thing in the world I want. Dad must 'a' been aiming to help me all the time and made out like he'd plumb forgot! Air school opens November 15! Can I be ready? Sure I can. Oh, boy!" Clint, the taciturn, banged the milk pails so hilariously that the glum old Juana brightened all over and met her herder husband with a playful cuff of affection which set old Andres glowing and chuckling too.

The mountain shadows were striding darkly down the road when Clint's listening ear detected the labored chug of an engine. His quick eye located the familiar headlight of his father's car nosing its tortuous way up the rock-studded road. His heart gave a leap. His feet bounded to the gate. Nervously his hand found the latch. The protesting hinges creaked wide, and Clint stepped back to wait.

A squawk startled the air. "Squawk! Squawk!"

Clint wheeled and tore to the chicken yard, grabbing both hands full of rocks as he ran. Abruptly the commotion stopped. A black-and-white object streaked up the hill beyond stone's reach. Clint's rocks chunked the bushes furiously, but the skunk had escaped with its prey. He turned and hastened back to where the car had stopped.

His father stepped down with surprising agility, darted around to the opposite door and helped out a bulky somebody with a middle-aged face that simpered youngishly in the half-light.

"Son," called his father, swelling with pride, "a mother for you!"

Clint stared.

"We were married last night!" the man's voice was saying.

Limply the boy stuck out his hand. Mechanically his lips moved. But no words would come. He felt a hand close puffily over his. He heard a voice purr kittenishly: "I met you at the Fourth of July picnic. You remember Miss Annie Mae, don't you, dear?"

Clint remembered.

"There flashed before him a vision of pink-frocked bulkiness, of middle-aged attempt at youthfulness, of the way the old gossips tittered whenever the florid Miss Annie Mae would smirk, "Oh, Mr. Warren, do you really think so!"

"Yes'm," Clint managed to reply. "But I didn't know——"

"Sure you didn't!" chuckled his father. "That's the surprise!"

Surprise, indeed! Clint bolted for the house, then dutifully slanted off to close the road gate. But the springiness had gone from his step. A cruel weight slowed the pendulum of his heart. Like

an aged man he clumped indecisively back and dropped heavily into his chair at the supper table.

There are two kinds of loneliness. The kind that walks with another solitary figure is not so bad. But the loneliness of a third party becomes unbearable. Clint withdrew into his shell and clamped it shut. And neither the chattering bride nor the beaming groom guessed the hurt behind the masked face.

Even the election-day picnic and barbecue two days distant paled into insignificance. And trips to the county seat had always been an event.

"I adore picnics," purred the new Mrs. Warren, rising from the supper table and letting her interested gaze light on a magnificent deer head, the one adornment of the bare room.

"Not much of a honeymoon," Mr. Warren admitted, crossing to the old sofa and rummaging through the mail bag. "But we can go to-morrow evenin'. Reckon Clint can see to things here and come on with the Joneses next mornin', can't you, Son?"

"Yes, sir."

Clint took the newspaper which his father tossed him and drew his chair into the scant light of the kerosene lamp.

At the first headline his eyes started. His pulse quickened. "AIRPLANE MEET AT CENTERVILLE," he read, "AT TEN A.M. WORLD FLYER COMING IN INTEREST OF THE NEW AVIATION SCHOOL. A Scholarship to be awarded from this senatorial district. Who knows but Center County may win it."

Clint's eyes gulped the words. His heart stood on tiptoe.

"Application for scholarship must be made in person."

The hand that held the sheet shook with excitement.

"Oh, Dad——"

But the sofa had no ears for a third person. So Clint read the notice to himself again. And again.

"Applicants must be over eighteen—" And he would be eighteen to-morrow! There would be an alertness test. An endurance test. Adaptability, character, and personality would score big. The world pilot would cast the deciding vote.

"And I stand a chance!" he exclaimed under his breath. "Oh, Boy!"

Another glance at the pair on the sofa, and Clint slipped off to his own room unnoticed. His strong-muscled body, drenched in outdoor fatigue, and his healthy boy-mind, spent with the day's tension, soon relaxed in sleep. But all night long his spirit sailed dream-high in a whirling maze of gyrations. Wings! Wings! The air seemed to vibrate with the whir of them. Great eagle wings! Even greater man-wings! But—always they would dodge beyond the reach of one lone boy and fade out, leaving him to jog through life on an inadequate pinto pony.

The next day Clint pushed gayly through the ranch routine on the remembered wings of the night. The sun beat down hot—too hot, as though summer, jealous of autumn, had renewed hostilities with a vengeance. Toward two o'clock Clint, coming back from the lower goat camp, met the bridal two en route to Centerville. He drew rein.

"Look after the goats, Son," was Mr. Warren's time-worn injunction.

"Yes, sir."

"I told the herders if the sky ain't clear in the mornin' not to take 'em out till the sun comes out, if it's noon. All you've got to see to is that they're penned to-night."

"Yes, sir."

"Jones said to tell you he'd be by before sunup. Adios!"

His companion echoed: "Adios, dear."

Clint, unused to terms of endearment, gave a shrug of dislike for that honeyed *dear,* and urged his slow mount into a sweating homeward jog.

An hour or two later the too-warm air began to quiver with an ominous something. Clint shot a glance of foreboding toward the mountain range. He saw the sky bend darkly down and wrap the peaks in a thickening blanket of gray.

"The goats are headed this way by now," he calculated. "They'll make it in all right." And he went on splitting the day's supply of stove wood.

Another hour, and Autumn swooped down, Winter pressing at her heels. In sharp, swift combat they routed Summer utterly.

Old Juana came running out, alarm registered on her seamed brown face. "Malo zwerte!" she cried, gesticulating toward the sky. "Chivos! Oo-oo-oo!" She wound her apron about her shoulders and shivered in imitation of the goats.

Clint too had felt the sudden change. With quick decision he flung into the saddle and spurred his horse up the trail. The far ki-yi-ing of old Andres struck a glad response. Soon Clint was at his side, helping rush the flock ahead of the storm. The pattering of those nimble feet rhythmed down the rocky slopes like the music of innumerable little hammers. The silky slithering of those shorn bodies through the dry brush sounded good to the boy entrusted with their safety.

With a heave of thankfulness he swung to the ground beside the corral gate to count the wind-hurried goats as they scudded to shelter. José five hundred from the lower camp were already penned.

"Help me, José!" he directed.

The young herder stepped opposite. "One hundred." The rapid, accurate count tallied. Then "Two." Now "Three hundred!" And "Thirty!"

In swift apprehension Clint looked up. His sweeping inquiry searched the nearer hills. Not another goat—anywhere!

"Andres!" he shrilled to the old herder, who came limping after the last stragglers. "Where are the rest of the chivos? One hundred seventy missing!"

The old man dropped his staff, threw up both hands in protest. "Quién sabe!" he shrugged. "Quién sabe!" The withered brown face contorted with consternation. Snatching up his staff, the distraught herder set off in a frenzied trot up the slope.

Clint raced after. "Come on, José!" he commanded. "Undalee! We've got to find those goats!"

Like mad the boy spurred his pony on. Up, up he rode into the snarl of the storm, the fury of the wind lashing boy and pony, the thin wisps of sleet blinding the air.

Night came on, black night. And still the three searchers combed the slopes. Clint far in the lead. "If they don't show up pronto," he reasoned, "they're goners, sure."

Higher, higher! At last, oh joy! He descried a line of huddled white against the gray base of a half-protecting cliff. Closer approach revealed other shivering creatures, here and there, in twos and threes, under leaky clumps of live oak brush, bleating piteously as he came upon them.

Having found the lost, his next problem was what to do with them. "Can't drive 'em to the pens," he told his men. "But they ought to make it to the cedar brake down in the flat. They can't hold out here much longer, that's one thing sure. Come on. The sooner we get 'em started, the better."

But saying and doing are two different propositions. Frightened, half-chilled goats don't drive.

It proved an all-night job, ousting from under the flimsy bushes perhaps only half a dozen here and fewer yonder, giving them a pull and a forward shove, dragging them out, goading them on, keeping them moving down, down the slippery rocks toward the shelter of the great cedars, and scrambling back after fresh relays, even carrying the fallen ones in their arms and in tow-sack stretchers.

South of the cedar brake and at a safe distance from the trees, should the wind veer, Clint had Andres keep a big fire blazing. Here the old herder rubbed the chilled goats back to life as Clint and the young herder brought them down.

Hours of this—tense, black, sleet-blinding hours. And still Clint kept old Andres piling on cedar boughs, which lighted the night weirdly; kept José working shoulder to shoulder with him in desperate endeavor till all but twenty were in.

They're hid out somewhere," Clint concluded. "Have to wait till daylight to make another round. Here's hoping they've found a cave."

Suddenly above the bleating of the goats and the crackle of the fire and the whistling of the wind sounded a distant droning. Clint cocked his ears. With an oncoming whir the noise zoomed through the saddle of the mountain. Louder. Lower. Louder. Now the roar was whirling close overhead. A drizzle-thickened light explored the flat in narrowing circles. Then zip! bang! The thing flopped to the ground not a hundred yards from where Clint stood gaping, and skidded into the clearing opposite the bonfire.

Clint ran forward. The plane wobbled top-heavily, gasped, and stopped. Out hopped a tall young fellow and jerked off his vizor.

The strained tenseness of his features relaxed to widespread relief.

"We're safe!" he grinned. "Thanks to your signal fire!"

"Engine trouble?" Clint stepped up and laid an inquiring hand on the still trobbing super-bird.

"Nope. Sleet. Wings got iced and went flooey. Like to have never found a landing place. Had an awful time to keep from hanging on those mountain jags. My flare wouldn't show much through that ice drizzle. But yours cleared things up for me."

The pilot was examining his plane, knocking the ice coating off the wing fabric, ascertaining the nature of the damage.

"Need help?" Clint offered, eager to put some of his book knowledge into practice.

"Sure do." The stranger looked about. "What's this, anyhow? A goat camp?"

Clint explained. With an agile dart he snatched up a kid that had toppled over and steadied its feet. Then as quickly he knuckled down and shifted the position of an old nanny that was scorching on one shoulder and shivering on the other.

"Andres, don't let 'em cook!" he warned. "José, drive those back under the cedars; drag that dead one away; and help Andres with these." Then he turned to his guest. "Keeps a fellow on the jump!"

"I should say!" The pilot nodded understandingly, and stretched his palms to the fire. The light of the flames revealed a masterful face with admiration written strong, the admiration of one hero for another. "Life-saving night of it! Whole bunch of goats. Then my ship and me for good measure. Some job!"

With sudden recollection he dived into the fuselage after the tool kit and the two fell to work, Clint keeping one eye on the Mexicans and their charges, and the other on the work in hand, managing both with growing dexterity.

Daybreak found the plane ready for flight.

"Thanks, awfully!" glowed the satisfied flyer, and buckled on his parachute pack. "You should go in for aircraft yourself."

"I am."

The eagle eyes gave him a sharp, penetrating "once over." "You'll make good!" came with conviction. Then, "Coming to the air meet to-day?"

The eagerness went out of Clint's face, the hope out of his eyes.

"I'd figured on it, big," he admitted. "But"—with a backward gesture toward the cloud-wrapped mountains—"there's another handful of goats to rustle. And"—his jaw squared—"Dad's counting on me."

Swift sympathy leaped into the man's eyes, and crash went the boy's reserve. And Clint blurted it all out: his longing, his hope for a chance at the scholarship, his disappointment.

"Too bad, old scout." The pilot gripped his hand, then stepped into the cockpit. "You've got it in you, all right," he called back. "It takes more nerve to stay on a job like this than to hop off to—the moon!"

And he was gone.

Toward noon the sun broke through the chill air, drying it with high-altitude rapidity. Clint, returning from a fruitless search, met the lost twenty.

Grimly he stumbled on after the browsing goats. Presently he lifted his eyes to the sound of a plane's motor. Why, it was coming back. Returning from the air meet. Arrow-swift they held their course, with a crescendo of sound. Two snouted bodies circled now and climbed and hung in midair. The third dipped and pinwheeled to earth. Clint caught his breath. His friend of the morning! He ran forward.

The pilot leaned clear out of the cockpit. "Hello!" he grinned. "It was great. Sure wished for you!"

"The world pilot, was he there?" Clint wanted to know.

"Sure. It was he that pulled the vote for you!"

"Me?"

"Ye-ah. For the scholarship." He drew out an official-looking envelope.

"But the tests," faltered Clint. "I—I don't understand."

The other laughed. "You passed them last night and this morning. Emergency test, endurance, mechanical aptitude, stay-on-the-job qualities and all that sort of thing." He tossed him the certificate and started his engine.

In a daze Clint read it. Comprehension began to dawn. His heart pounded unbelievingly.

"You!" cried the boy, running after, "are *you* the world flyer?"

The pilot answered with a mischievous twinkle. "See you the fifteenth," he grinned. "They've put me there for a few weeks of instruction." With a comradely wave of the hand he soared to join his fellow planes.

"The world flyer!" repeated Clint, his eyes following the fascinating glint of wings. "And I too—shall fly!"

The Hall Distance Model

Flies a Mile—Costs Less Than a Dollar

By Joseph J. Lucas

THE Hall distance model airplane is an outdoor type, built and flown by Thomas Hall (a pioneer model builder), of the Illinois Model Aero Club. This Hall distance model broke the world's hand-launched distance record with a flight of 5,337 feet (57 feet more than a mile) during the National Model Airplane Competition in 1916, and held this record up to 1924, when Robert V. Jaros, of the same club, made a world's official hand launched distance flight of 7,920 feet during his record-breaking duration flight of 10 minutes and 14⅕ seconds at the Dayton National Air Races.

This model is a very simple type to build, and is a very strong one for all-round flying purposes, its frame longerons and main wing beam being made of pine or spruce.

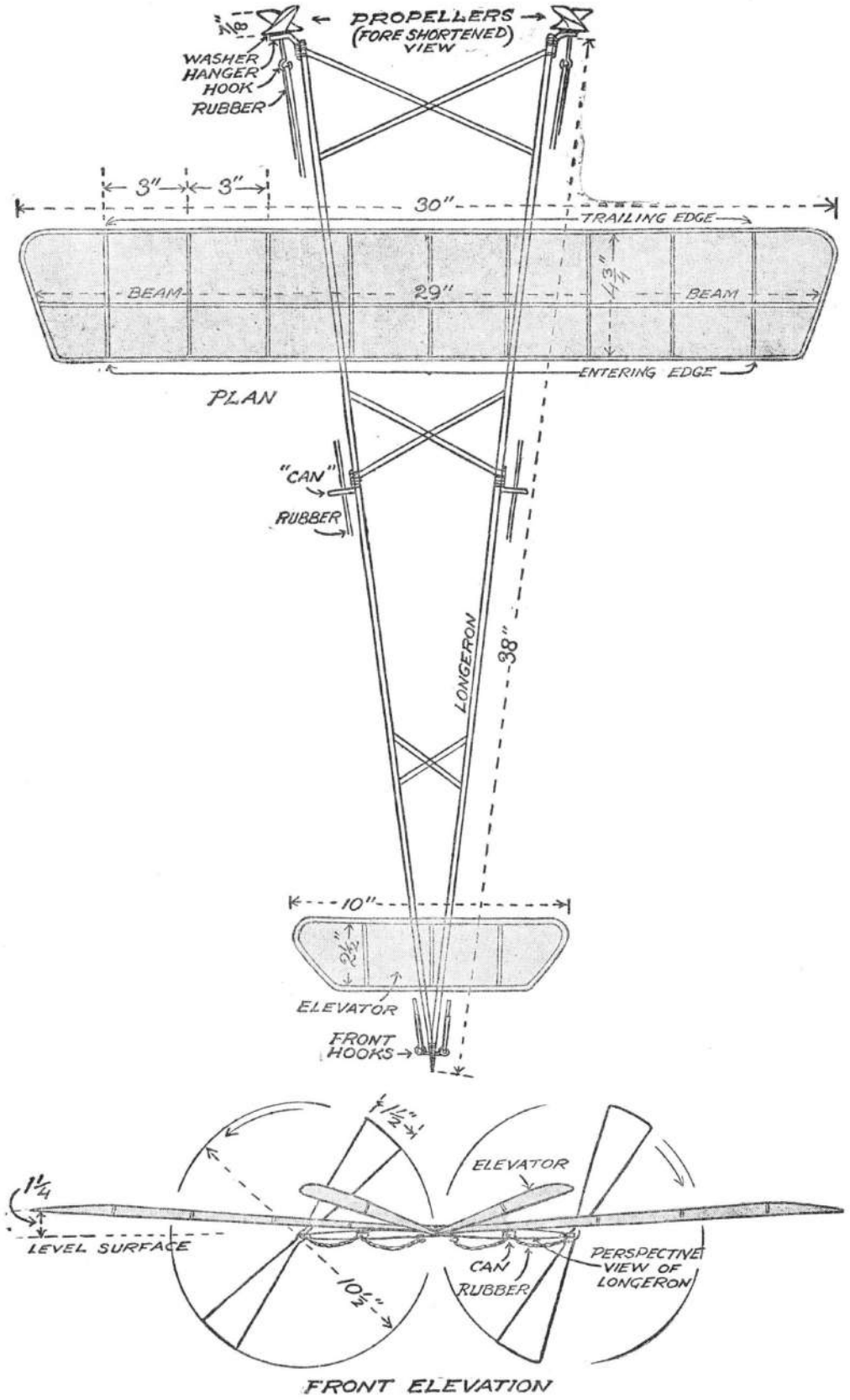
Only a few tools are needed—a sharp knife, long nose pliers, small block plane, razor blades, ruler and several pieces of fine sandpaper. The materials for building this model, such as the bamboo, pine or spruce, piano wire, paper, rubber, doping solution, and ambroid or glue, cost less than a dollar. The amount spent for materials and tools will be more than compensated for by the experience in building the model and the pleasure in flying it.

Propellers

The first parts of the Hall model to build are the propellers. Propeller carving is not an easy job and great care should be taken, for the reason that the success of the model's performance depends upon how well they are made. The propellers are cut from 10½"x1½"x⅞" pine or spruce blanks. Diagonals are drawn with pencil on the 1½ inch faces from corner to corner; true holes drilled at the intersections of the diagonal lines for inserting propeller shafts, and ¾ inch circles drawn around the holes to allow for the hubs. Then the blanks are sawed along the outside of the lines, allowing for the hubs at their intersections. The propellers are now ready to be carved. Both are carved alike, except that they are cut to turn in opposite directions, revolving outward from the center on top. When properly carved, the propellers are sandpapered to the proper thickness. See that they are perfectly balanced; if so, dope them with banana oil. Bend the propeller shafts into shape, using No. 16 piano wire, and insert in the hubs with ambroid or glue; bend the ends over to anchor, but do not indent. Be sure the shafts are ambroided or glued securely and that the propellers are again perfectly balanced and shafts of propellers are true. Then put a few copper or brass washers on the shafts for bearings to reduce the friction.

Frame

The next part of the hand-launched dis-


PROPELLERS
(FORE SHORTENED)
VIEW
WASHER
HANGER
HOOK
RUBBER
3"
3"
30"
TRAILING EDGE
BEAM
29"
4 3/4"
BEAM
ENTERING EDGE
PLAN
"CAN"
RUBBER
LONGERON
38"
10"
2 1/2"
ELEVATOR
FRONT
HOOKS
1 1/2"
ELEVATOR
1 1/4
LEVEL SURFACE
10 1/2"
CAN
RUBBER
PERSPECTIVE
VIEW OF
LONGERON
FRONT ELEVATION

tance model to build is the A-frame motor base. The longerons are of pine or spruce strips 38 inches long with a rectangular cross-section of 3/8"x3/16". The longerons are tapered toward the ends and sandpapered very smooth; then coated with banana oil or airplane dope. When longerons are coated, the inside front ends are wedged and put together with silk thread and glue. No. 16 piano wire is then bent to form two hooks, called the front hooks, to hold the rubber in place, and fastened to the nose of strips with silk threads and glue. The longerons are separated by three X-shaped braces, made with straight pieces of bamboo, 3/16"x1/16" cross section. The ends of the cross braces are made wedge-shaped on both sides. Slits are made in the longerons at their proper places and cross braces are inserted and fastened with ambroid or glue. If these joints are made with ambroid and done carefully they will not require binding. The bearings or hangers for the propellers are made from No. 12 wire. The hangers are made by flattening the wire to proper shapes, with small holes drilled to fit propeller shafts, and then glued and bound to rear outside ends of longerons. The two "cans" are bent to shape out of No. 18 piano wire, and fastened with thread and glue at their proper places as shown in the drawing.

The shape into which the wire is bent to form the "can" was shown in the illustration to my article on the Lefker model in the February issue.

Main Plane

The main plane or the wing is the next thing to construct. The main wing is the important part of the model and great care must be taken when building it. The wing has a span of 30 inches and chord of 4 3/4 inches. The wing beam is 29 inches long, with cross section of 5/16"x1/8". The beam is sandpapered smooth and coated with banana oil or airplane dope. Then the beam is cut into two equal lengths and joined together again by two 1"x1/32" pieces of bamboo, which are bent to the required dihedral angle of the wing as shown in the drawing and bound with thread and glued or ambroided.

The required dihedral angle can be checked by balancing the beam, after it is put together at its center, on any level surface. If each end of the wing beam is one inch above the surface the angle is correct.

The bamboo ribs, nine in number, are 4 3/4"x1/16"x1/8" with a curvature of about 1/8 inch. To get the required curvature bend bamboo ribs over a flame. For this purpose a low flame such as produced by a candle is satisfactory. The ribs are bound and glued or ambroided to the 5/16 inch edge of the wing beam and at their proper places as shown in the drawing of the main plane. Then cut two straight strips of bamboo 24"x1/16"x1/32" for entering and trailing edges, and bind and glue to ends of bamboo ribs. The wing tips are made of one piece of bamboo about 10" x1/16"x1/32" and bent to shape over a flame and then split in two. By splitting the bended bamboo in two you have your wing tips symmetrical. Bind and glue or ambroid wing tips to the ends of outer ribs and beam. The wing is covered on top with Japanese silk tissue paper. A very good method for gluing tissue paper is to apply banana oil. Cover the top surface with tissue paper, cementing with dope to the ribs, entering and trailing edges, and wing tips and drawing each section of the paper taut, particularly along the wing rather than across it, in order to preserve the shape of the section. Then trim the paper off around the edges and dope the surface with a weak doping solution.

The Hall Distance Model

Elevator

The elevator or front plane measures 10″x2½″, and is entirely made of 1/16″ round bamboo. The elevator bamboo framework consists of two halves, which are bent to shape as shown by the drawing. Use one piece of bamboo 3/16″x3/32″, heat over a flame, bend to shape and split in two, so that both halves are symmetrical. The bamboo halves are sandpapered and rounded to 1/16″ in diameter. The halves are put together to the required dihedral angle of the elevator as shown in the drawing, and bound with thread and glued or ambroided. The required dihedral angle can be checked by the same method as described for the correct dihedral angle of the main plane. The three bamboo ribs are 2½″x1/16″x1/32″ with a curvature of about 3/16″. Bend over a flame for the correct shape. One rib is then fastened in the center while the other two are fastened on each side 2½″ from the center. The ribs are secured to entering and trailing edges of elevator with ambroid and silk thread. The elevator is single-surfaced; cover the top only with Japanese silk tissue paper and dope with a weak doping solution.

Power

The required power to fly the model is 8 strands of 3/16″ flat rubber for each motor. The strands should hang loosely between the two hooks. In the front end, the rubber should be attached to S-shaped hooks, bent to shape out of No. 16 piano wire, which permit the rubber to be detached when winding the motor with a converted egg-beater.

Flying the Model

Knowing how to fly the model is very important. When the parts are all made and the set of motor strands are made up, you are ready to assemble the parts of the model.

First fasten two ¼ inch elevator blocks to the frame about 2½ inches back from the nose of the motor sticks, to give the elevator a correct incidence angle. The elevator is held in place by a rubber band. The main plane is placed on the frame a short distance behind the middle X-brace, and held in place with two rubber bands. The propellers are put on next and the rubber motors hooked to the front nose hook and propeller shafts, passing through the cans.

Glide the model first before winding up rubbers. If glide of model is too steep move main plane forward and glide it again. If model stalls while trying to glide, move main plane backward and try again. Glide the model a number of times until you have the right adjustment for the proper glide. Your model should glide four or five times the distance you hold it above the ground when launching it for gliding. When model glides well, wind up rubber motors with an egg-beater winder. Before winding be sure your rubbers are stretched two or three times the length of the frame. Wind rubbers until you have about one thousand turns of the winder, and are very near to the front nose hooks of frame. Unhook rubbers from winder and attach motors to the nose hooks. See that the rubbers are properly placed in "can" and the elevator and main plane are secured well to the frame. After careful inspection you are ready to launch the model for flying. In launching hold the propellers, one with each hand, and point the nose of model upward at about an angle of five to ten degrees. Release propellers and push model forward gently. If model climbs too steep or stalls, move main plane back a little. If model does not climb very well, move main plane a little forward.

The Hall Distance Model

If adjustments of main plane are made carefully good flights can be had. Remember, if you want to keep your model in flying condition, care must be taken in assembling, winding and launching, as it is fragile. If you study the drawing of the model and carefully follow the instructions for building and flying, you may equal or even better the Hall distance record of 5,337 feet.

List and the Cost of the Materials to Build the Hall Model Airplane

The most expensive material on the Hall model is the rubber. The cost is about forty cents. It can be purchased from any model supply house.

The long strips of pine or spruce for the frame and wing beam for the wing can be bought from a carpenter shop for about ten cents.

The propeller blanks can be sawed out of pieces of pine or spruce about one inch thick, eleven inches long, and two inches wide. This material can be bought from a carpenter shop for a few cents.

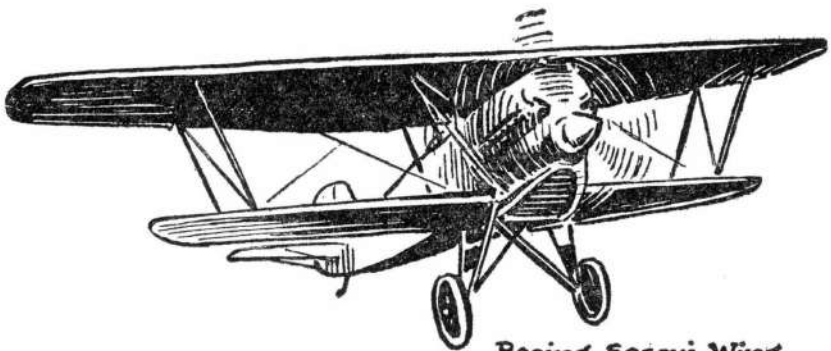
The Japanese silk imperial tissue paper which the elevator and wing require (about one sheet) costs about five cents at a model supply house.

You can use the bamboo from an old fish-pole or porch shade for bamboo parts of the model.

Ten cents' worth of piano wire from a model supply house is enough to make the nose-hooks, and cans for the frame and shafts for the propellers, and S hooks for rubbers.

A fifteen-cent can of ambroid for gluing the model parts together and ten cents for doping solution for the wing and elevator are ample.

The total cost of the materials to build the Hall model will be less than a dollar.



Boeing Sesqui-Wing

The Diesel Engine

By Augustus Post

ONE of the first known uses of the principle of "compression-ignition" was the method of making fire by the use of the fire-piston and air-tight cylinder in use in Burma.

The origin of their fire-piston is a most baffling question and has kept scientists guessing very much like the question of the origin of the boomerang used by the bushmen of Australia. Even to-day, if you were traveling in the windy jungles of Burma, your coolie would light his cigaret with his little fire-piston if the wind was high. He would put a little grease on the end of the piston, to hold a wad of cotton in place and to seal the sides so no air could escape, then with a quick snap and stroke by the palm of his hand, he would force the piston into the air-tight cylinder, made of hard wood or bone with a hole drilled in the center. This he would hold in one hand while driving the piston down with the other. The compressed air becomes hot enough to ignite the cotton so that when the piston is quickly withdrawn the cotton is already aflame. If, at the moment when the compression of the air in the cylinder is the greatest and the temperature the hottest, we could pump into the cylinder a fine spray of oil in just the right amount, it would be burned and cause great power by its rapid expansion and it would drive the piston out of the cylinder with the force of an explosion.

This is the basic principle of the newest aeronautic engine of to-day, the "Diesel" type heavy oil engine, the modern use of which marks a new turning point in the rapid development of aviation and mechanical flight (see illustration).

The Diesel engine made the submarine effective, for the fumes of gasoline were easily exploded by chance sparks and many accidents followed. Herr Diesel, a famous German inventor, knew that compression of any substance makes its temperature rise. He thought that if he could produce sufficient pressure, he could use an inert, inexplosive substance which would take much less room than the ordinary forms of fuel. He found the burning-point of the crude oil which he expected to burn. He determined the resistance which should be offered by the cylinder walls as well as those chambers in which the explosion took place. He obtained sufficient capital to enable him to make a model. When this was finished and things were ready for trial, interested persons were called in and put in positions of safety from which they could observe the workings of the machine. Diesel, the only one who stood in the immediate neighborhood, started it going. A terrific explosion blew the machine to pieces, and put its inventor in the hospital for many months. It is said that when he regained consciousness, he was very happy, for his invention worked. That it worked too well was the trouble. The walls and the chamber in which the ex-

plosion occurred had been made too thin and too weak to stand the explosive force. When this fault had been remedied in the second model and the amount of oil in the chamber reduced, a successful trial was the result.

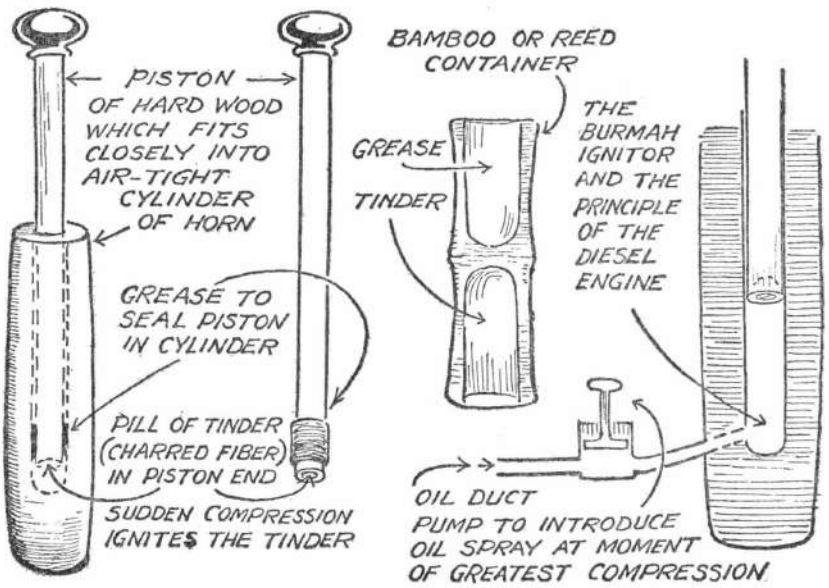
Ever since the Wright brothers made their first machine, the only fuel used in airplane engines has been a light explosive in the form of gasoline, highly inflammable and very uneconomical on account of the large quantities which have to be consumed. This was necessary because heavy engines were impossible, as airplanes could not lift them. While the airplanes have developed to a point where they can carry relatively heavy motors the Diesel type engines have been made lighter by the use of modern very light and very strong metals and special methods of pumping in the fuel in the form of a spray.

Professor Hugo Junkers has been testing a 600-horsepower oil engine in a large airplane at his works in Dessau, Germany, while the Packard Company in Detroit have been testing a nine-cylinder, air-cooled radial engine closely resembling the Wright Whirlwind, except that it only has one valve functioning both for exhaust and for taking in air to mix with the fuel oil.

The Packard Motor Company has been working for the last five years in the development of this motor which was flown from Detroit, Michigan, to Langley Field, Virginia, a distance of 650 miles, at a cost of only $4.68 for fuel, less than a cent a mile. The cost of gasoline as fuel would have been about $25. It is said that 90 gallons of crude oil will carry a plane equipped with this motor as far as 100 gallons of gasoline would take the same plane equipped with a gasoline engine.

The Diesel engine takes petroleum oil, sprays it into a combustion chamber filled with highly compressed air, and automatically ignites the explosive mixture, not requiring any electrical ignition or spark plugs.

The economy of fuel load amounts to a



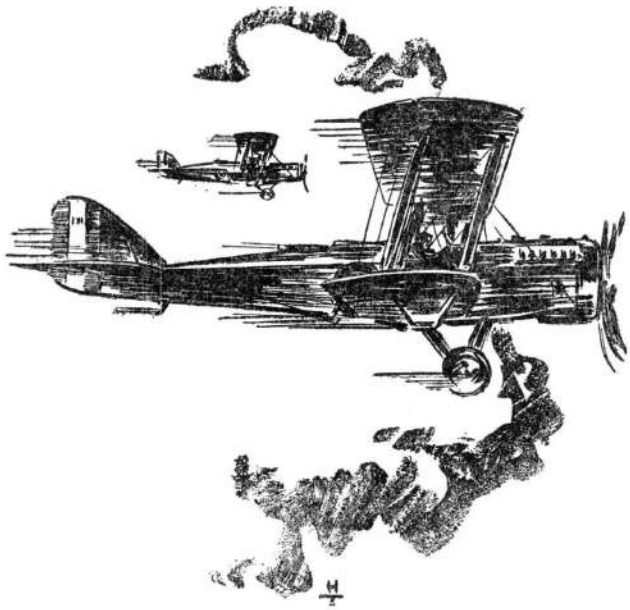
40 per cent saving, and although the engine weighs more than a gasoline engine of equal power, or about three pounds per horsepower compared to two pounds for the ordinary motor, the difference in weight is more than compensated for by the lesser weight of the fuel.

This is but one of the advantages claimed, the others being: (1) that risk from fire is greatly lessened; (2) that as there are no magnetos or electrical ignition required, there is freedom from interference in wireless communication; (3) the range of flight is increased, because less fuel is consumed under all conditions and especially at cruising speeds; and (4) there is greater reliability because all electric ignition apparatus is done away with.

The importance of gaining freedom from interference with wireless communication is one of the most valuable points on account of the increasing use of wireless beacons and other direction-finding apparatus.

The Diesel engine has completely revolutionized ocean navigation: it has brought about new speeds, brought into being new types of ships. It may make an equally important change in aircraft especially in view of the fact that one of the large airships now built in England, the *R-101,* is to be driven by oil engines; motorcycles are operated on the Continent, with single-cylinder Diesel engines as well as motor cars and motor boats.

It will take some time, however, for new and basic improvements, however important, to equal the reliability and confidence in motors which have already gone through the successive stages of production in large numbers.



The Pigeon V. C.

By Captain J. Winchcombe-Taylor

Illustrated by Harry H. A. Burne

A COLUMN of mud and water shot up not ten yards from the tank on the left. Bobby Dare watched it closely.

"Mr. Blore's bus is getting strafed pretty badly! Hope it isn't our turn next!" he shouted to his driver, Corporal Rafferty.

The man nodded tensely, his eyes on the shell-pocked ground in front. For three hours now, the tanks of the battalion to which Bobby and his crew belonged had been wallowing through the morass caused by many thousands of shell holes, all but the most recent of them filled to the brim with autumn rains, rains which had done far more than had the enemy to prevent the British Army in Flanders from reaching its summer objective—Paschendaele Ridge.

Concrete blockhouses, better known as "pillboxes," and a brave and determined enemy supported by thousands of machine guns had not stopped the advance to any extent, but the weather had, and even now, on this October day, the attack was breaking down and being scattered entirely because of the eternal mud, mud, mud, which sucked greedily at man, gun and tank and drew them into its slimy, hungry maw.

Sixteen machines had started off at dawn to the attack, and to Bobby's knowledge already at least ten of them had been ditched even before the hostile guns had started to fire at them. But now that the remainder had reached higher ground which had not suffered so much from shell fire, the German batteries were becoming active.

Cr-u-u-mp! Even above the roar of the 105 H. P. Daimler engine, the young American heard the explosion and swept his eyes toward the companion tank just as it became enveloped in a cloud of black smoke. Hardly had this drifted away, exposing a gaping hole in the side of the stricken machine, before tongues of yellow flame shot from all portions of it until it became a blazing mass.

Bobby gritted his teeth to choke back a cry. Blore had been a good pal of his, and he hoped that he and his crew had been killed outright before the fire had reached them.

But his own position allowed little time for sympathy for the battery that had

knocked out Blore would now, in all probability, turn its attention upon him.

Three hundred yards ahead was the shattered skeleton of a small wood, and on its forward and western edge stood a dark rectangular blockhouse of reinforced concrete which had hitherto held up wave after wave of the British infantry, in spite of the battering it had received from the heavy howitzers. This was the first objective of Bobby's company; but as now his machine was the only one to survive the advance through the mud in that sector, he must attack it alone.

At present, however, he regarded it more as a haven than a target for he knew that once close to it he would be immune from shelling, as the German gunners would be afraid to fire lest they damage their own strongpoint.

A stream of bullets from it spattered against the tank and made him snap down the flap of his window hurriedly. As he did he felt the concussion of a large shell, which plunged deep into the sodden earth not five yards in front and threw up a huge volcano of water mud.

"If we're to get out of this alive, don't get ditched now!" he shouted in Rafferty's ear. "If we can get close to that pillbox, we'll be safe for a while; otherwise we're done."

Rafferty nodded, and swung to the right to avoid the crater made by the shell.

The last three hundred yards seemed interminable to the remainder of the crew for, unlike their officer and driver, they could see very little of what was happening, and all they could hear above the noise of the engine were the bursts of heavy shells, sounding nearer and nearer until the next seemed certain to blow them to atoms. For hours they had been cooped up in the stuffy machine, the only light coming from the two window flaps in front, when they were open, and when not, only from the peepholes and the slots in the gun mountings.

The heat was so oppressive that every man was soaked with perspiration, and the atmosphere was poisoned with the fumes of gasoline and burnt powder.

Bobby's Lewis gun began to chatter vigorously as he fired at the loopholes of the pillbox, and the gunners, seeing him, peered through their own slots and commenced to fire as well.

The tank, named *Donner und Blitzen,* being of the male type, carried a six-pounder gun on each side in addition to its machine guns, and Bobby directed Rafferty to approach the pillbox head-on, so that each of these guns could shoot point-blank into its loopholes and emplacements.

The blockhouse garrison fired back steadily with their machine guns, and even as Bobby turned his head to see if his men were all shooting, Sergeant Scott, the left six-pounder gunner, staggered back clutching his shoulder where a bullet, coming through the slot in his gun shield, had hit him. But he was game to the core and without a word opened the breach of his weapon again, inserted a shell and fired grimly.

Many of the shells from the two guns entered the interior of the pillbox before bursting, so that Bobby decided to swing the tank around and prevent any of the garrison from escaping.

The way around was not easy, as splintered tree stumps and broken boles made the going difficult, but at last the *Donner und Blitzen* arrived safely, after having peppered the side loopholes thoroughly. Bobby could see a steel-shielded door, and concentrated the fire of the six-pounders and the Lewis guns until at last it commenced to give. A few more shots and the gunners were able to shoot directly into the dark interior until a dirty white

rag tied to a rifle fluttered out from one side of the broken doorway.

"Cease fire!" shouted Bobby excitedly. "They've had enough!"

There was a pause, then a white, scared face under a massive steel helmet peered from around the jamb of the door, ready to dart back should this terrible death-dealing monster start firing again.

Bobby opened the flap and poked his head out. *"Kameraden?"* he called.

"Ja! Kameraden!" the German shouted back thankfully; then turned to speak to others in the interior.

Most of them were wounded and had to be carried by their companions, groaning and looking fearfully at the tank which had hurt them.

"Alles?" inquired Bobby, using the only other word of German he knew.

"Nein! Oberst Leutnan!" replied the spokesman, and indicated that the officer was still inside.

"All right, I'll take a looksee!" said Bobby, and ordered one of his gunners to accompany him while the others covered the prisoners with their guns.

After the hours inside the machine it was wonderful to feel the ground beneath him and to breathe the pure air again, and this gave him far more confidence than was warranted; for, as he strode carelessly past the cringing prisoners and entered the broken doorway, an automatic spat viciously and a bullet flattened itself against the concrete beside him. Like a flash he drew his own gun and fired back into the darkness, a yelp of pain telling him that his shot had been a lucky one.

With the gunner behind him, he went farther in, his eyes becoming accustomed to the dim light. There were several bodies on the floor, and, crouched in one corner was a slim figure who sobbed and clutched a broken arm.

Bobby approached him, his revolver ready. "Hands up!" he said grimly.

"Curse you!" The English was so perfect that it startled Bobby.

"Who the heck are you, anyway?" he demanded. "Put 'em up or I'll shoot some hot lead into you for firing after you'd stuck out the white flag!"

"Didn't stick it out! Those dirty pigs covered me with their guns and then did it themselves. Can't put my hands up anyway! Can't you see my arm's broken?" The voice was hysterical with pain and anger, but something in the accent caused Bobby to ask curiously. "Say, where did you learn to speak English, anyway?"

The boy, for he was even younger than Bobby himself, spat contemptuously. "I don't speak English, I speak American! I was born in New York City!"

"Huh?" Bobby gasped. "Why, I'm from Manhattan myself! Say, don't you know the U. S. has been in this war since April?"

"Yes, I know!" the other said wearily. "I've been praying I'd be opposite some Yankee troops so's I could give myself up to 'em, but there's none up in his hell, and I'd rather die than give in to the cursed English!"

"Well, you can surrender to me without any fear, though I've been with the British for over three years now!" said Bobby cheerfully. "Anyway, come outside and I'll fix your arm up before I send you back with your men!"

The young German came out of the pillbox frowning so much that his men cringed from him, far more than they did from their captors, and stiffened to attention rigidly as he spoke venomously to them in German. Bobby could not understand the words, but the meaning was enough; for the men became ashen under the lashing of his tongue.

"I'll not go down with these swine!

Do with me what you like, but a Von Krast does not associate with cowards!"

"Look here, young man!" Bobby remonstrated, as he ripped the other's sleeve with a clasp knife, and proceeded to stanch the flow of blood and to put the arm in a splint made of a German bayonet and its sheath. "These men of yours surrendered because they couldn't do anything else, and, anyway, they've got to go back for miles through the mud under the fire of your own guns. They should have someone with them who understands English in case our infantry make a mistake and do not know they've surrendered!"

Von Krast winced under the rough bandaging, but closed his jaw bravely. "I'll not go with them and let the English laugh at me!" he persisted.

"Tell you what, then!" said Bobby. "I'll take you in my bus, if you'll give your word not to escape. If I get through all right, you'll come back all the way with me, and if I'm knocked out, then you'll get knocked out with me! Fair?"

"You'll take me to the prisoners' cage yourself? You won't let those English swine touch me? You promise?" The young Prussian insisted like a child asking a favor.

"Only unless you don't behave!" Bobby promised. "But you must tell your fellows how to get back through our lines. Tell 'em to keep straight down the hill until they see the ruins of Zonnebeke, then to get on the road. By that time they'll be within our lines I expect, only warn 'em to carry the white flag in case of accident!"

Von Krast nodded, and shouted curtly at his men, who picked up their wounded and made their way slowly away.

"Now," said Bobby, "we'll get back into the bus!" He led the way toward the left door of the machine. "Scott!" he called. The sergeant climbed out of the tank gingerly, his shoulder covered in a rough bandage.

"Yes, sir!" he answered.

"This officer will come with us. Feel strong enough to look after him? Let Small work the gun. I don't suppose he'll give you much trouble, but if he does, shoot! Savvy?" Bobby stated.

"Yes, sir!" answered the sergeant, and the look he gave the prisoner indicated that he would welcome the opportunity for trouble. His shoulder was sore, and it was one of the Germans under this officers command who had shot him.

Bobby helped the young German inside. Just as he was about to follow, there was a sudden rush through the air and a large shell landed not two yards from the side of the pillbox. Mud, stones, fragments of steel and pieces of concrete spattered the tank profusely, the direction of the burst indicating that it was a British one.

"Gosh! Looks like our guns don't know we're here!" muttered Bobby as he made his way to his seat on the left of Rafferty. "Let's get out of here before we get crumped! There's that other pillbox to deal with yet. Seen any of the infantry?"

"Not a wan, sor!" replied the Irish driver, and lifted his foot from the clutch.

Hardly had they moved a dozen yards from the deserted blockhouse before two more shells landed around it in quick succession.

"Wait a minute!" ordered Bobby. "Our fellows don't know we've cleaned out that place, so they're shelling it so's the infantry can get on and take it. Hand me the pigeon basket!"

Rafferty put the gears in neutral and pulled a large wicker basket out of the locker on his right, while Bobby busied himself writing a brief message on the special pad in front of him. In a few

words he reported that he had captured the blockhouse and that the infantry could occupy it, as he was going on to attack the other one on the other side of the wood before going on to his final objective on the Green Line.

As he wrote, Sergeant Scott came up behind him and looked over his shoulder.

"Goin' to send the duplicate by the other bird, sir?" he asked.

"Can't afford to send 'em both; we might need the other one later for an emergency!" answered Bobby, as he rolled the thin paper into a quill and inserted it into the tiny aluminum capsule attached to the left leg of the pigeon.

The little creature trembled as he held it in his hands; for it had been scared terribly by the noise of the past hours. "That should be back at the loft in about ten minutes!" he said, and, opening the flap, threw the bird out.

It almost touched the ground before getting its balance, then shot away, gaining height and flying in wide circles until it was a mere speck against the leaden sky, flying back over the British lines toward its loft. But the tank crew were not alone in watching it. From several shell holes in the fields around the wood, rifle and machine-gun muzzles pointed at it and hundreds of bullets were fired, but it kept on and was soon lost to sight.

"Now let's get on and deal with the other joker!" Bobby ordered, and told Rafferty to skirt the northern edge of the wood so as to come on the second pillbox from a flank. At the same time this gave his gunners an opportunity of firing at the groups in the shell holes, and both he and his Lewis gunners found good targets.

At last the *Donner und Blitzen* approached the new objective and opened rapid fire. This time it was not so easy, for the hostile machine-gunners were firing armor-piercing bullets, which, although they did not actually cut through the steel, caused the metal on the inside to splinter into tiny flying fragments which burned as they entered bare skin and were often the cause of blindness to tank men.

Every gun in the machine poured an intense fire against the blockhouse, battering the loopholes or entering through them to burst inside. But the return fire was stubborn, and Bobby discovered his Lewis gun to be out of action. Through the small sighting port he could see that its barrel had been ripped and smashed by bullets until it was useless.

By the time he had inserted a spare gun into the ball trunnions, the machine had crawled directly behind the pillbox and was battering in the door. Shell after shell they fired into the darkness within, yet there came no signs of surrender.

"Cease fire!" yelled Bobby, eager to know if the opposition had been crushed. But the hostile fire, though weak, kept on, and the *Donner und Blitzen* had to approach within a couple of yards from the battered doorway before the shooting from within ceased.

"Here, Von Krast! Tell these fellows inside to surrender! I don't want to shoot 'em all!" Bobby turned and shouted to his prisoner.

The Prussian came toward the back of the American's seat. "I will not advise anyone to surrender to the cursed English!" he said sullenly. "They are good soldiers in there. Not like my swine!"

"O.K. with me!" answered Bobby shortly. "Put her in neutral, Rafferty!" he ordered, and, calling a gunner named Jones to follow, got out of the machine.

Cautiously he approached the broken door. "Anyone in there?" he demanded. Groans were his only answers; so, with revolvers drawn, the two entered.

The tank's work had been thorough this time; for only a few badly wounded

men remained alive. Seeing an ax in a corner, Bobby picked it up and smashed every machine gun there. He would have liked to attend to the wounded, but he realized that his position was too dangerous and that he must push on to his final objective on the Green Line; which, being under a slight ridge, might afford some slight shelter from the enemy shells.

"Listen, Rafferty," he said, when he was back in the tank, "we've got another five hundred yards to go, and it's the worst of all because we'll be under direct observation from the moment we leave here. You'll have to keep swinging all the time to keep throwing the Boche gunlayers off their aim. Understand?"

"Yis, sor. I'll do me best," answered the corporal.

"Then let's go!" Bobby ordered, and prayed that their good luck would continue. Not every tank had the opportunity of knocking out two pillboxes by itself!

Before they had gone a hundred yards into the open, however, the German gunners picked them up again. *Cr-u-u-mp!* A shell burst not ten yards ahead.

"Swing to the right and keep going!" shouted the American. Then: "Back left again!"

Shell after shell dropped close to the slow-moving machine, and only the constant swinging saved it from destruction.

Another hundred yards: Only three hundred to the Green Line now, and then, once the infantry had occupied it, the job was done.

Suddenly there was a deafening crash behind Bobby on the right. A horrible yellow flame; the right caterpillar track flew through the air and fell on the ground and Rafferty yelled with pain, clasping his right shoulder from which the blood spurted. The machine, the throttle still full open, slued around to the right, the left track crossing the broken strip of the right, then the throttle closed and the engine stopped.

Bobby looked over to the right. Jones and the other gunner were dead, and the right secondary gearsman, Smither, lay shrieking on the floor. The engine had protected those on the left from the blast.

"Evacuate tank!" Stunned as he was by the concussion and shock, Bobby's words came almost automatically.

Another shell burst just outside the left side of the machine which was now facing the German lines.

"Right door! Take your guns and ammo with you! Fast as you can!" he called, at the same time disengaging his own Lewis from the ball and grabbing two drums of ammunition.

"Come on, Rafferty! I'll fix you up outside. Let's get Smithers!" he said tensely, his ears straining for the sound of another oncoming shell.

Rafferty staggered out of his seat and made his way toward the right door. Part of it had been blown away at the top and it swung open.

Crash! Even as the men on the left were climbing over to the right another shell burst directly outside the left door, blowing it in and knocking a man down by the concussion.

"Now!" yelled Bobby, and, throwing the Lewis gun and the drums down outside, dragged Smithers along the steel floor toward the opening.

Sergeant Scott and Von Krast, both weak from their wounds, were the first outside. Rafferty followed, and one of the left gunners, named McDonald, followed them with his Lewis and ammunition. Small, the man who had been knocked down by the explosion, was still stunned, but he helped Bobby with Smithers who had been hit in the head and had a large abdominal wound as well.

Once outside, the party made a dash for near-by shell holes. Some of the men would have stayed within a few yards of the tank, but Bobby urged them on to a safer distance.

He busied himself in organizing his little party into a machine-gun strong-point and with making the wounded comfortable. Smithers, he could see, would not last long and was already unconscious. Rafferty's right shoulder had been ripped by a fragment of steel and was bleeding badly.

Shell after shell crashed around the tank and each moment he expected to see it burst into flames.

Suddenly the realization came to him that the attack might have failed or at least been held up by the mud. If so, he was isolated behind the enemy lines, with three wounded men and a prisoner on his hands and only two uninjured men to help him. How would they get back? And how was he to let those in the rear know where he was?

A machine gun chattered from somewhere near, and a burst of bullets ripped over the heads of the men crouched in the small water-logged craters. Bobby realized that some of the hostile gunners whom he had fired at in their shell-hole emplacements had not been damaged enough and were now having their turn against the crew of the tank.

He remembered the remaining pigeon. That was their only chance! A message arriving at the loft could be telephoned up to the British batteries and the troops in the sector who could help him to get back.

Another burst of bullets overhead almost deterred him from his object, but unless he could get the bird soon it would be killed by the tank catching on fire.

"Sergeant!" he called. Scott poked his head up cautiously from an adjacent shell hole. "I'm going back to the bus to get that pigeon. If I don't get back here, hang on and hope for the best. Got your gun going?"

"Yes, sir. Small'll fire it. Good luck, sir!" the noncom answered.

"Open fire to keep down that Hun gun while I make a dash!" Bobby ordered. "You fire, too, McDonald."

Pop-pop-pop-pop-pop-pop-pop! Small and McDonald opened fire.

"Now!" breathed Bobby, and sprang into the open.

It was only forty-odd yards to the derelict, but it seemed to take him an age even to cover the first ten yards where a burst of bullets just in front made him drop prone and wait. Bullets sang just over his head and all around him, and he found that the only way was to crawl forward inch by inch, while with Teutonic precision a shell came hurtling toward the tank at minute intervals. Each time one exploded, Bobby was afraid that it would make his mission superfluous, but at last he got into the shadow of the machine. The bullets could not reach him here because of the angle, and he was able to stand up and enter the shattered door. He stumbled over the body of one of the dead gunners and made his way to the pigeon locker. Even as he did so there was a crash outside, the concussion almost throwing him off his feet.

He grabbed the basket and took out the bird. Holding it carefully he dashed to the door. Another shell was due. Which side would it fall? With a spring he leaped out and threw himself into a hole not fifteen yards away. As he did so there was another crash and the tank burst into flames. He had been just in time!

He tried to soothe the terrified bird that lay shuddering in his hand. Would it be too frightened to head back to its

loft, he wondered. Unless it arrived, he saw small chance of rescue, for obviously the attack had been held up in some manner.

Holding the pigeon in one hand, careful not to disarrange its feathers, he laboriously scrawled his call for help upon the crumpled pad balanced on his knee. Then, writing the time of dispatch upon it, he inserted the message into the capsule, saw that it was securely attached to the left leg of the carrier, and threw it free.

Like the other it rose in wide circles, and each time it completed one Bobby prayed that it would not be scared out of its direction. When it had almost reached flying height there was the chatter of machine guns again, and he fancied that it began to flutter down. But it seemed to recover itself and was soon lost in the haze that was punctuated with the woolly puffs of shrapnel bursts.

Funny, thought Bobby, that men's lives should have to depend upon such a timid creature as a pigeon!

"Scott!" he called. A hand waved in answer out of the ground ahead.

"I'm coming back! Open fire as hard as you can!" he shouted, and crouched until both Lewis guns had opened fire; then made a wild dash.

But in spite of the covering fire the German gunners were quick in picking up the target, and even as he flung himself head first into the hole next to the sergeant a bullet whisked his steel helmet from his head.

Von Krast regarded him smilingly when he had recovered his breath.

"Don't you think you'd better surrender to me now? I will put up a white flag and the firing will stop. Then I will lead you out with me and you can be my prisoners. I will see that no harm comes to you, for I like you! You are brave and also an American," he stated.

"I'm not thinking of surrendering just yet, thank you!" Bobby answered curtly.

The German shrugged his shoulders. "My arm is paining, and three of your men are hurt, too! Would it not be simpler to surrender and be out of the war for good? My father is highly placed on Prince Rupprecht's staff and would see that you received good treatment."

"Now look here, I'm not going to surrender, and that's flat! If you want to talk to me, tell me where you used to live in New York and whom you knew. Maybe I knew some of the same people!"

Von Krast unbent a little, and soon they had forgotten their position, the fact that they were on opposing sides and that at any second they might be blotted out in death. They talked of Manhattan, of the people they knew and of the places each had visited. Von Krast, it seemed, had an American mother.

The long afternoon wore on. Smithers was still alive, and Bobby thought that he might even recover if aid could be brought to him. The sergeant and Rafferty became feverish from their wounds, and even Von Krast showed that he was suffering.

At one time Bobby had almost decided to release the young officer on the condition that he would send a stretcher-bearer to help Smithers, but the hope that help might come was still strong and he forbore.

All through the day the terrible roll of gunfire had been maintained, and occasionally British shells burst around the wood, but there was no evidence that the infantry were still advancing. The attack seemed to have died down.

Worn out by the long hours preceding and during the attack, Bobby had almost dozed off when he heard Scott telling Small that he wanted some water. This

Holding the pigeon in one hand, he laboriously scrawled his call for help.

brought Bobby realization that the little party had neither food nor water, and that none of them had eaten for many hours. Both had been kept in the tank, but that was now a red-hot mass, twisted out of shape.

The German machine guns had not forgotten the party, and any incautious movement always brought down a storm of bullets.

Then Von Krast, without any warning, cracked up. He tried to get out of the hole and run toward his own lines, and Bobby was forced to draw his revolver and cover the prisoner menacingly.

"Let me go! I want to get out of this hell! Why should I stay and be killed with you!" he sobbed; then commenced to shout in German. Faint voices from the German gunners answered him.

"That's enough! Stop or I'll kill you!" threatened Bobby. "You gave me your word and I trusted you!"

Just then a British shell crashed about fifty yards from them, and Von Krast became hysterical.

"Cowards!" he sobbed. "You want me to be killed by the shells! You're torching me, you cursed English swine!"

It was merely nerves, Bobby realized, but his shout had attracted the Germans, and unless the party were rescued before night, he felt sure that it would be rushed and overwhelmed.

"Listen, you! I thought you were a Prussian officer! Why, you haven't got the nerve of a pigeon!" As he spoke he realized the comparison he had made between this sobbing boy and the little winged messenger he had sent asking for aid.

"Shall I shoot him, sir? He'll get us in trouble if we don't out him!" Sergeant Scott, half delirious himself, pulled out his revolver.

"No, it would be murder! I'll see to him," answered Bobby, and pushed the muzzle of his gun against Von Krast's ribs. "Quiet, now!" he ordered.

The German subsided, muttering to himself, shivering as shell after shell burst around them. It was clear now that the British guns were putting down a creeping barrage in front of the wood which was coming closer to them each minute and threatening to blot them out. Would they escape its blast, and would the infantry come up behind? Bobby was tortured by the uncertainty of it.

Then he heard fresh bursts of machine-gun fire and saw the figures of men picking their way slowly around the edges of the wood. It was almost too dim now in the twilight to distinguish whether they were friends or foes, but he guessed that they were British.

Then, without warning, there was a flash of flame and a burst almost on top of them, and Smithers rolled down to the bottom of the hole quite dead. They were engulfed in the heart of the barrage.

The next few minutes seemed an eternity, but at last the shells passed on and Bobby could see the line of men coming closer. His great fear now was that they might be mistaken by the advancing infantrymen for Germans, and blotted out.

"Hey! Tank men here! Help! This way!" he called and waved his steel helmet.

A few figures bunched and came toward them. One carried a Lewis gun pointed toward them as if fearing a trap, and two others, Bobby could see, were bombers.

"Who are you?" demanded a voice.

"Tank men with wounded!" answered Bobby.

The men came up. "We're the Tenth Australians. Heard you were out here.

Been tryin' to get here for hours, but were held up by the mud," a sergeant said.

An officer came over to them, covered from head to feet in mud. "Glad we got you in time. Never would if you hadn't knocked out those pillboxes, though. Who's that with you—prisoner?" he said.

He called stretcher-bearers for the wounded, and a guide to lead them back, then returned to his task of leading his men on toward the Green Line.

It was not until the early hours of the morning that Bobby managed to get his little command back to the battalion headquarters, and he was too tired to do more than make a brief report. As Von Krast insisted that a part of the bargain was that Bobby would take him personally to the prisoners' cage, however, he arranged that the young Prussian should share his hut for a few hours so that they might sleep.

After a rest and some food he took Von Krast with him and handed him over to the officer in charge of the cage.

"Sorry I called you a pigeon yesterday, Von Krast. We were both pretty well used up, I guess. Good luck, and I hope to see you in dear old Manhattan!" he said in parting.

As the cage was close to the pigeon loft, Bobby decided to visit the officer in charge, whom he knew, and find out if the birds had arrived safely.

"Denton," he asked, "did both my birds get in all right? I sent them separately and I thought the second one was hit."

Lieutenant Denton, to whom carrier pigeons were far more than just birds, greeted Bobby cordially.

"Yes," he answered. "The first one got here eleven minutes after you sent it, and the second one—" he broke off abruptly. "Here, I'll show you!" he said, and led the way to his hut.

On a table lay a dead pigeon, its left leg hanging by a thread of skin, the message capsule driven deep into its left side and the feathers of its breast spattered with blood.

"I saw it coming toward the loft myself," explained Denton. "It was flying very low and seemed weary. It landed on the platform of the loft and just as I thought it was going to push through the trap door and enter, it suddenly fluttered a little and died.

"As I understand it, the attack yesterday broke down and wasn't to be resumed until to-day, but when I forwarded the message that you were out there stranded, it was decided to push on and rescue you.

"You know we give Victoria Crosses to men for deeds of extreme sacrifice. Well, to my mind this little bird, wounded and dying, won the V. C. too! It saved your life because it had been trained to bring messages back to the loft in spite of everything, and when its big test came, it was faithful unto death!"

As Denton ended, Bobby stood silent for a minute; then, as the realization came to him of what he owed to the shattered little body on the table, he drew himself up and very gravely and sincerely saluted it. "Yes," he said softly. "It was faithful unto death!"

AUTHOR'S NOTE.—The bird mentioned in this story is at present preserved in the Museum of the United Services Institute at Whitehall, London.

It is posed exactly as when it died, with the container piercing its body, and is known as the "Pigeon V. C."

Lathrop's Tractor Model

By Joseph J. Lucas

National Model Flying Outdoor Champion

THE Lathrop Tractor Model was built and flown by Donovan Lathrop, a member of the Illinois Model Aero Club. In 1914 this model made an official world's duration hand-launched Tractor record of 240 seconds, and held the record for this type of model for over ten years.

During its record flight the Lathrop Tractor disappeared from sight at the end of four minutes and the judges report that the actual flight of the machine was much longer.

The Lathrop Tractor is an outdoor model and can be flown either hand-launched or rise-off-the-ground. It is very light, weighing 1⅛ ounces complete, and it is not difficult to build.

Motor Base

Begin the construction of this Tractor with the motor base, using a strip of white pine 36" long with a rectangular cross section ⅜"x3/16". This should be sandpapered smooth and treated with three coats of banana oil. Bend a "can" in the shape of a loop, as shown in the diagram, of No. 16 piano wire, glue and bind it with silk thread on the top at the center of strip, with the small edge up. The hanger or bearing for the propeller is made of No. 12 wire flattened and drilled for the shaft, glued and wrapped with silk thread on top of strip. The motor hook is bent to shape out of No. 16 piano wire.

Tail Plane and Rudder

The tail plane frame is made entirely of 1/16"x1/32" bamboo. It is bent over a flame to the shape shown in the sketch. When the tail-plane frame has been bent to shape required, bind the two ends of the bamboo together. Two bamboo crosspieces 3/32"x1/32", spaced at about equal intervals, are cemented to the tail-plane frame. These crosspieces make the tail rigid and keep it from getting out of shape. The tail plane is then glued and bound to the underside of the motor base at the entering edge of the tail plane, which is 29⅜ inches from the front end of the motor base, and at the crosspieces.

The rudder is bent to the shape shown in the diagram, out of 1/16"x1/32" bamboo over a flame. The rudder is glued and bound 33 inches from the end, on top of the motor base.

Both tail plane and rudder are covered with a single surface tissue paper and treated with a weak doping solution.

Skid

The front skid is very important on a Tractor, for it protects the propeller from breaking in landings and in dives. Bamboo ⅛"x1/16" is bent to shape as shown, and a straight piece of bamboo of the same cross section is made long enough to permit the nose of the motor base to be at least 5½ inches above a level surface

when the skid is fastened to the under side of motor base.

Main Plane

The main plane or wing is an important part of the model, and should be carefully constructed. It has a span of 33 inches and a chord of 3½ inches and consists of two white-pine beams with bamboo entering and trailing edges, wing tips and ribs. The beams have each a cross section of 3/16"x1/16", and run the full length of the wing. Each of the beams consists of two spars, and are put together so that the wide part of the beams can be fastened to the under side of the ribs, and set at a dihedral angle of 9 degrees by a lap joint. Seven bamboo ribs of 3½"x⅛"x1/16" are bent to a slight camber or curve over a flame. The ribs are spaced 4½ inches apart and fastened on top of the wide part of the beams, with the front beam ½ inch from the entering edge, and the rear beam 1½ inches from the front beam. The wing tips are made of 1/16 inch round bamboo. The two wing tips are symmetrical and can be bent to shape over a flame out of a single piece of bamboo and split in two. The entering and trailing edges are 1/16 inch round bamboo. They are fastened to the ends of the ribs, while the wing tips are fastened to the ends of the wing beams, entering and trailing edges. Two wing clips are bent to shape with No. 16 piano wire. One of the clips is fastened on top in the center of the entering edge and the other is fastened on top in the center of the trailing edge. These clips are used to hold the main plane in place on to the under-side of the motor base. The clip for the center of the entering edge is made so that the center of the entering edge will fit as close as possible to the under side of the motor base when the plane is fastened, while the clip for the center of the trailing edge is made so that the center of the trailing edge will extend ⅜ inch below the motor base when plane is fastened. The ⅜ inch gives the proper elevation for wing when model is in flight. Make these wing clips to fit to the motor base firmly. If this is not done the wing is apt to get out of adjustment or come off from motor base while the model is in flight. The wing is single surfaced and covered on top with Japanese silk tissue paper, and treated with a weak doping solution. The tail plane and rudder are covered with a single surface of tissue paper and treated in the same way.

Propeller

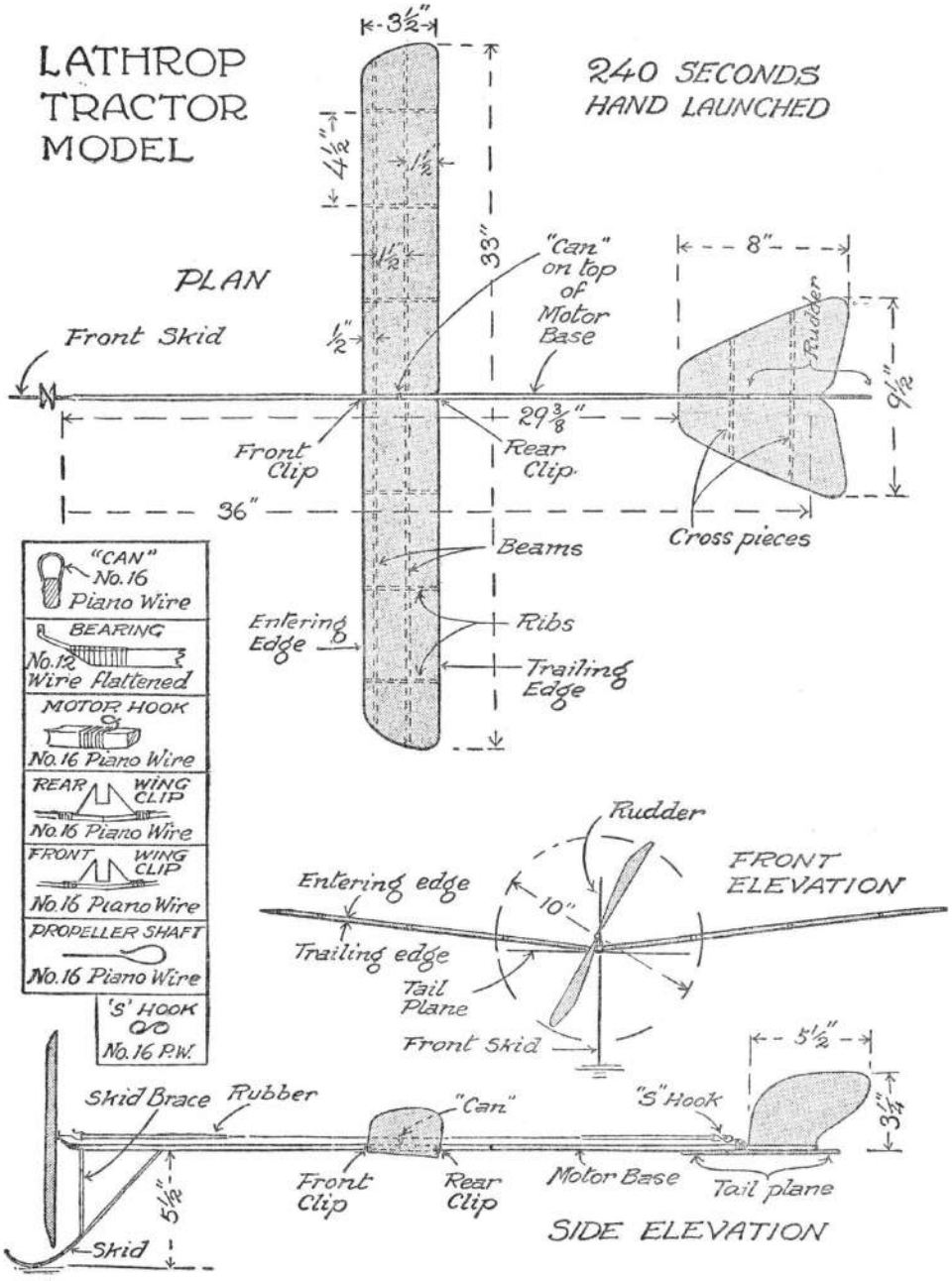
The successful performance of the model depends upon the propeller, and therefore great care should be taken in making it. The propeller is cut from a 10"x1 3/16"x½" blank. When propeller is carved to the proper thickness, about 1/16 inch, it is sandpapered and coated with banana oil and finally balanced in order to insure smooth running. Shaft of No. 16 piano wire is bent to the shape of a hook to receive the rubber and is inserted and fastened in the propeller hub with ambroid or glue. Small copper or brass washers are used as a bearing to reduce friction. Three strands of 3/16 inch flat rubber are used for power to fly the model.

Flying the Model

I have often heard boys say that it is easier to build a model than to fly one, and I know from experience that this is true. Flying is more than half of the art in this model.

Remember that it is a tractor type, and like large tractor airplanes it has the wing well to the front.

When the parts of model are completed and the motor strands of rubber laid


LATHROP
TRACTOR
MODEL
240 SECONDS
HAND LAUNCHED
PLAN
3½"
4½"
1½"
1½"
1½"
33"
"Can" on top of Motor Base
8"
Rudder
9½"
Front Skid
Front Clip
Rear Clip
29⅜"
36"
Cross pieces
Beams
Ribs
Entering Edge
Trailing Edge
"CAN" No.16 Piano Wire
BEARING No.12 Wire Flattened
MOTOR HOOK No.16 Piano Wire
REAR WING CLIP No.16 Piano Wire
FRONT WING CLIP No.16 Piano Wire
PROPELLER SHAFT No.16 Piano Wire
'S' HOOK No.16 P.W.
Rudder
FRONT ELEVATION
Entering edge
10"
Trailing edge
Tail Plane
Front Skid
5½"
Skid Brace
Rubber
"Can"
"S" Hook
3¼"
Front Clip
Rear Clip
Motor Base
Tail plane
5½"
Skid
SIDE ELEVATION

out, you are ready to assemble the model. No elevation block is required as the angle is given by the rear wing clip. The correct position of the wing, which should be fastened to the under-side of the motor base, can be found only by trial, and that is by gliding it after you have propeller on and the rubber strands hooked to the rear hook and to the propeller shaft, passing them through the "can."

Hold the model in your left hand and looking back from the propeller end, sight the wing from the center of the entering edge to the right to make sure that you have the correct counter-torque which is the warp upward of the right-hand side of the wing. This is made by twisting the right-hand side of the wing upward about ¼ inch. This counter-torque is used for the purpose of counteracting the torque of propeller while it is revolving during the flight of model. If the wing does not have the warp, the torque of the propeller would capsize the machine in the opposite direction to which it revolves. Sometimes the rudder can be used when turned slightly to the left (looking from the propeller end) to help aid the wing warp to counteract the propeller torque. Turning of the rudder slightly can be done by breathing on bamboo shape rudder and binding it at the same time with your hands.

In gliding the model hold it by the motor base in your right hand just back of the wing over your head and launching on a slightly downward angle with a gentle forward push. To insure that the model has the right adjustment, before winding up the rubber for the trial flight glide the model three or four times. The initial gliding and flying of the new model should be attempted only on a fairly calm day. If the glide is too steep, the model has insufficient elevation. To remedy this, move main plane forward a little and glide it again. If model stalls while trying to glide, it is over-elevated and can be adjusted by moving the wing a little to the rear. Your proper glide should be at least five or six times the height you hold the model above the ground when launching it. In an outdoor tractor model your glide should be a little better than the outdoor twin-pusher type, as the tractor model has less drag while gliding through the air. Make all adjustments to correct under and over-elevation by moving the main plane forward or backward as required. The bending of the tail flaps up or down to increase or decrease the elevation, of course, is the same principle and has the same effect as moving the main wing forward or backward to get the right glide for a good power flight. It is best for the tractor model to have a slight negative angle in tail flaps to maintain longitudinal control while gliding or while in a power flight. Be sure to glide the model with the wind always.

When the model glides well, wind up rubber motor about 500 turns with an egg-beater winder for the initial flight. Before winding be sure you have someone to hold your propeller and someone to hold the fuselage near the tail a little below the rubber motor, so that the fuselage will not be in the way while winding the rubber, and be sure that you wind carefully so that the propeller will have the proper power and turn in the right direction when released for flight. Walk in toward model while winding until you have about 500 turns in motor and are near to the hook of the fuselage in front of the rudder. Unhook rubber from winder and attach motor to the hook. See that the rubber is properly placed through the "can" of the fuselage before winding; and that the tail, rudder, and main wing adjustment are all right, and

last be sure that the main plane is well secured to the frame.

In launching hold the model by the fuselage (a little to the rear of the wing) in your right hand and with the left hand hold the propeller to prevent it from turning. When launching model for flight, release the propeller with your left hand and then launch model on a slightly downward angle with a gentle forward push with your right hand. If model climbs too steeply or stalls, the wing needs to be moved back a little; and if the model does not climb very well it means that the main plane needs to be moved a little forward. The adjustments to improve the flight are the same as for the gliding test. Remember, gliding a model is very necessary before you fly it. You can make better model flights and have less breakage by gliding a model before flying it. Do not be discouraged if it does not fly well at the first trial, the trouble is probably in the adjustment.

After you have obtained a good steady flight with the model, the rubber may be wound up to 1,200 turns for a much longer distance flight and for a much longer duration flight. Under fair-weather conditions the model should remain in the air for a very long time.

If you choose to have your model fly in circles either to the right or left after you have proper adjustments for good model flights, turn the rudder by bending either to the right or left the required amount needed to make the model fly in the size of the circles wanted.

If you at any time have to fly the model in windy weather, with the model in hand run along with the wind (about the same rate of speed as the wind), and launch the machine high and smartly. The reason for this is that the wind has a tendency to beat the model to the ground if launched while you are in a stationary position and if you launch it gently.

Material required for building the Lathrop record breaking tractor model:

Frame

Motor base, 1 strip of white pine 36″ long with a rectangular cross section of ⅜″ x 3/16″.

Bearing or hanger No. 12 wire flattened and drilled for the shaft.

1 foot of No. 16 piano wire for rear hook, S hook, can, wing clips, and propeller shaft.

1 small can of ambroid.

Tail Plane and Rudder

1 strip of bamboo for elevator or tail plane 34″ x 1/16″ x 1/32″.

1 strip of bamboo for rudder, 13″ x 1/16″ x 1/32″.

2 bamboo crosspieces for tail plane, one 6″ x 3/32″ x 1/32″ and the other piece 8″ x 3/32″ x 1/32″.

Skid

1 piece of bamboo, 10″ x ⅛″ x 1/16″.

Main Plane

2 white pine beams, 33″ x 3/16″ x 1/16″.

7 bamboo ribs 3½″ x ⅛″ x 1/16″.

2 strips of bamboo for entering edge 17″ x 1/16″ round.

2 strips of bamboo for trailing edge 17″ x 1/16″ round.

1 strip of bamboo for wing tips 6″ long to be cut in two to the dimensions of 1/16″ round.

2 wire clips made of No. 16 piano wire.

Covering

1 sheet of Japanese silk tissue paper.

2 oz. of banana oil.

2 oz. of doping solution.

Propeller

1 balsa propeller blank 10″ x 1 3/16″ x ½″.

1 shaft made out of No. 16 piano wire.

Motor

1 three-strand 33″ x 3/16″ x 1/32″ rubber.

From the Clouds

By Francis J. Rigney

Illustrated by the Author

BILLY REED was "bugs" on bugs. In other words, he was an enthusiastic entomologist. He had spent the greater part of the late afternoon in the field collecting specimens and making notes. Now he felt the need of supper.

He had been on his hands and knees most of the day, and as he stood up to go home a long, infinitesimally fine strand of silky cobweb brushed across his face. He looked around and observed with keen pleasure a host of webs floating in space, shimmering in the rays of the setting sun. On the lower end of each of these bits of gossamer was a tiny spider, a diminutive aeronaut drifting hither and thither in the gentle evening breeze.

"Some aviation meet," said Billy, "I wouldn't have missed this for worlds." He stayed around a little longer than he had intended, making more observations and notes until a freshening of the breeze put an end to the shimmering spectacle. A small cloud on the horizon was but the leader of a pack which was steadily marching upward into the sky.

"I'll just be able to make the lake and get around the bluff before it spills," said Billy, figuring on making a short cut home. While his eyes were on the rapidly darkening clouds his mind's eye was up in the clouds of his own imaginings. A smile broke over his face and he laughingly spoke his thoughts.

"It's a mighty good thing that tarantulas can't pull that flying stuff," said he as he visualized a sky full of enormous, hairy, murderous-looking brutes of spiders. A drop of rain striking against his forehead aroused him with a start. The clouds had reached the lake before he had and all overhead was now a dull leaden gray. What threatened to be a heavy shower became a steady misty drizzle which blotted out most of the landscape.

Billy knew his short cut, however, and soon the great shoulder of the bluff loomed up through the mist. He reached the lake shore quickly, and started a half mile sprint along the sandy beach.

Suddenly his hat was snatched from his head. Scared out of his wits he jumped sideways and, instinctively gathered himself into a defensive fighting crouch. His hat fell, which up to that moment rested on the side of his head, at his feet. With remarkable alacrity he jumped backward and again sideways like a highly trained ring champion. Had the flying trantulas born in his imagination really come into being on the outside of his head? Without looking up he lashed out violently at he knew not what and struck the end of a small branch which hung down from a tree growing on the side of the bluff!

Realizing the foolishness of his fears he laughed as he picked up his hat and again started on his way. Halfway along the beach he was compelled to stop to fasten a snapped shoestring. It wasn't very comfortable kneeling in the rain trying to get the broken string back into

service, but it took more than rain to dampen Billy's natural cheerfulness. He was grinning from ear to ear as he arose to his feet.

"Won't Dad laugh when I tell him about the fight I had with the tree," he said. Still grinning, he was about to resume his journey when, with the suddenness of an electric flash, he froze in his tracks and his smile instantaneously vanished, being replaced by an expression that indicated terrified amazement combined with helplessness. His eyes were staring and his breath came in choking gasps. He tried to think clearly but he could only in a dull sort of way repeat to himself, "It can't be. It can't be." *But it was!*

Right out over the lake, hanging from the center of the low-lying heavy black cloud, was a monstrous creature bigger by many sizes than any tarantula that ever lived! Vaguely outlined in the mist Billy saw this thing dangling and squirming on the end of a giant web, the other end of which was lost away up in the thick mist. There wasn't any crossbar over the lake, nor could any tree growing on the top of the bluff extend its branches so far. Just as the small spiders of the late afternoon hung, as it were, from nothing, so apparently did this apparition!

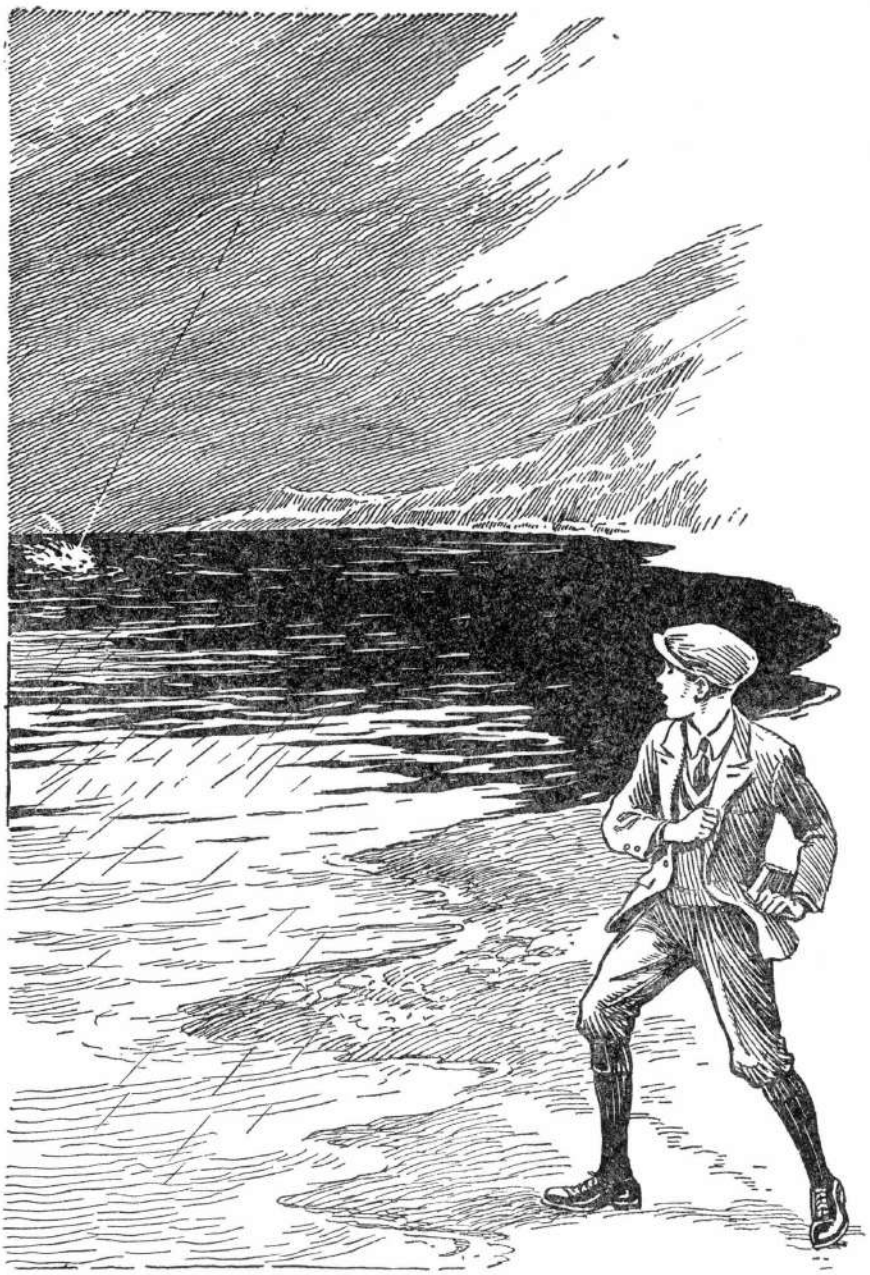
Billy broke out into a cold sweat when he realized that the dreadful thing was traveling rapidly in his direction. Billy then broke into a mad dash for home. No, he wasn't imagining things now, for he distinctly saw, as he terrifiedly looked over his shoulder, a white splash when the creature struck the lake surface. He also heard the noise of the splash. He saw a second splash, then a swirl, and then, horror of horrors, the thing suddenly darted from its course and streaked through the water toward a point in the direction whither he himself was running. Billy stood rooted to the spot, his eyes transfixed.

Climbing the bluff was out of the question, even were Billy's knees normal, which they were far from being at this moment. His inclination was to run back, but the desire to fade out of the picture was unequal to the shivering spell which had him in its grip. As a shiverer he could easily shatter the record of the nervous man who applied for a job as a bricklayer and got a job as a sieve shaker.

Ah! What was happening? The giant thing was reaching the shore! The long, long web was crumpling or something. It was coming down like a writhing snake! The great insect was in the water swimming! The web struck the water and made a hissing splash, leaving a twisted line of foam to mark where it had disappeared. What was it all about? Like a flash came an answering thought to Billy—"an airplane."

Like the blackness that comes after a flash of lightning came the next thought —"No, there wasn't any noise, not even a hum!" This weird thing had come with the silence that one usually associates with a tomb. Eerie, creepy, chilling, blood-curdling, horrifying, appeared this enormous spider creature, at which Billy stared with bulging eyes through the clammy drizzling mist.

Daring neither to advance nor retreat, Billy now did not even dare to shiver for fear of attracting attention. He stood bravely as firm as a petrified jellyfish. He was literally scared stiff. With the exception of the terrific thumpings of his heart, the "creeps" that chased along his spine and the cold sweat that ran down his face, he was as motionless as the rocky bluff behind him. It was only by exerting his last remaining bit of rapidly dwindling will power that he managed to suppress



He saw a white splash as the creature struck the lake.

and swallow what would have been an agonized groan. This effort seemed to make his eyes bulge all the more and his heart to beat faster.

The thing disappeared under the water for a moment or so, to appear again nearer to the shore line. It churned the water as it thrashed its way toward the beach. The thing gained the shore and crawled out. A black indistinguishable mass it was that lay resting on the sand.

What would it do next? Would it scramble up to hide in some large cave-like hole in the rocks, would it throw out another web by means of which it would again be carried into the upper regions, or would it advance to the immediate attack and destruction of the hypnotized Billy? These were the questions that coursed through Billy's bewildered brain. Billy's bewilderment was considerably added to when the mysterious object shot up into the air to stand apparently on its hind legs!

Billy rubbed his eyes and gasped, "Why —why it's taking a coat off!—Why it's a man!"

A man it was, a man who staggered around finally falling exhausted on the sand.

Billy's knees at last awoke into action, but this time Billy's direction was toward the strangely arriving visitor now lying prostrate from lack of breath on the sodden ground.

By the time he reached the spot the man was sitting up rubbing his head, looking anything but unearthly—in fact looking very earthly, decorated as he was with sand and mud.

"Can I help you?" cautiously asked Billy.

"Mebbe," replied the man, "but I think you are a bit late."

"How—how—?" began Billy about to ask the man concerning his extraordinary arrival.

"Listen," broke in the man, "if we move fast I may yet be able to get 'em."

Billy was completely in the dark as to what the man was driving at and was beginning to have doubts as to his sanity, when the stranger again spoke.

"Can you get me a fast car and direct me to the nearest telegraph office?" he asked, adding, "I'll explain it to you as we go along." "Follow me," said Billy, starting for home at a brisk trot, figuring that this stranger might be crazy and that it would be safer to be in a neighborhood where immediate help would be at hand. Swinging on to the main road that led toward the town, Billy felt more comfortable. The stranger was about ten paces behind and running heavily. Billy wasn't waiting for explanations until he had reached some safety zone. Along came a trolley car which Billy promptly hailed. The stranger and he boarded the car, which was conveying but a few scattered passengers. The man sat close to Billy, and looking around to see that there wasn't anybody within listening distance, whispered, "I'm a detective!" at the same time giving Billy a quick peek at his badge of office.

In undertones and from the corner of his mouth he related his adventure to his new-found help.

"You see," he said, "it was like this—it took me almost three weeks to trail these two birds."

"Birds?" echoed the astonished Billy in rather audible tones.

"Easy," cautioned the man, continuing, "I mean two counterfeiters who broke jail and beat it all the way down to these parts—all the way from New York. Must be on a thousand miles as the crow flies."

"But you don't mean to say that you

flew after 'em," said Billy in an awed whisper.

"No," answered the detective, "the flying commenced in a little town about ten miles, I should say, from here across the other side of the lake. The folks over there are having some sort of a fair, or firemen's carnival or something. Anyway, the big event of the evening was the balloon ascent and the parachute jump. The parachute part of the performance did not come off, but the balloon ascent did, although I might say, not exactly according to arrangements.

"It was like this—I had just spotted the pair in the crowd and was making arrangements with the sheriff for the round-up when they spotted me. They remembered me right away, and before I had time to get a bead on 'em they had mixed into the crowd. My only hope was grab 'em then and there. The sheriff ran one way, I ran the other, in case they might separate. They stuck together, however, and when I saw them again they were diving into the crowd that stood in a large circle around the balloon. Whatever they did—probably threatened to shoot—made the crowd scatter in all directions, which considerably held me back in my speed. Before I could realize it they had knocked the balloonist out, got into the basket of the balloon and cut the anchor ropes. Like a nut I grabbed a tow-rope, and before I could count 'one' I was yanked about fifty feet into the air. With my free hand I pulled my gun, intending to shoot a hole into the ballon and take a chance on coming down easy, when I unfortunately let the thing fall.

"By this time I was up about one hundred feet and was right over the town. I didn't dare let go. The next thing I rememebered was being carried into what I

"Birds?" echoed the astonished Billy.

guess must have looked like a cloud to the people on the ground but as far as I was concerned it was a dirty wet fog which lasted all the rest of my trip. I have no idea of how high up I was, but after a while I felt the rope being let out and that I was getting further away from the balloon. I figured that the two birds above didn't want to have murder added to their charge and that they were letting me down as far as the rope would run, hoping perhaps that I might drop off or that they might be able to cut me off when I got near enough to the ground. Say, boy, it was a lucky thing for me that they cut the rope when it was over the lake. Getting wet is better than getting a broken leg any day. By the way, what direction was I traveling when you saw me?"

"Let me see," said Billy. "I guess you were going a little to the north of direct east."

"Good," said the detective; "that'll help me to trail 'em."

"How trail 'em?" asked Billy.

"Oh, every way," answered the detective—"telegraph, radios, autos and an airplane if I can get one."

"There's an airplane mail station about thirty miles north of here," said Billy, "and mebbe I could get my dad to drive you there."

"Well, this is a government job, and I'm sure everybody will be glad to help," commented the detective.

"Here we are," said Billy as the trolley car came to a stop. "There's the telegraph office over there, and while you are sending your message to the broadcasting station I'll go and see if I can get dad to drive you to the flying grounds."

The detective wired to the nearest radio station, which happened to be about five hundred miles away in the direction in which the balloon was traveling, asking that all radio fans be requested to keep a lookout for it. In the meantime Billy had persuaded his father to cut short supper and to get his car ready for the chase.

Billy, of course, included himself in the trip. Filling a tin can with all of his supper and with all the extra helpings on which he could get his hands—potatoes, bread, meat and dessert mixed indiscriminately—he stuffed a couple of soup spoons into his pocket, filled a thermos flask with hot coffee and calling on his dad to bring along a couple of heavy rugs, he dashed out of the house and into the car.

They found the detective waiting and in a few moments were off for the flying grounds.

The detective was agreeably surprised at Billy's thoughtfulness and lost no time in settling down to supper. Table manners were dispensed with as Billy and his guest dipped their spoons into the can and gulped alternately from the thermos flask.

Along through the darkness they raced. Having a fairly good road, they made considerable speed. Before long they caught the sky's reflection of the enormous lights which marked the location of the flying field. A short time later they arrived.

The detective was lucky in finding the commander of the field and also in finding that there were a couple of extra planes in good order ready for flying.

The radio message had already been received and a number of pilots were around ready for the adventure.

It was with regret that Billy realized that his part of the program was now over, but he cheerfully wished "good luck" to the detective as he and his father started for home.

The return of the trip was uneventful enough and seemed rather long to Billy, who was in a tremendous hurry to get home to his radio. The home trip ended,

Billy got into warm, dry clothes and put on a radio headpiece. He tuned in on different stations and impatiently listened to bits of the regular broadcasting programs. He was hoping for an announcement concerning the escaping pair. It was late at night when the longed-for words came.

"MMJ speaking," said the announcer. "The escaping balloon reported earlier in the evening has been sighted north of Danville, Kentucky. Night clear, two airplanes in close pursuit. Balloon traveling in a northeasterly direction."

With that bit of information Billy had to be content and feeling thoroughly exhausted he was glad to go to bed.

With his mind in a whirl, sleep was some time coming, and when it did come it was but to bring Billy into a land where enormous tarantulas were flying around in airplanes, where giant balloons were equipped with long hairy spider legs, where men were falling from the sky like rain, where he, his dad and a detective were climbing a rope extending miles into the sky, and where spiders big and spiders small swirled through space in countless swarms.

It was with relief that he awakened into a regular world the following morning. Nevertheless he lost no time in getting dressed, eating breakfast, and getting down to the local store where the morning papers were sold.

"They got one of your men," was the greeting that met Billy when he arrived.

He found himself the center of a group of admiring townsfolk, all of whom proceeded to bombard him with questions. Billy, however, was looking for results and grabbed a paper from one of his volunteer interviewers.

"Balloon get-away frustrated," in large type was the opening caption, and underneath, in lesser type, he read, "Only one occupant in balloon car. Mystery in disappearance of companion."

"Your name's printed too," said one of the crowd to Billy, indicating where Billy's name appeared in the paper. The town's hero had not figured on appearing in print, and it was with true hero's modesty that he decided to read the story in private. Excusing himself as best he could, he hurried away from the crowd and headed toward the bluff down by the lake beach.

Settling down comfortably under the tree with which he had sparred the previous evening, he unfolded the paper and proceeded to read all the details of the balloon hunt.

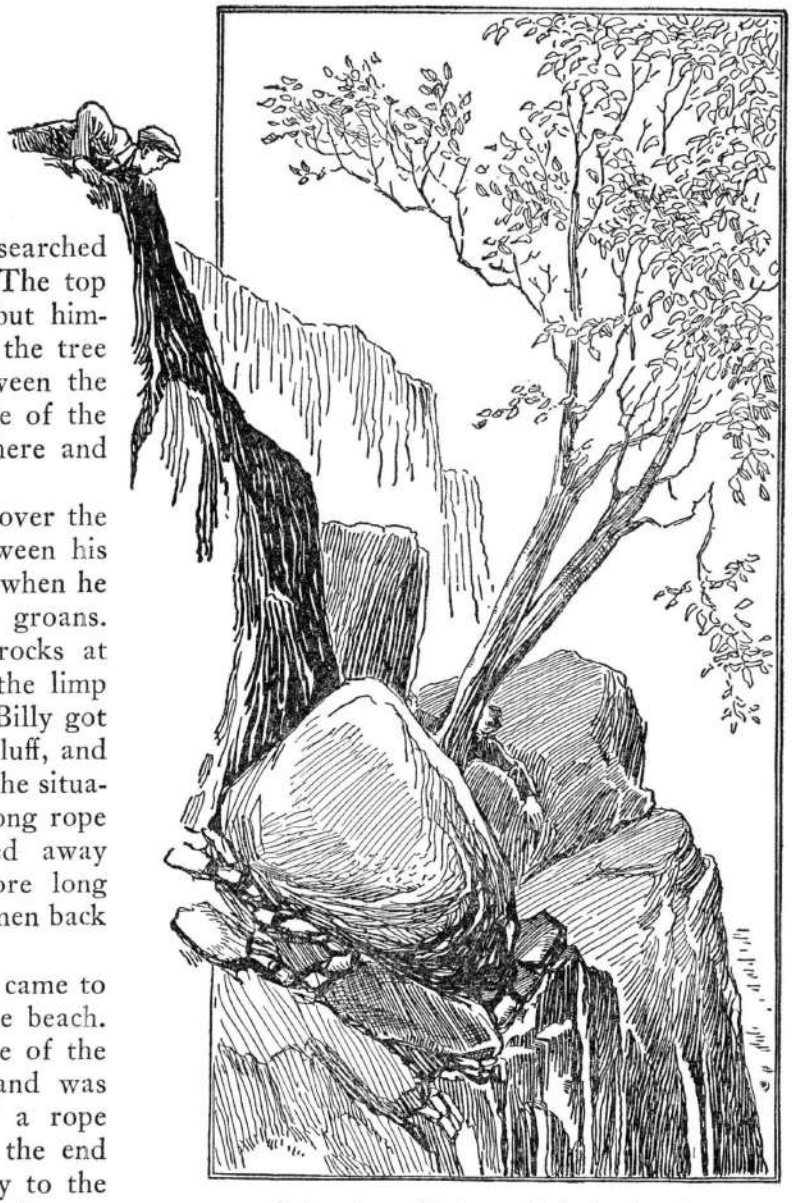
It seemed, according to the story told by the captured counterfeiter, that the man who was missing was the one who had leaned out to cut the rope to which the detective had been attached and that it was not until some time later that he was missed; the explanation of the captured man being that he was too sick to notice anything in particular. Billy then came to the part of the story in which he played a part and read where he had seen the detective falling from the clouds. This part of the story was under the small sub-caption "From the Clouds," and just as Billy repeated the words a long-drawn-out groan broke on his ear, coming from he knew not where. He jumped up in alarm and looked up and down the deserted beach, seeing nothing. Again the prolonged groan, this time seeming to come from overhead. Billy involuntarily ducked from the overhanging tree and stared up into its branches. Nothing there but leaves, and leaves certainly did not groan. Once more a groan accompanied by a feeble call of "help."

"Wonder if there is another feller going to fall from the clouds," said Billy half aloud, when another call for help

awakened him into action. "Mebbe he's on top of the bluff," he said, and he started along the beach to get around to the sloping side of the larger rocky prominence. In quick time he scaled the height and searched around, but to no avail. The top of the bluff held nobody but himself. He looked down at the tree which projected from between the two large rocks on the side of the bluff and decided to get there and investigate it.

He had just let himself over the edge and was looking between his feet for a further toe-hold when he saw the cause of the groans. Wedged in between two rocks at the foot of the tree was the limp figure of a man. Quickly Billy got back on to the top of the bluff, and lying down flat, he studied the situation. Assistance and a strong rope were needed. He dashed away down the slope, and before long he had the sheriff and two men back at the bluff.

His father and a doctor came to the scene by auto along the beach. Billy, being the lightest one of the group, partly clambered and was partly lowered by aid of a rope down to the tree. Tying the end of the second rope securely to the man, he helped, with the assistance of the men pulling above, to raise the unfortunate one from between the rocks. The man was then lowered to the beach. He was none other than the one who had fallen from the balloon as it was drifting low across the bluff.



Lying down flat he studied the situation.

A broken leg and a few minor bruises were the result of the fall, and the doctor and the sheriff soon had the prisoner on the first part of his trip to the hospital and back to the proper authorities.

"It never rains but it pours," said Billy as he looked up into the morning clouds.

Boys' Life-Lucas Speed Model

By Joseph J. Lucas

National Outdoor Model Flying Champion

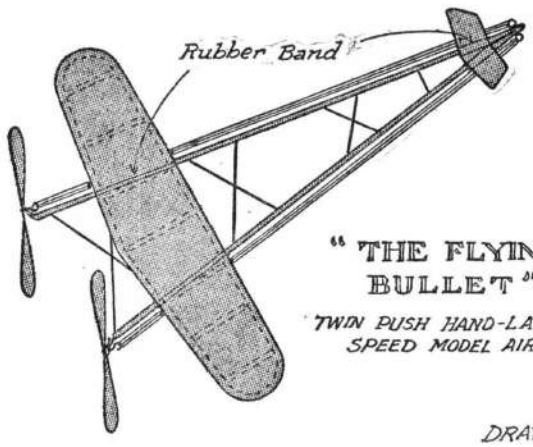
THE second of the models especially designed by the writer for *Boys' Life* is *The Flying Bullet,* a twin-push hand-launched speed model that in test flights has attained a speed of over fifty miles an hour. This model is designed for speed and not for duration. It has several novel features. The main plane is carved out of a solid block of balsa wood, combining lightness with the sturdiness that could not otherwise be secured. The front plane or elevator is made out of one sheet—aluminum or duralumin—and is mounted on an elevator block as in the Boys' Life–Lucas Outdoor Duration model. This is an added feature of strength. This model is able to attain a high speed because of the powerful motors which it carries and the high number of revolutions per minute it is able to get from the propellers in consequence. In the outdoor duration model every bit of weight that could be saved was an advantage. In building the speed model the most important factor is strength.

Building the Model

Study the diagram and instructions carefully before you begin to build the model. It will help you greatly if you know just how the completed model should look before you begin to build the separate parts. Again we want to emphasize the importance of sturdiness in building this model. Remember, the speed at which it flies requires that it withstand a far greater air pressure than a duration model does, and that the greater number of strands in the rubber motor and increased revolutions of the propeller put a greater strain on this type of model. In a word, to get the best results from this model, particular care must be given to building it to be as strong as possible. Remember that all parts that can be stream-lined add to the speed of the model.

The frame as in the Duration model is A-shaped, and is composed of two semi-elliptical balsa longerons 26½″ long, 9/32″ wide, and 5/16″ thick. The longerons are shaped as shown in drawing No. 2. The longerons should be sandpapered smooth and doped with several coats of doping solution (banana oil or acetone mixed with ambroid in the ratio of 7 to 1 makes a good doping solution). After the longerons have had several coats and dried, face the semi-elliptical shaped side of the longeron inward (see diagram of elliptical-section drawing No. 2), and taper the inside front end of the longerons to wedge shape and cement together with ambroid and bind with silk thread. In putting the longerons together see that the rear ends are spread 7″ apart, measuring between their inside surfaces.

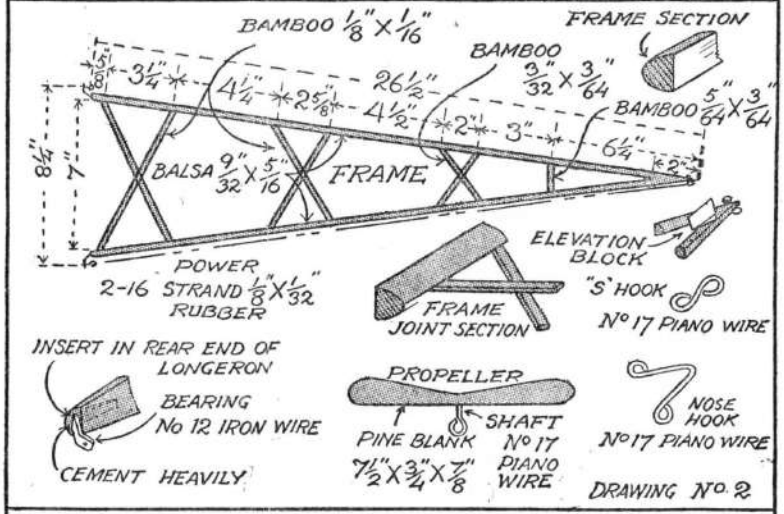
The elevator block is made of a piece of balsa and should be ½″ long, ¼″ wide and ¼″ thick. It is ambroided on the A-frame 2″ from the nose, as shown in drawing No. 2.



"THE FLYING BULLET"

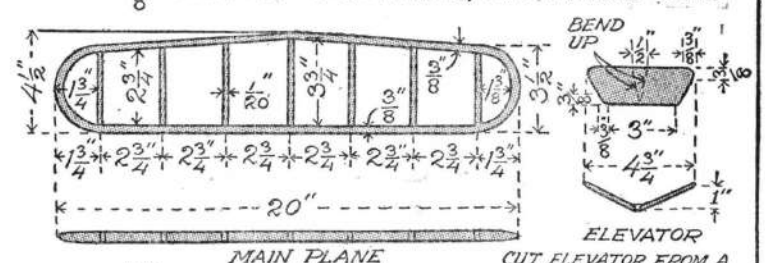
TWIN PUSH HAND-LAUNCHED SPEED MODEL AIRPLANE

DRAWING No 1

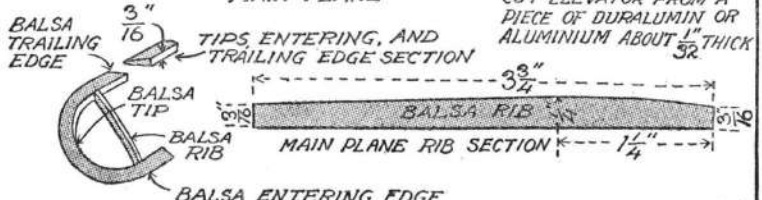


DRAWING No 2

CUT MAIN PLANE TO SHAPE FROM A SLAB OF BALSA 20" X 4 1/2" X 1/4" ALLOWING 3/8" WIDTH FOR TIPS, ENTERING, AND TRAILING EDGES



CUT ELEVATOR FROM A PIECE OF DURALUMIN OR ALUMINIUM ABOUT 1/32" THICK



DRAWING No. 3

Bend to shape out of No. 17 piano wire the front or nose hook as shown in drawing No. 2. On the outside of the wedge-shaped longeron joint fasten the nose hook and cement with ambroid and wrap with silk threads. Make doubly sure that the nose hook is held firmly to the joint, as the powerful motors put an added strain on this type of model.

Three X-braces and one straight brace, all made of bamboo, join the longerons. The two X-braces in the rear are of the same width and thickness, 1/8"x1/16" and are inserted as shown in the frame diagram of drawing No. 2, so that the rear end of the longerons are 7" apart. The front X-brace is of bamboo 3/32"x3/64" while the straight brace is 5/64"x3/64". Cut out and shape down the ends of all X-braces and the straight piece with a knife to wedges. As stated before in these pages, the X-braces should be cut so that the side with the wider surface is the glossy side of the bamboo. This is done because in a piece of slit bamboo the glossy side is much stronger. The longerons should be marked off with ruler and pencil for proper spacing of "X" and straight braces as shown in drawing No. 2. Make a slit with your knife at the proper marking on the longeron. (It is easier to make these slits while the longerons are held in a vise.) This will prevent the balsa wood from splitting while the slits in the longerons are being cut. The "X" and straight braces (made to the proper length) are fastened to the longerons by forcing the ends of the braces into the slits so that they extend to the other side. Before the braces are glued into place the whole frame should be trued up so that the longerons are straight. It may be necessary to slide the braces one way or the other in the slits to do this. When you are satisfied that the longerons are true, ambroid and bind them with silk thread. After the ambroid has dried and hardened, cut the protruding bamboo parts flush with the longeron surface.

The Bearings

The bearings or hangers for the propellers are made of No. 12 iron wire, forged to shape and drilled with holes large enough to insert the No. 17 piano-wire propeller shafts as shown in drawing No. 2. When the hangers are forged and drilled, insert them in the rear ends of the longerons, cement heavily with ambroid, and wrap firmly with silk thread as indicated in the diagram.

The Main Plane

The main plane is made from a slab of balsa wood as shown in the diagram. Lay out the shape as shown in the diagram, drawing No. 3, with a ruler, compass and pencil. Sandpaper the slab so that the wing tips, trailing edge and entering edge are stream-lined, retaining the proper airfoil to fit the wing section rib as shown in the diagram of wing section of drawing No. 3. Be sure you sandpaper the whole wing after cutting the outside shape, and before you begin to carve out the inside shape. Balsa splits easily, and in following these instructions you will run a minimum risk of having the balsa split while it is being sandpapered.

Lay out and cut the inside section as shown in the diagram, allowing 3/8" width for the entering, and trailing edges and wing tips. Do your cutting out carefully. The best tool to use would be a scroll saw, although it can be done with a sharp knife. Make seven balsa ribs 3 3/4" long and 1/20" thick, and shape to the wing section as shown in the rib diagram of drawing No. 3. Fit and cement the center rib in first, the two outer ones next, and the two end ones last. The spacing of these

ribs should be 2¾" starting from the center in each direction. In cutting the outer ribs that fit in on each side of the center be sure that you cut off only from the rear end (cutting from the front end would spoil the airfoil section of the wing). If the ends of ribs when fitted into the entering edge and trailing edge are a little high above the entering and trailing edges, sandpaper them down flush with the entering and trailing edges.

Coat the skeleton of the plane three or four times with acetone-ambroid solution at a ratio of 5 to 1. Note that this plane has no dihedral angle. As shown in the diagram, the completed width of the main plane at the center should be 4½", tapering from the center in each direction to 3½" at the beginning of the wing tips.

Wing Covering

The main plane is covered on both upper and lower surfaces with Japanese silk tissue paper, using banana oil or the acetone-ambroid solution we have already suggested. Cover the top of wing plane first with a piece of tissue paper large enough to overlap at least 1" on the edges, starting from the center rib outward to the tip. Apply banana oil to the top of center rib of wing and lay the paper on it immediately. Allow this to become thoroughly dry and fast before attempting to proceed with the balance of the covering. Then apply the banana oil to entering and trailing edges, section by section, between the ribs, and stick the paper to them. Before the banana oil has evaporated draw each section of the paper taut and work out the wrinkles in the paper, particularly along the wing, rather than across it, in order to preserve the section. When doing this keep the paper flat against the entering and trailing edges. Then put tissue paper on the other top half of wing by the same method. Trim the paper off around the edges and dope the entire top surface three or four times with a weak doping solution. The bottom surface of main plane is covered, trimmed, and doped the same way.

The Elevator

The elevator is cut to shape (using a pair of shears or tin snips) as shown in the drawing from a piece of aluminum or duralumin 4¾" long, 1 9/16" wide, and 1/32" thick. In getting the dihedral angle for the metal elevator, mark a line with a pencil at the center of the entering edge. Then mark off the center on the trailing edge, and a point ¼" on either side of the center. Draw lines from the two outer points marked on the trailing edge to the center point marked on the entering edge. Bend up the wing on each side along these lines to give a dihedral angle of one inch. To check the dihedral angle of the elevator place put the elevator on a level surface—if each wing tip is one inch above the level surface the angle is corect. The reason for the flat triangular surface at the center is to insure a better contact surface when elevator is fastened near the nose of the frame.

Propellers

The propellers are made from pine blanks, known as the X-blank, 7½" diameter, ¾" width, ⅞" thick. Instructions for carving the propeller are the same as for the other models described by the author. These propellers should not be whittled too fine because of the strain they must withstand. The propeller shaft and the S-hook are made of No. 17 piano wire, and are bent to the shape shown in the diagram.

The Power Plant

This model flies at a high speed and requires more strands of rubber than a

duration model. To have this model fly properly use two 16-strand motors of 1/8"x1/32" flat rubber. The strands should be hung between the propeller hooks and the nose hooks so as to have very little sag when the motors are unwound.

Assembling the Model

Instructions for assembling this model are the same as in the outdoor duration model. The elevator is held in place to the model frame by a rubber band with the center of entering edge of elevator resting on elevation block, which is 2" from the nose of the frame. The main plane is tied with rubber bands to the A-frame at the point shown in drawing No. 1.

Flying the Model

Gliding tests should of course be made before undertaking any flights with *The Flying Bullet*. Two or three very important things should be borne in mind. In gliding this model a sharp forward thrust should be given approximating the speed at which it is designed to fly. It should glide four or five times the height at which it is launched under these conditions. The adjustments for it are the same as for every other twin-push model; that is, if the model stalls, it is over-elevated, and the main plane should be moved back a little. If it glides too steeply, the model is insufficiently elevated and the main plane should be moved forward. In making your flying tests give the double motor the full number of winds, that is, about 400, and launch it as in the gliding tests with the sharp forward thrust. Remember that the best results are obtained from this model when it flies a straight and level course, so that necessary adjustments should be made with this in view. If the model shows a tendency to climb, steeply or at a great angle, move the main plane backward a little. Make your tests over a measured course of 300 feet. If you have followed the instructions and built this model carefully, you will get a satisfaction all its own in launching *The Flying Bullet* and watching it cover the ground at the speed of an express train.

The tools you will require to build this model are: a sharp knife, a pair of long-nose pliers, a small block plane, razor blades, ruler, pencil and several pieces of fine, medium and coarse sandpaper, pair of shears, a draftsman's compass.

Here are the materials necessary in building this speed model:

1 piece of bamboo to be cut up at least 9½" between notches.

1 slab of balsa wood 20" long, 4½" wide, at least ¼" thick.

1 sheet of aluminum or duralumin 4¾" long, 1 9/16" wide and about 1/32" thick.

2 pieces of balsa for longerons 27" long, 5/16" wide, 3/8" thick.

1 foot of No. 17 piano wire.

1 sheet of Japanese imperial silk tissue paper.

Six 1/8" washers.

66 feet of 1/8" by 1/32" flat rubber.

Spool of silk thread.

Small can of ambroid glue.

1 small can of doping solution—banana oil or acetone mixed with ambroid.

2 pine propeller blanks 7½" x ¾" x 7/8".

1 piece of No. 12 iron wire about 6" long.

The Phantom Pilot

By Irving Crump

POISED on the wing of a Huff-Daland light bomber, a mile and a half above the earth, Paul Stanley, civilian test observer, watched Lieutenant James T. Hutchinson feel desperately through roaring flames for the ignition switch.

The cockpit of their plane was ablaze, the cowl and fire wall blown away, giving the malignant bursts of flame a chance to reach out for human flesh, the flesh of two men who, accustomed to peril, had leaped from their seats to precarious safety at the sound of the first explosion.

Stanley, bracing himself on the long strut, was awaiting the verdict of the pilot, for Lieutenant Hutchinson had failed to stall the engine, and that meant that the plane was doomed. Only one thing remained to be done. The army officer looked at his mate and cried: "Jump."

Stanley said, "Are you sure you're ready? I'm ready to go, but I've got to know you are all right before I go."

"Jump, old boy. I'll follow you," Lieutenant Hutchinson yelled, and with that Stanley let go the long strut, slid down along the wing, and fell like a plummet toward the earth, eight thousand feet below. Hutchinson watched him until he saw the parachute open, and then prepared to jump himself.

Reaching for the plane controls, the officer set them so that the ship could continue straightaway on her course. Unfortunately, one of the wings, because of the heat from the flames, had become warped and slightly tilted. It was too late to do anything more. The gasoline was feeding the fire through a break in the line, and the burning fuselage and volatile fumes had become unendurable. Hutchinson then grasped the long strut, helped himself upon the wing, and like his observer, leaped far out into space, not pulling his ring until he had cleared the plane.

There was rather more than a gentle wind blowing, and the parachute, instead of describing a gentle loop, was blown around, and seemed to remain at the original height. While Hutchinson was contemplating his drop and wondering where and when he would land, he noticed his abandoned airplane, a streak of flame, describing huge circles around him and acting exactly like a machine in full control of a pilot.

To the lieutenant this was unheard of, and he tried to puzzle it out as both he and the plane began to lose height at exactly the same rate of speed.

There he was in the center of a giant spiral executed by the blazing derelict of the air, falling gently, and always on the same level with the doomed machine.

Then the wind began to play some tricks. It did not seem willing that the man who had jumped from the plane to escape death from the flames should get to earth unscathed.

A stiff breeze sent the pilot close to the airplane, so close that Hutchinson could feel its hot breath. Then began the real struggle with the elements. The pilot tried to side slip his parachute out of danger, but after several attempts found this maneuver worse than useless. The 'chute would not respond, and, as a matter of fact, carried him closer and closer to the orbit of the man-made comet.

Machine-gun bullets, of which there were two thousand rounds in the plane, protesting against the terrific heat, proceeded to burst one after the other like so many firecrackers. Hutchinson by this time was so close to the plane he feared that some of the escaping projectiles might hit him. Then he remembered that stored in the plane, for experimental purposes, were six bombs which now were apt to explode any second. And all this while the blazing plane clung to its spiral and seemed to exert magnetic influence over the parachute, much as a planet does over its satellite.

The phantom driver in the machine was guiding the death-dealing, furiously flaming thing with an accuracy that was awesome. Not an inch did it deviate from its circuit.

Finally, just as the pilot had become convinced that his parachute would catch fire with the next gust of wind, the superstructure of the plane, due to the conflagration, partially gave way, and some of it dropped. This had the effect of changing its direction, and the pilot with a whistle of satisfaction, proceeded to earth unmolested.

In the meantime, the phantom pilot had not quite finished his ride. The falling of the superstructure merely had the effect of causing the plane to fall several hundred feet, and then to change its orbit for an entirely new circle. Observers on the ground, some seven thousand feet below, not knowing of the near tragedy, thought some pilot was above them experimenting with a new smoke-writing device. Seeing the plane behaving perfectly, then, they paid no more attention to it.

When the plane reached the 2,000 foot level, still accomplishing a perfect spiral, Lieutenant Bertrandias, flying from an opposite direction on a practice flight, noticed that the machine was afire. He guided his plane near and called to the supposed occupants to jump. He could not believe but that someone was guiding the machine. Through the flame and smoke he could not see that the crew already had left. He could not understand what could possess a pilot to stay along with a blazing craft.

Bertrandias, for his own safety, then had to do a nose-dive to get out of the path of the derelict. The phantom driver had decided to do some stunt flying, and went up, down and into a tail spin from which the plane miraculously recovered.

Then, quite as if it were on exhibition, the phantom caused the blazing craft to dip, and then level out when flying speed had been picked up. Then again he caused the machine to bank when emergencies of balancing were present. Over a field the machine banked and circled and proceeded toward land in the orthodox way. And with the exception of failing to put down its tail at the psychological second, in order that all three points might touch the ground simultaneously, the phantom driver caused the nose to hit the field first. And the plane, done with its flight, exploded with 320 gallons of gasoline spouting up in a geyser of liquid fire.

This unprecedented flight occurred on June 17, 1926, out of Wilbur Wright Field, and is vouched for in the records of the Army Air Service.

According to these records, Mr. Stan-

ley and Lieutenant Hutchinson landed in a field within hailing distance of each other several miles away from their starting point.

Incidentally, because they had saved their lives through the use of parachutes, they were eligible, and became members of the Caterpillar Club. Only flyers who had thus foiled death are permitted to join, and at the time they were initiated the total membership of the group in the United States was only twenty-eight.

The annals of the Army Air Service have records of at least two of its officers, each of whom has saved his life twice through the use of the parachute.

One of these men had one of his terrifying experiences at Selfridge Field, Mount Clemens, Michigan. He is Lieutenant O. D. Hunter. The other officer who shares with him the honor of two parachute self-rescues is Colonel Lindbergh. This incident will deal with the experience of Lieutenant Hunter, for in addition to being a thrilling event it also has a comic vein, because the indomitable lieutenant wore a mustache when he left the ground for his flight but upon his return to earth, via the parachute route, after his plane burned, found that he was clean shaven.

Lieutenant Hunter, during the first week of March, 1926, had joined the early morning formation at Selfridge Field, and with the other pilots left the ground as part of the routine of the morning.

The flock of planes had attained a height of barely 1,000 feet, when Hunter felt something go wrong with the mechanism. He was able to keep his place in the formation for a while, but at last the bucking plane became unmanageable. Suddenly a piston in one of the cylinders broke loose from the connecting rod and ripped through the water jacket of the engine and through the cowling of the plane. In the general breakdown, the gasoline line, two carburetors and the crank shaft became involved. The break in the feeder mechanism allowed the gasoline to be sprayed over the engine, and a flash from in front of the fire wall completed the damage, for the plane immediately burst into flames. Hunter headed his plane out of the formation, and with his hand in the parachute ring jumped clear of his machine.

He landed without incident, but his friends on the ground saw that he was in bad temper. The mustache which it had taken him two years to mature had gone up in smoke, and he was angry. The escape he had made meant nothing to him, nor would he talk about it. He simply said, "That was routine, and was necessary, but I don't see why my mustache had to go up in smoke."

Hunter, of course, was a veteran at escape, having had a similar experience at McCook Field, Dayton, Ohio, while he was flight testing one of the first of the P-1 type pursuit planes which the Air Service had received. As in the last incident, he had left the field in the regular morning formation and had attained a height with the rest of the flyers of not less than 1,500 feet. He had just dived to his spot in his element after having done a "stunt" when he saw smoke curling from beneath the cowling of the engine. He realized at once there was no use to try to fight the fire and prepared to take his plane to the ground.

Quickly as he could he dropped out of the formation, and pointed the plane for a dive to the ground. As he started the dive the increased speed of the craft through the air forced the smoke and flames past the fireboard into the cockpit. The heat became intense, and, suffocated and blinded, the pilot unbuckled his safety

belt and with no more ado clambered upon the wing and slid off into the air.

Although at that time Hunter had only about 600 feet of altitude, his parachute opened immediately and he had a gentle descent. While loafing downward he watched the frenzied plane go into a nose dive and bury its seared and blistered body in the icy waters of Lake St. Claire. Breaking through the twelve inches of ice was no effort for the plane.

Lieutenant Hunter, in telling later of his experiences, said that the ice on the lake was quite smooth and he landed upon it rather hard. He said he scudded along the surface of it for many feet before he was able to swing the 'chute out of the wind. The last he saw of the plane was its tail sticking up through the ragged hole it had made.

A comrade asked Lieutenant Hunter to tell of his sensations when he realized his plane was afire. Hunter, rather a diffident individual, said he had no sensations. He declared: "Don't you see? My plane was on fire, the cockpit was full of fire and smoke, my face was burned and I couldn't see. There was nothing to it. I simply had to jump." War Department records show that not only is Lieutenant Hunter a great peace-time flyer, but reveal that he won many laurels as a flyer over the enemy lines. Official credit has been given him for the disposal of eight German airplanes during the World War.

About one week before the Selfridge Field episode of Lieutenant Hunter, Lieutenant Laurence C. Elliot of the same station and a member of the First Pursuit Group Air Service, had a similar experience with a burning plane, and escaped with no further damage than a singed eyebrow and a pair of scorched boots.

At that time he was driving a type PW-8, and was in the early morning formation far above Lake St. Claire when the pungent odor of smoke aroused him to activity. He had barely taken alarm when the fore part of his machine burst into flames and enveloped his feet and burned his face and hands.

It was impossible for him to leave the cockpit until he had thrown the plane into a gentle glide by means of the control stick. Accomplishing this, he then endeavored to stall the engine, but the fire by this time had become so menacing that he was unable to completely halt the motor, although he did succeed in throttling it down.

There he was, flames all about him, this boy officer of barely twenty-one years of age, wondering whether to jump at once to save his life or to try to force the plane into a perfect landing so that the wreck would not prove a total loss to the government. After pondering for only a fraction of a second he determined to save the plane if possible.

So, standing erect in the cockpit, with one hand still on the control stick, Elliott continued the plane in its glide, and all the while the flames about his boots were causing him more and more agony.

When the flames began to envelop him his first act after grasping the control stick was to try to loosen the safety belt. In this effort his fingers seemed so stiff that it seemed as if he suffered hours of terrible agony before he felt it give. And while this struggle with the belt was in progress he could not help giving a thought to his new boots which were being spoiled, and he even took time to be startled when the flames licked off one of his eyebrows like a puff of gunpowder going up in smoke.

In his semi-official report of his experience which is in the files of the Army Air Service Mr. Elliot related this as his experience:

"Unconsciously, instinctively I suppose, I managed during this time to throttle the engine. This decreased the flow of gas and was the best I could do, since I could not get my head down into the blazing cockpit far enough to entirely close the gas valve.

"I had also put the ship into a gentle glide toward the field, and I remember now that I had the fingers of my left hand tightly clasped around the ring attached to the rip cord of my 'chute. I must have done all of these things without ordered thought, for it seems impossible that the human mind could diagnose such a situation and convey to the body all these things during the small part of a second it took me to do them."

While he was gliding downward, even in the presence of impending death, Lieutenant Elliot had time to look about him, and think, quite apart from the danger, that if he didn't watch out he would land on top of some buildings. He quite coolly thought it out that if he accelerated the engine, this would only be encouragement to the flames, and yet he knew he did not have enough height to reach the landing field. A quick decision made him swing the ship so that it would land on the ice in Lake St. Claire.

With this decision, Elliot said he laughed aloud like a demon, for no other reason than that he was thinking of the dilemma of the boy who stood on the burning deck. With all the peril, and with the responsibility upon his shoulders to think clearly and rapidly, these irrelevant thoughts found space in his brain, although they did not detract an iota from his competence.

In his story of the flaming flight he continues:

"Time passes so quickly that we cannot reckon its flight. Again, it often drags its lingering length across our consciousness while we die of agonizing torture.

"My ship, capable of 160 miles an hour, seemed to be suspended motionless on invisible threads. Sharp tongues of brilliantly colored fire darted upward past my eyes to lose themselves in the cold clear air of the morning. I must have counted a million. From my precarious position I picked out all the old familiar buildings of the field, even remembering their use—headquarters, the Aero Repair, and I wondered if I would have lunch as usual at the Club. The sky, cloudless and serene, fascinated me—it looked so peaceful. And then, after what seemed endless hours of reminiscence, I saw the ice slowly coming to meet me.

"I don't know that I breathed any easier, for smoke and fire were still pouring from the cockpit, but I do know that the ice looked mighty, mighty good to me then. My mind was perfectly clear, painfully so, for I realized I had to make a good landing or come out on the loser's end after all.

"I forced my cramped fingers from the ring of my 'chute, and clamped them around the edge of the cockpit, although I fail to see now how that would have helped me had I crashed."

Experts who examined the plane in the laboratories where it was taken later, said Elliot's escape was almost miraculous. They found the fire had burned so intensely as to melt the aluminum cowling supports between the engine and the cockpit, and that all of the machine that had not broken away from its fastening was ready to break just about the time Elliot had effected his landing.

Had his ship been constructed of wood instead of the tubular steel he would have been dead before the débris of his ship reached the ground. His only alternative would have been to use the parachute the second he knew his craft was burning.

The Boys' Life-Lucas Indoor Tractor

By Joseph J. Lucas

THE Boys' Life–Lucas Indoor Tractor, duration model (a camber wing model) is the third model especially designed by the writer for *Boys' Life*. The author has built and tested this model very thoroughly and many successful long-duration flights have been made. It has fine record-making possibilities.

The Boys' Life–Lucas Indoor Tractor has four striking features that add considerably to its efficiency and record-making possibilities. These are: First, its single-surface camber wing, which adds to the lift of the model. Second, the tail of the model, covered with Japanese silk Imperial tissue paper on the under-side and set at a negative angle, which helps to keep the model from going into a stall while in flight. Third, the rubber motor runs underneath the motor base, instead of being on top, while the wing is fastened on top of motor base, instead of being clipped or fastened to under-side of motor base, as is customary in Tractor models. This feature keeps the rubber motor from interfering with the adjustment of the wing while in flight. Fourth, the outline edges of the rudder and tail are threaded with balsa stream-lined braces to retain their shapes. This helps to make the rudder and elevator extremely light, gives them a stream line and assures the requisite strength.

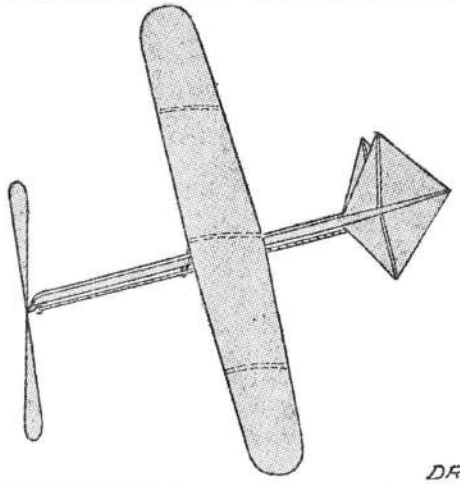
The tools you will require to build this model are: a sharp knife, a pair of long-nose pliers, a small vise, razor blade, draftsman's compass, scissors, ruler, pencil and several pieces of fine, medium and coarse sandpaper.

Building the Model

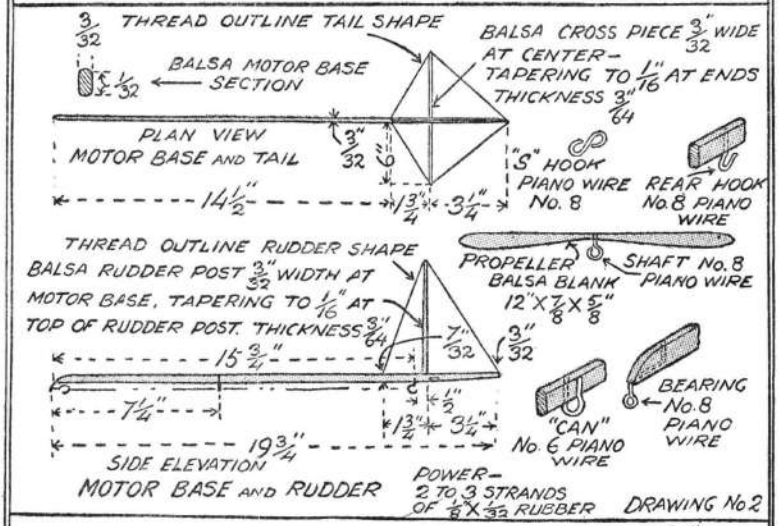
Before building the model, study the diagrams carefully and read over the instructions. Diagram No. 1 shows the perspective view of the model. Saving weight on this model is important, and every factor that makes for lightness is worth considering, but be careful not to sacrifice the required strength by trying to make the parts too light. Stream-line parts of the model wherever possible, and last but not least, put the best workmanship you are capable of on the model. The above are fundamental in all good model building, and we feel sure that good workmanship will result in the model making record-breaking flights.

The Motor Base, Rudder and Elevator

In making the motor base, first sandpaper the surfaces and edges to the size and shape of motor-base section as shown in drawing No. 2. Then cut the length of the motor base to 19½ inches. Next, taper the motor base, beginning 5 inches from the rear end of the motor base and tapering the under-side of motor stick to 3/32 inch. (See side elevation of motor base and rudder of drawing No. 2.) After the motor base is cut down to its proper length, and sandpapered to its



DRAWING No 1



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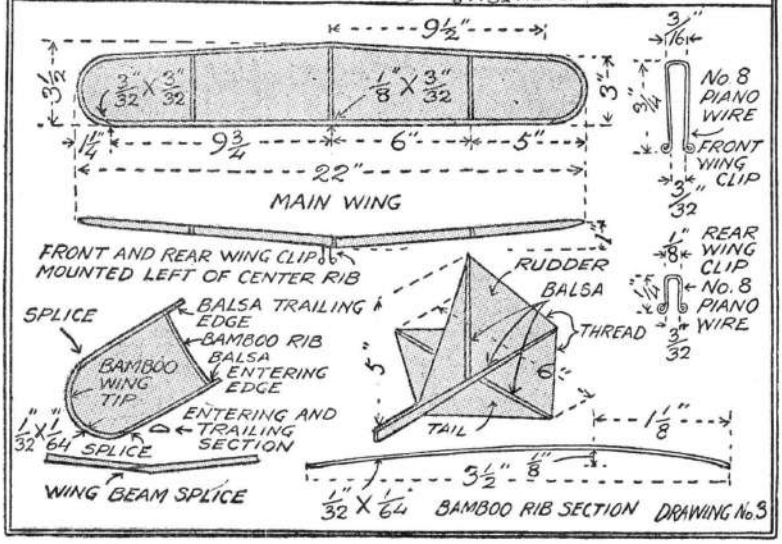


DRAWING No 3

proper width and thickness and has the right taper, dope the motor base with banana oil or acetone-ambroid solution twice. If the acetone-ambroid solution is used mix seven parts acetone to one part ambroid for this solution. Use fine paper for sandpapering after the doping solution is dry, as it will make the motor stick smooth and give it a stream line.

Make the propeller bearing with your long nose pliers and bend to shape out of No. 8 piano wire as shown in the diagram of drawing No. 2. In mounting the bearing to the motor base, fasten it to the under-side of motor stick as shown. Be sure to ambroid this bearing on firmly.

Bend and shape the rear hook out of No. 8 piano wire as shown in drawing No. 2. Insert the rear hook into the under-side of motor stick 15¾ inches from the front end. Use ambroid to fasten the rear hook in firmly. Thread bindings for bearings and rear hook are not necessary if work is neatly done.

Sandpaper a piece of balsa wood 6 inches long to the proper taper and thickness for the crosspiece of the tail as shown in diagram of drawing No. 2.

Make rudder post for rudder out of a piece of balsa wood 5 inches long, and sandpaper to the proper taper and thickness, as shown in sketch in drawing No. 2.

Dope the tail cross-piece and rudder post the same number of times as you have doped the motor base. Cut a notch so that the balsa crosspiece of the tail will fit in the under-side of the motor base. This notch should be cut 3¼ inches from the rear end of the motor stick. Fasten the crosspiece of tail into the notch with ambroid. Between the rear hook and crosspiece of tail plane cut a little slit on the top-side of motor base to insert the balsa rudder post. The balsa rudder post at motor base is made to wedge shape, inserted in the slit, and ambroided so that it holds firm. Use silk thread to form outline of tail and rudder as shown. To hold the thread on tail crosspiece rudder post, and motor base, use ambroid. See diagrams Nos. 2 and 3 for details of rudder and elevator.

Bend to shape out of No. 6 piano wire a "can" with a long-nose pliers and cement with ambroid to the under-side of motor base 7¼ inches from the bearing, as shown in side elevation of motor base and rudder in drawing No. 2.

The Wing

The wing used on this model is known as a single-surface camber plane; that is, the top of the wing shape is covered and presents a curved surface due to the shape of the bamboo rib section. In building this wing great care should be taken in making the bamboo ribs (shown in drawing No. 3), as they are very important. If ribs do not have the proper camber, the wing will not be as efficient as it should be.

The wing has a span of 22 inches and a chord at the center of 3½ inches, tapering out at the wing tips to 3 inches. The wing beams consist of two balsa strips: one, the entering edge, 19½"x⅛"x 3/32" at the center and tapering outward to 3/32"x3/32" at the ends; and the other, the trailing edge, 19"x⅛"x3/32" at the center and tapering outward to 3/32" at the ends. Both beams are sandpapered smooth and stream-lined, as shown in the section of the entering and trailing edges of drawing No. 3, and coated with banana oil or acetone ambroid solution. Give the wing beams two coats of doping solution, and sandpaper after each coat. If acetone ambroid solution is used, mix in the same ratio as for mixing doping solution for motor stick. Then the two beams are cut and spliced in their centers, as shown in the wing beam splice in drawing No. 3.

Note that the wing has a dihedral angle of one inch; that is, the beams bend upward at the center so that the wing tips are raised one inch from a level surface. Also note that the rear wing beam has an inward bend from the center to the beginning of the wing tips of ½ inch, which gives the taper of the wing. Set the wing beams to the dihedral angle of one inch. Be sure that you have the rear wing beam set to give the proper taper to the wing in conjunction with the dihedral angle of the beam. Cement the splices with ambroid, and let them dry. The bamboo ribs, three in number, are cut to the length of 3½" with a width and thickness of 1/32"x1/64" respectively. After ribs are cut to the proper length, width, and thickness, sandpaper them smooth. Bend to the proper curve (as shown in bamboo rib section in drawing No. 3) over a candle flame or any other means you have of bending bamboo. Wedge-shape the ribs on the under-side of each end. Then cement rib on to the top-side of beams at their centers, and dry. Fit the two outer ribs 6 inches from the center rib so that the beginning of the wing tips has a 3-inch chord. In fitting the outer ribs cut them off at the rear end only. The reason for this is that it does not spoil the bamboo rib section, as would be the case if the bamboo was cut at both ends. Before cementing outer ribs on with ambroid, be sure to make the underside at both ends of these ribs wedge-shape.

The wing tips are made of one piece of bamboo 6"x1/16"x1/32" and bent to shape (as shown in the bamboo wing tip in drawing No. 3) over a flame and then split in two. Splitting the bamboo in two makes your wing tips symmetrical. Fit the bamboo wing tips to the extreme ends of the wing beams with splice joints and cement with ambroid, as shown in diagram of bamboo wing tip in drawing No. 3. If silk thread wrappings are required on spliced joints, use them.

Bend to shape to the proper measurements, with your long-nose pliers, the front and rear-wing clips out of No. 8 piano wire, as shown in drawing No. 3. Cement them on with ambroid to the left of center rib on the under-sides of wing beams. Be sure that the front-wing clip is cemented to the entering edge beam, and that the rear-wing clip is cemented to the trailing edge beam.

Covering

The wing is covered with Japanese silk tissue paper on top only. There are several methods of gluing the tissue paper on, but the two best methods are banana oil or acetone ambroid solution. Cover half of the wing first with a piece of tissue paper large enough to overlap at least one inch on the edges. Apply the banana oil or acetone ambroid solution to the top of center rib of wing and lay one of the ends of the paper with a slight overlap over the rib on it immediately. This overlap is to be turned under the rib and stuck with doping solution, which holds the paper on more firmly than if the paper was stuck only on the top-side of the rib. Allow this to become thoroughly dry and fast before attempting to proceed with the rest of the covering. Now apply the doping solution to entering and trailing edges of the first section between ribs, and stick the paper to them. Before the doping solution has evaporated, draw the section of the paper taut and work out the wrinkles in the paper, working along the wing rather than across it in order to preserve the section. When doing this, keep the paper flat against the entering and trailing edges. Put the tissue on the next section in the same way, then follow the same method in covering the other

half of the wing. Trim the paper off around the edges and dope the entire top surface four times with a weak doping solution. If acetone ambroid doping solution is used, make the strength fifteen parts acetone to one part ambroid.

In covering the rudder, the method for doping and sticking the covering to the surface of the rudder is the same as for the wing, except that the paper is overlapped about 1/8 inch over the threaded outline of the rudder. Put the paper on the elevator in the same manner. Make a slit in the under-side of elevator covering to allow the rear motor hook through. Note that the covering of the under-side of the elevator makes it possible to give the tail a negative angle. The top of the elevator is not covered.

Propeller

Good long duration flights with this model depend on how carefully the propeller is made. The propeller is carved out of a solid block of balsa wood 12"x 7/8"x5/8". Draw diagonals with pencil on the 7/8-inch faces from corner to corner, and saw along the outside of the lines, allowing enough for the hub at the intersection of the diagonals. Then drill a fine true hole at the intersection of the diagonals for the propeller shaft. With a sharp knife carve the leading faces of the sawed-out blank so that when through carving it will be a right-handed propeller. By that, I mean, the propeller will rotate counter-clockwise, when inserted in bearing of the model as you look at the model from the front. To be sure you are carving a right-handed propeller, hold the propeller blank in your left hand and with your knife in your right hand cut on the end away from you so as to carve away to a flat surface in between and just slightly above the upper left-hand edge and the lower right-hand edge of blank. Carve the other half on the propeller blank in the same way. Then with fine sandpaper smooth and camber both surfaces slightly. Then carve the other sides (the back sides) of the propeller blank by turning over the propeller blank so that the camber surfaces of both halves of the propeller blank will be on the under side. Holding the propeller blank in your left-hand, carve the faces of each half of the blank in the direction of the camber faces of the blank. It would be more accurate to say that the faces you are now carving will be convexed instead of cambered or concave. In other words, the camber or concave surface is curved inward and the convexed surface is curved outward. The propeller is carved rounding to a curve of the camber of the leading faces of the propeller with a uniform thickness throughout the blades. When the propeller is sandpapered the uniform thickness of the blade should be about 1/32 inch.

Carefully shape the blade tips of propeller as shown in drawings No. 1 and No. 2. Then start cutting downward on the trailing edges toward the center of the propeller about 2 1/4 inches on each side of hub, reducing the hub to a thickness of 3/8 inch, as shown in drawing No. 2. Sandpaper the blades and hub of the propeller to the proper thickness, judging by the feel of them to your fingers or by seeing sunlight through the wood when propeller is held up towards the sun. The tips can then be rounded off with sandpaper to a more graceful shape. Finish off the propeller with very fine sandpaper. Balance it on a knife or razor blade edge at the center and if you do not have a perfect balance sandpaper the heavier blade until you do. Dope the propeller with banana oil or acetone ambroid solution about three times; after each coating rub lightly with fine sand-

paper and balance the propeller. In using the acetone ambroid solution make it 7 to 1 strength. Bend the propeller shaft into shape as shown in drawing No. 2, using No. 8 piano wire, and insert in the hub with ambroid, bend the end over to anchor but do not indent. Be sure the shaft is ambroided securely and again that the propeller is perfectly balanced. If another coat of doping solution is required on propeller balance the propeller once again, and be sure that the shaft of the propeller is true. Then put three 1/16 inch washers on shaft for bearing to reduce friction.

Power

The power required to fly the model is obtained from two to three strands of rubber, 15 inches long by 1/8 times 1/32 inch. The strands should be strung between the two hooks with very little sag when laid unwound in the "can" and along the motor stick. In the rear end the rubber motor should be attached to an S-shaped hook bent from No. 8 piano wire, shown in drawing No. 2, which permits the rubber motor to be detached from the rear hook when winding.

Flying the Model

The actual flying of an indoor tractor model is a good deal easier than flying an outdoor tractor model, for you always have ideal conditions indoors, instead of the varying weather conditions found out of doors. Before flying the model be sure that your model is assembled properly (shown in drawing No. 1) and that you glide it several times first. Note that in assembling the model that the front and rear wing clips are set off to the left of the center rib (looking from the front of the model). This is to counteract the torques. This will also help to eliminate some of the twisting of the right side of the wing upward. This counter-torque is used for the purpose of counteracting the torque of the propeller while it is revolving during the flight. The torque of the propeller would capsize the machine in the opposite direction to which it revolves if it wasn't for the above methods for counteracting the torque. In gliding the model hold it by the motor base in your right hand, just back of the wing over your head and launch on a slightly downward angle with a gentle forward push. If the glide is too steep the model has insufficient elevation. To remedy this move the wing forward a little and glide it again. If model stalls while trying to glide, it is over-elevated and can be adjusted by moving the wing a little to the rear. If model glide is five or six times the height you hold the model above the ground when launching it, you are ready for a trial flight. Note that this tractor model has a slight negative angle in the tail to help maintain longitudinal control while gliding or while in a power flight.

For the trial flight wind up rubber motor about 500 turns with an egg-beater winder. Before winding be sure that you have some one to hold your propeller and that rubber motor passes through "can" of motor base; also be sure that you wind carefully so that the propeller will have the proper power and turn in the right direction when released for flight. Before winding the rubber, stretch the rubber about three times the original length, and while winding the rubber walk in towards model until you have 500 turns and are near to the hook of the motor base. Unhook rubber from winder and attach motor to the hook. See that wing adjustment is all right, and last, be sure that it is well secured to the motor base.

In launching, hold the model by the motor base (a little to the rear of the

wing) in your right hand and with the left hand hold the propeller to prevent it from turning. When launching the model for flight, release the propeller with your left hand and then launch the model on a slightly downward angle with a gentle forward push with your right hand. If the inside wing flies low and sideslips to the ground, warp the right end of the wing a little. This sideslip is caused by the torque of the propeller and warping end of the wing serves to counteract the torque in addition to the offset of the wing caused by the placing of the wing clips. If the outside wing tip flies low and starts to sideslip it is due to too much angle of incidence or to warp in the right end of the wing. If model climbs too steeply or stalls and does not show the tendency to sideslip either to the left or right the wing needs to be moved back a little; and if the model does not climb very well and does not show any tendency to sideslip it means that the wing needs to be moved a little forward. Make these adjustments carefully to improve the flight of the model. If you want model to fly in smaller circles than in previous flights, warp the right end of the wing. Of course on some indoor models you can circle the model by bending the rudder, but on this model you cannot very well do that for the reason the rudder has silk thread entering and trailing edges. Remember, you can make better model flights and have less breakage by gliding a model before flying it. When you have obtained a good steady flight with the model the rubber may be wound up to 1,000 turns for a much longer duration flight.

The tools you will require to build this model are: a sharp knife, a pair of long-nose pliers, a small block plane, razor blades, ruler, pencil and several pieces of fine, medium and coarse sandpaper, pair of shears, a draftsman's compass.

Here are the materials necessary to build this indoor model. Get the best material obtainable, for every part is of importance in the design:

2 pieces of bamboo to be cut up at least 6 inches between notches for wing tips and ribs.

2 balsa beams at least 20″ long x 1/8″ x 3/32″.

1 balsa piece for rudder 5″ long x 3/32″ x 3/64″.

1 piece of balsa wood for tail 6″ long x 3/32″ x 3/64″.

1 piece of balsa for motor base at least 20″ long x 3/32″ x 7/32″.

6 inches of No. 6 piano wire for can.

2 feet of No. 8 piano wire for S-hook, rear hook, propeller shaft, bearing, and wing clips.

1 spool of silk thread.

1 sheet of Japanese Imperial silk tissue paper.

Three 1/16″ washers.

2½′ to 3¾′ of 1/8″ x 1/32″ flat rubber.

1 small can of ambroid.

1 small can of doping solution—banana oil or acetone mixed with ambroid.

1 balsa propeller blank 12″ x 7/8″ x 5/8″.

The Hoodoo

By Raoul Whitfield

Illustrated by William Heaslip

CADET HUGH GREENE turned away from the Headquarters bulletin board, a frown on his lean, rather handsome face, his gray eyes slightly narrowed. Johnny Means, crossing near him, called out, but Cadet Greene did not hear the other training pilot, so absorbed was he in his own thoughts. They were not pleasant ones. In the formation flight of two-seaters, which was to take place in two hours, he had drawn Cadet Don Fisher as his rear cockpit man. Don Fisher, the jinx!

He shook his head slowly. "An hour of it—formation flight with Fisher at the controls!" he muttered grimly. "Rotten luck for me!"

Hugh Greene moved from the low, long building in which was the adjutant's office. There were ships on the dead-line, outside P. T. 9's and some of the Douglass types. Two single-seaters were in the air, off to the south, doing combat work. It brought him a swift memory of Don Fisher's last crash. That had been in combat training, and it had been Fisher's ship that had crashed into the one piloted by Cadet Gary. A bad break of the air, Fisher had called it, and the Field Officers' Committee had apparently agreed. But that did not change Hugh's opinion any. Bad breaks seemed to follow along Don Fisher's sky trail. He had more cracked-up crates to his credit than any cadet in training at either Brooks Field or Kelly. And generally, when Don Fisher cracked up on the ground another ship cracked up, too. He was just naturally a tough-luck pilot, Hugh felt, a hoodoo.

He moved along the dead-line, toward the barracks in which he had his quarters. A figure, tall and erect, came toward him. Cadet Greene snapped a salute; it was returned by Captain Loomis. The flying officer who was in charge of Kelly Field operations spoke in a peculiar tone.

"Just been talking with Cadet Fisher, Greene. Did you know him before you came to the field?"

For several seconds Cadet Greene hesitated. The captain's eyes were on his, searching his. He nodded his head.

"Yes, sir," he stated. "We went to State Prep together, sir."

The captain frowned. "Played on the same football team, perhaps? Knew each other pretty well?"

Hugh Greene straightened. His eyes were wide. The captain was getting at something. He wondered what it was.

"Pretty well, sir," he agreed. "But we *didn't* play on the same football team."

Captain Loomis' eyes were narrowed. His head was lowered slightly, aggressively.

"Why not?" he snapped.

Hugh Greene did not hesitate this time. He spoke in a level tone.

"He didn't make the team, sir," he replied.

The captain smiled grimly. His voice

was cold, sharp as he stabbed out another question.

"Why not?"

Hugh Greene hesitated, then replied. His voice was low.

"Played in one game, and Prep didn't get a break. The other team did. Seemed like Fisher was a jinx. Fumbled a couple of times, messed up one of our best plays by getting in the way of the interference. Coach seemed to think——"

Hugh checked himself abruptly. There was an expression in the captain's eyes that stopped him. A fierceness mingled with mockery.

"He was *trying,* wasn't he?" The flying officer snapped out the question.

The cadet nodded. "I guess so, sir," he replied.

The captain nodded his head. A ship droned over the hangars near them. The flying officer spoke slowly.

"There seems to be a feeling on the field, Cadet, that Don Fisher is a sort of hoodoo. The boys seem to feel the way your Prep coach felt. Fisher has had some crashes. I suppose you think he should be washed out? Am I right?"

Cadet Hugh Greene did not reply. The captain's voice was a bit sharper as he went on. His brown eyes were on the gray ones of the cadet.

"This isn't Prep, Greene. Some coaches try to make a reputation at the expense of the players. They can't afford to have a man make a fumble or two, can't afford to risk a game to bring out something in that man. We can—down here. That's why Fisher is still flying; we don't think he's a hoodoo. Your record, Cadet, is much cleaner than Cadet Fisher's. Does that please you?"

Hugh smiled lightly. "Naturally," he stated. "Of course, sir, it most certainly pleases——"

"It should not!" The cap-

tain's eyes were grim. "Fine landing—nice take-offs. Good formation flying and combat work. Never a bad break in the air, Cadet, that's your record. Nothing tough. And how do we know what *you'd* do in a crash?"

Hugh Greene stared at the captain. That officer relaxed slightly. The tone of his voice changed. "We know what Cadet Fisher would do. That's why he's still flying. I tell you these things for just one reason—Fisher came to me an hour ago. Said that he'd read the notice posted at Headquarters. Didn't want to sky-ride with you. Felt that you'd been largely responsible for his being termed a hoodoo. You'd talked about the Prep affair. Felt that his style differed from yours. You, he said, were a conservative pilot. He asked a change of assignment."

Cadet Greene's face was flushed. A conservative pilot! And *Fisher* wanted the change of assignment. Fisher, the jinx!

"Better have a talk with him, get things straight." The captain's eyes held a peculiar smile. "Because I *refused* his request. You fly together and you take turns in piloting your plane in formation. That is all, Cadet!"

Mechanically Hugh Greene saluted. The captain returned the salute, moved swiftly along the dead-line. Hugh stood motionless for several seconds. Don Fisher wanted a different assignment; that seemed incredible. He was too "conservative!" With a perfect air record!

"Squealing!" he muttered, as he moved on toward the barracks. "Crying because the fellows know his Prep record! Talk to him—I'll talk to him!"

He increased his pace toward the barracks. Rage was gripping him. And the worst part of the whole thing was that Captain Loomis had seemed to think that Don Fisher was right. Not *all* the way right, for he hadn't changed the assignment. But he'd made Don Fisher out as the one who complained. It was—well, almost incredible. A change of ship assignment asked by a sky jinx!

"Well?" Don Fisher spoke quietly enough. "Some one told about the Prep football stuff. Wasn't it you?"

Hugh Greene stared down at the straight-featured, browned face of Don Fisher. That cadet was seated on the edge of his cot, cleaning the glass of his pet goggles. He was medium-sized, with blue eyes and light-colored hair.

"Brett Rushly asked me if I'd known you before and I told him I had." Hugh's voice was low. "He said he thought he'd heard of you at Prep. And I——"

"You refreshed his memory," Don cut in. "That's all right, I know about that. Told Captain Loomis what I thought, that's all. Didn't want to fly with you, Greene. But it failed to go over. We fly together."

The quietness of Fisher's voice enraged Hugh. But he conquered his anger.

"You're lucky," he snapped. "We'll get along fine!"

Fisher nodded. "When *you're* piloting, we will," he stated calmly.

Hugh stiffened. His eyes were narrowed on the blue ones of Cadet Fisher. He started to speak, but Don spoke first.

"That's what you're thinking, isn't it?" he asked. "And maybe you're right. Get your 'chute on carefully, and be ready for the jump, when I'm flying. You won't mind going over the side. I've jumped, you know. Hoodoo stuff, but it's good experience. I'm sorry, Greene."

Hugh spoke grimly. "About what?" he asked.

Don Fisher shrugged his shoulders. "The whole thing," he replied. "About my getting some tough breaks and about

your talking so much. And most of all about pulling a sky-ride with you."

Hugh leaned over. "Why don't you want to sky-ride with me, Fisher?" he snapped. "What's the *real* reason?"

Don Fisher raised his eyes. "Most fellows would grab the chance, eh?" he replied. "Well, here it is, Greene. You're so sane I don't know what *would* happen if anything went wrong. You're good, Greene, *too* good. Clear?"

Hugh Greene straightened. He fought down the rage within him, the desire to strike at the seated cadet. Fisher went on polishing his goggles. It was seconds before Hugh was able to speak, but his voice was steady when he did speak.

"Fly the way you *usually* do, Fisher, and you'll probably have a chance to see how good I am!"

Don Fisher nodded. "Thanks," he returned quietly. "Maybe you're right."

Hugh Greene climbed into the front cockpit of the two-seater P. T. 9. The ground crew, arms linked together, spun the prop, the engine roared through the exhausts. Turning his head slightly as he tuned up the ship's engine, Hugh saw that Cadet Fisher was climbing into the rear cockpit. There were four other P. T.'s near by; the formation flight would consist of five planes. Captain Loomis would lead the formation for the first hour, after which Lieutenant Haver would come up from the field, the formation would break and change form, being led by the lieutenant. The captain then would observe from the air.

The engine warmed up, the blocks pulled away from the wheels, Cadet Greene turned his head and shouted to Don Fisher. "You take her, Cadet!"

Fisher nodded his head. The controls moved from Hugh's finger and foot touch, as Fisher gripped the stick in the rear cockpit, got his feet in the pedal controls. Hugh relaxed in the cockpit; Don Fisher was to fly for the first hour and he was to handle the ship during the second. The controls were dual; when Fisher moved stick or foot pedals in the rear cockpit they moved in similar manner in Hugh's cockpit.

He smiled grimly as the captain's ship taxied out from the dead-line. The four other ships thundered out and got into the air. The climb from the field was not a stiff one, and they picked up formation as they gained altitude. Fisher was flying the P. T. 9 in the Number 3 position. It was a V-shaped formation, the Number 2 ship was to the left of the captain's plane and slightly higher. The Number 3 ship was to the right and slightly higher. The other two ships carried out the V in a similar arrangement. The formation, at 5,000 feet, became very close.

Less than ten feet of air separated the planes. There was a nasty wind; the day was gray. At six thousand feet there were clouds. It was difficult to hold such close formation in straight flying; on the banks, dives and zooms it would be even more difficult. But it was a necessary part of flying. A well-held formation made enemy attacks extremely difficult.

For a half hour the formation flight was steady, with only mild banks and a few dives. Then the captain commenced to signal, to execute swift, almost vertical banks, to zoom almost immediately after a signal was given. Hugh Greene, stiff in the seat now, watched the narrowness of several escapes from crashes. Once Harrison, flying the Number 5 ship, above and to the right of their plane, almost nosed into them as they came out of a dive. He zoomed over them and it was five minutes before he picked up formation again.

The work of Don Fisher, Hugh was

forced to admit, was good. Extremely good. There was no shakiness in it. He flew sharply, in a clean-cut manner. Once, on a steeply banked turn, he swung a bit wide. But he was in formation quickly with a neat sideslip and a fine control of the Number 3 plane.

It was cold. Even in the cockpit back of the engine, Cadet Greene was forced to slap his gauntleted hands together again and again. The captain was leading the formation just below the clouds, zooming, diving and banking. Minutes passed. Hugh did not turn his head to look at Cadet Fisher. There had been only the one poor piece of flying on his part. Hugh Greene, smiling grimly, was determined there would be *no* bad piece on his part.

Then, suddenly, the captain was signaling. The formation was breaking up, scattering. Staring over the side, Hugh saw a ship climbing up from the field. It was the lieutenant coming up to relieve the captain.

Don Fisher had banked off to the southward. He was circling the plane now in a mild bank. The other ships were giving Lieutenant Haver plenty of air room as he climbed up. The captain banked over toward the P. T. 9, in which were Hugh and Don Fisher. And it was then that Hugh though of something that stiffened him in the cockpit.

The captain had not watched Fisher's work. There had been observation from the field, but the distance there was great. And the captain had been too busy leading the formation to note anything but a very severe break. Certainly he had not seen Fisher's wide turn and sideslip to get back into formation. But the captain intended to watch—*this* time. To fly close and watch. And he had given Hugh the control assignment for this period!

The P. T. 9 was diving, the engine was cut. The stick moved loosely from side to side; a voice reached Hugh, Don Fisher's voice.

"Didn't crash her, Greene! Too bad, eh. We'll be—all right *now*—you take the stick!"

The voice died beneath the shrill of screaming wires. Hugh Greene, his face set grimly, gripped the stick. His feet went to the pedals. Almost savagely he nosed the plane upward. It seemed to him that above the roar of the engine, as he gave her the gun, he could hear Fisher's laughter.

He got the plane out of the bank and zoom. Formation was picking up; this time he was to fly the P. T. 9 in Number 2 position, above and to the left of the lieutenant's ship. Getting into position he almost used too much throttle, was forced to zoom and stall a bit in order to come in right. And then the formation was on, picked up. With the captain's plane off to one side, the five formation ships roared to the northward.

Hugh Greene caught himself handling the controls too tightly, almost freezing on them. He eased up on his right-hand finger grip of the stick, relaxed his foot pressure on the pedals. The formation was a close one now. He had known the air was bad, but he had not realized the skill with which Don Fisher had been forced to handle the plane. It took all he had to ride the sky in perfect formation, but he was determined to out-fly Fisher.

And for thirty minutes he did just that. His air work was a bit crisper, his banks smoother. He neither lost nor gained distance on the lieutenant's plane, in zoom or dive. There was a faint smile on his face. The lieutenant signaled a right bank, went into it sharply. The left wing of the P. T. 9 tilted up, the right one went down with almost a snap. The

whole formation started to swing. And then——

Something went wrong. A shape shot past the P. T. 9 between the lieutenant's banking plane and the ship to the right of Hugh's. Wing fabric flashed close to wing fabric. Hugh Greene, stiff in the cockpit, hesitated for a split second. Dive or climb? Which?

He zoomed. But the split second had counted—had counted big. There was the jerk of wing fabric, the snapping sound of metallic struts. The stick jerked savagely from his grip, the whole ship was twisted violently to one side. Something battered sharply over Hugh's left temple; he felt himself slumping forward in the seat, tried to fight the waves of weakness off.

He had crashed—crashed with another ship—in formation!

For seconds all sensation left him—and then he was aware of the ship spinning; through misted vision he saw bits of wing fabric trailing off above them as they plunged downward. Something was striking at his hands; he was conscious that they still gripped the stick. A voice sounded, hoarsely, in his ears.

"Out! Greene—get up! Quick! The 'chute——"

The voice trailed away into the shrill of wind through the rigging of the falling plane. His grip on the stick was suddenly gone—strong hands had ripped his own loose.

The voice came again.

"Up! Stand up—jump! The 'chute!"

Something struck Cadet Greene on the left side of his face. He struggled up from the whirling cockpit—a face was close to his. A body was sprawled across the fuselage behind him. Fisher—Don Fisher!

Fisher's eyes were burning into his. His lips were close to Hugh's. And his words, this time, came clearly above the shrill, the ship-plunging sounds.

"You—crashed! Down to—two thousand! Are you—quitting?"

Hugh's fingers fumbled at the safety-belt buckle. Other fingers than his snapped it loose. Fisher was gripping a center strut with one hand, but his other was free. Hugh was rising shakily in the cockpit now. The plane was whirling fiercely.

"Wait—until—clear!" Fisher's voice was hoarse.

"Jerk rip-cord—got that?"

A pain stabbed through Hugh's head. His right hand went down to the harness over his left hip, to the rip-cord ring of the Irvin 'chute. He felt his body suddenly lifted, swung out from the fuselage——

Then he was falling. With his last strength he jerked the rip-cord ring. He somersaulted downward, only half conscious of the motion. Dimly he sensed the freeing of the pilot 'chute, heard the crackling of the greater spread of the big 'chute. His body was jerked by the harness—now he was drifting, drifting down toward the field below. Shaking the tears from his eyes, he twisted his head, with an effort.

Below him—another 'chute was drifting downward. Figures were running out upon the field. He did not hear the crash of the P. T. 9. His lips moved slightly.

"Got me—loose!" he half muttered. "Good old—hoodoo!"

Captain Loomis looked down at Cadet Hugh Greene. Hugh smiled up from the barracks chair in which he was seated. There were bandages on his head—a strut splinter had cut him up a bit.

"I didn't see the crash," the captain said slowly. "I was banking off at the time. But I saw you both jump."

Hugh's eyes widened. They went past

the captain's, to those of Cadet Don Fisher. Fisher was smiling, too.

"Didn't jump, sir," Hugh's voice was steady. "Fisher got me loose—lifted me clear. It was his sticking until I was out that saved——"

"It looked to me, sir," Don cut in abruptly, "as though the crash was unavoidable. Major Gray's ship came down out of the clouds——"

The captain raised a hand. "It was an accident," he said slowly. "We are fortunate that both the major and you fellows got down safely. It was just a bad break. They happen fast—in the air."

He somersaulted downward, only half conscious of the motion.

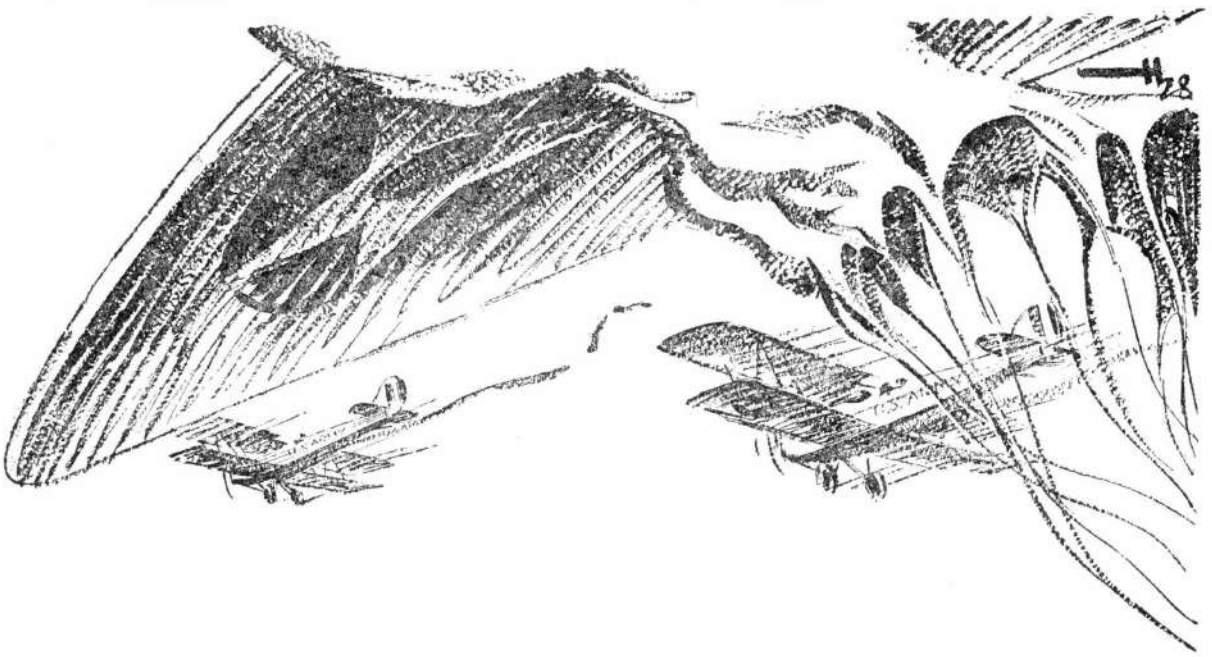
There was a little silence. It was broken by Cadet Greene. His eyes were on Don Fisher's.

"Sorry, Don," he said slowly. "Guess I talked too much, saw things wrong. I was the hoodoo—this time. I'll set the boys right about the whole——"

The captain cut in, his voice low. There was a twinkle in his eyes.

"If you fellows are hoodoos," he stated grimly, "that's what we need at this field. I'll go look for some more like you two."

The Hoodoo



He grinned at Don and Hugh, moved down the barracks corridor. At the end door he paused, glanced back. Don Fisher and Hugh Greene were talking with their heads close together. The captain smiled as he moved out toward the dead-line.

"Things happen fast"—he breathed happily to himself—"in the air!"

My Flight Across the Atlantic

By Rear-Admiral Richard E. Byrd

WHEN our preparations for the transatlantic flight were all made, we decided to wait until Colonel Lindbergh returned and to take part in the reception to him. I was glad that he was the first to fly from New York to Paris, for he succeeded in arousing an interest in aviation probably as no other flight could have done. After the reception, at the first report of fair-weather conditions, we took off. We were not waiting for ideal conditions.

The flight of the *America* was a scientific expedition. In every new endeavor information has to be added to information until this combined knowledge turns what once was a hazardous enterprise into a commonplace, everyday undertaking. In the matter of long transoceanic flights we are at the beginning. Alcock, Lindbergh, Chamberlin showed that the North Atlantic could be flown. The Wright Whirlwind motors in the *Spirit of St. Louis* and the *Columbia* showed that we had a dependable engine capable of the tremendous strain. But it was still necessary to secure primary data regarding the air conditions, types of planes and accommodation, safety devices and other information—approximating as near as possible conditions under which such commercial flights would be undertaken—before long ocean voyages can become a regular service. In her construction and with her equipment, the *America* was ideally constituted to do such pioneering.

The most careful consideration was, therefore, given to factors of safety, for these would be of prime importance in a commercial undertaking. The *America* was equipped with three engines, any two of which would have kept her in the air with a load of ten thousand pounds. We carried a collapsible rubber boat with oars, which we had tested for its seaworthiness. Our tanks were equipped with dump valves so that in case of forced landing in the sea we could have emptied them in a minute and, being airtight, they would have buoyed the plane until we could pump up our rubber boat. We were equipped with a radio, both for sending and receiving, and it proved of the greatest utility. Although while flying across the ocean for nearly nineteen hours we saw neither land, sea, sky, nor ship, there was never a minute in that entire period when some station was not receiving our automatic signals. When it was impossible because of weather conditions to take any bearings, Lieutenant Noville's radio exchanges with two ships giving him their positions, enabled me by drawing two lines on my chart, from the direction of the ship in the direction of the plane to place our position, which would be exactly on the point at which the lines crossed.

The Take-off

One of the greatest dangers of a flight with such a heavy load as the *America* carried is the take-off. Runways in which

such ships can take off, built of concrete, are a necessary development for long-distance flying. I had examined every inch of the runway on Roosevelt Field, and had taken every precaution to guard against accident. To give the *America* a little added speed at the start, we built a little hill at the top of which the *America* had been moored, and when we took off in the early morning of June 29th, it helped us as much as seven or eight hundred added feet on the runway would have done. As it was, the mile of runway we had was not any too long, leaving a margin of safety. One of the improvements that will be made in air fields is the use of such inclines. They could be placed on wheels and moved as may be required so that the pilot could take off into the wind. We were unable to take off one day because of the danger of a cross wind. Such a wind could easily turn over a heavily loaded plane, resulting in a bad crash.

The *America* went into the air in 48 seconds, after a run of 3,268 feet. This was a remarkable accomplishment, for the plane weighed about 15,000 pounds. We had 1,300 gallons of gasoline. Of course, we could have taken much more gas if he had not taken the emergency equipment, mail, food and medical supplies, and cut our personnel down to two men. But, as I said, it was important that we provide for every emergency as the transatlantic commercial plane of the future would have to do.

The First Day

It rained just before we took off at 5:24, and it was thick and drizzly until 8:30. One of the problems of aviation is keeping such a heavy load in the air, and for the first few hours we chose our altitude for safety rather than speed. After that the weather up until Newfoundland was clear, although there were some rough bits over Nova Scotia. We had an opportunity while on this lap to get data as to what altitudes it was best to fly at to take advantage of the wind. Remember that a good following wind on a journey as long as this could add as much as 800 miles to the cruising radius of the plane, and that the factor of safety that our three engines gave us decreased our cruising radius because it is less compact and affords greater resistance than a one-engine plane.

We had three scares during that first day. Right near the start there was difficulty in making the plane lift, and we were afraid that it would be necessary for us to dump half of our gasoline and return. Actually Lieutenant Noville was all ready to dump one of the tanks when at the crucial moment the plane began to lift!

Our second scare was over Newfoundland. I noticed a big stream of oil floating aft on the deck. If it was due to a leak we would have been in a serious predicament. I recalled our North Pole experience and the miracle that saved us. I asked Noville, who was forward, to see what the cause was, and we were certainly glad to find that it was due to his spilling some oil while pouring it into the engines.

Some time after leaving Newfoundland I asked Noville to check up the gas consumption. On the figures he gave me we were burning forty-two gallons of gas an hour. If we had kept on at that rate and with any winds against us, it would have been impossible for us to reach the other side, especially if I did not succeed in picking up the northern side of the high-pressure area from which I hoped to get a following wind. I did not tell the boys this, but I was worried. I chanced everything on our weather map. We began to climb for the tail wind that would prove the chart's value.

In the Grip of the Fog

That climb took us above the fog and clouds just in time to see the sun dip in a blaze of glory into the western fog banks. Now began our long struggle through the entire night to get out of the fog. Hour after hour we were flying blindly by our instruments, and I couldn't help but admire the way in which Balchen and Acosta, who were relieving each other at the wheel, kept at their job. Our only contact with the world was the radio. Daylight, although we could not see the sun, was welcome. Sometimes the fog thickened so that we could hardly see the wing tips of the *America*. Occassionally the fog was so dense and wet that the water came dripping into our cabin. It was during this long period of fog that I checked up on the gas again, and found to my great relief that a mistake had been made and that we had enough for many hours' flying. The tilt of the plane had shown a wrong reading of the gasoline gauges. Actually the consumption proved to be at the rate of about thirty gallons per hour for the entire flight.

Flying between these layers of fog we saw some wonderful and awe-inspiring sights. Sometimes we looked down hundreds of feet into dark ominous valleys. At times the horizon looked like a mountain range. Occasionally the effect was an illusion of blue lakes and rivers against the gray clouds.

Once or twice we found ice forming even on our engines and had to maneuver quickly out of this danger. We wondered what would have happened if the ice formed on our propellers.

Fog, rain, sleet for more than eighteen hours, but we were staking everything on our weather map in order to get the best following wind. This had led our course south of the route we had originally planned. Instead of steering for Ireland we aimed for Finisterre. We certainly were glad, after hours of flying blind, to catch our sight of sea when nearing Brest and to see the second sunset of our journey.

Lost over France

We now began to receive radio messages from all directions. It seemed as if every radio station in Europe was wanting to talk to us. Setting our course for Paris, I checked very carefully for the points of land we should see. We had traveled for more than 3,300 miles and there were only 300 left to the end of our journey. It began to rain, darkness fell, and while it became more and more difficult, and finally impossible, to check on the lights of the cities beneath us, I was so confident that when we saw some bright lights ahead of us, at about the time we should have reached Paris, I got Noville to send a radio message to Mr. Rodman Wanamaker that Paris was in sight.

Imagine our astonishment to find when we reached the lights, that we were at some amusement resort on the water. Our compass had taken us in a circle instead of a straight line.

It was a crucial moment, for our gas was naturally getting low. I made a rapid calculation of our position and set another course to Paris. I checked the earth-induction compass with the magnetic compass and found they agreed. It was quite evident that some magnetic attraction either on the ship itself or on the land had swung us around in a circle. We kept to this course until we thought we were over Paris, but the weather conditions, if anything, were worse, and we could see nothing underneath us. We were told that they had heard our engine at Le Bourget with a sound intensifier, but we saw no lights or anything else that would give us an indication of exactly where we

were or that would make a landing possible.

If we kept on we would have been forced to make a landing in the darkness, should we miss Paris, and our only hope of safety was of making a forced landing on water. So we swung around back. It was our only course, if I was not to jeopardize the lives of the crew, as well as the lives of the people on the ground, if we made such a landing. I accordingly set our course to go back over the amusement resort, and coming out of the fog we saw it several times. We circled around it without finding a landing place. Noticing a revolving light some distance away, we made for it, hoping that its flashes would enable us to judge our distance when we came down. The light flashed too quickly, however, and proved useless for our purpose. I knew it was a perilous undertaking, for I had never heard of anybody landing on a pitch-dark night on water without a light.

The Landing

Balchen was at the wheel. For navigation purposes we had bombs which would ignite on striking water and give us a light for a few minutes. Our gas was almost exhausted.

We dropped a bomb and Balchen brought the plane down slowly, keeping up flying speed. He made what would have been, with pontoons, a good landing, but the land wheels striking the water were wrenched off the fuselage, the plane tore through the water and stopped with a crash. The whole plane began to fill with water.

I was looking out of the window trying to judge our distance from the water. Noville says I was shot out of the window. I swam around and back to the window, shouting to Noville. But we had all be deafened by the roar of the engines! Noville was getting out of the window on the other side, and seeing he was safe, I swam forward to the cockpit, reaching for Balchen. I found him disentangling himself, rather stunned from the impact of the landing. I yelled for Acosta and looked for him in the cabin. I was afraid that he might be pinned under the fuselage. It was very dark and we swam around shouting for him. Presently Acosta, who also had been flung out of the plane, appeared, and I certainly was glad to see him.

Our emergency compartment on top of the plane had been placed there so that in the case of forced landing the top of it would remain clear of the water. Our calculations again proved accurate. Noville tore off the top, we got out the rubber boat, got on top of the wings, and pumped air into it. We were stiff and bruised, and this was rather a strain. The main tank, empty of gasoline, was buoying us up. Embarking on the boat, we rowed ashore, carried it up the beach and set out for the nearest light of the village of Versur-mer, which was some distance away.

The Value of the Flight

Because of the adverse conditions under which the flight of the *America* was made, we were able to demonstrate the practicability of transoceanic flights in a much more convincing way than if everything had been plain sailing. For one thing, the voyage of the *America* proved that an airplane could stand up against anything but the worst storms. The *America*, designed by Mr. Anthony Fokker, will, I think, in all essential respects prove the forerunner of the transatlantic plane of the future. Our three Wright Whirlwind motors, each of 225 horsepower, beat flawlessly the entire forty-two hours. The radio proved that such equipment is absolutely essential to the safety

of the regular transatlantic airplane when it does come.

The difficult weather conditions did also give us data, which otherwise would not have been possible, on how to combat bad weather conditions. Because of the speed of the airplane the drift of the utmost importance when such a long journey is contemplated. If a navigator is not able to check his wind drift for a long period, he might find himself at the end of the journey four or five hundred miles off his course. The flight of the *America* in eighteen hours of fog proved that a plane's position could, in such circumstances, be constantly checked by finding our bearings through the position of the ships received over the radio.

We found that the strength of the winds increased up to 1,500 feet and did not increase much after that until an altitude of 3,000 feet had been reached. Thereafter the strength of the wind seemed to increase with the altitude. We also found several occasions that, when the surface winds were from an easterly direction, by climbing 6,000 feet or so we could get a following wind.

The wind in the storm areas of the North Atlantic travel counter-clockwise around the storm center when going from west to east. Flying on the southern side of this disturbance, the navigator is helped by the wind, especially if he flies at a good altitude. In the high-pressure or good-weather areas the wind moves clockwise in the North Atlantic and by traveling on the north side considerable assistance could be gained from the winds.

Data such as this are absolutely necessary to the commercial flyer of to-morrow. Even storms will be made to shorten the distance he has to fly.

Our Message of Good Will

One of the chief hopes in which the expedition of the *America* was undertaken was that the flight would serve to foster the good will between France and America which has existed for so many years. We carried a piece of bunting from which was made the original Betsy Ross flag, to present to the President of France, and in other ways we hoped to further cement the traditional friendship which has existed between these two countries. In this respect, too, we were eminently successful, for the French people received us with a sincere cordiality and showered upon us many kindnesses that betoken the friendship and esteem in which they hold the American people. I was glad that among the expressions of American good will that I was able to convey to the French people was one of greetings from the Boy Scouts of America to the Boy Scouts of France. They are fine fellows, and it gave me a great deal of satisfaction to do this as one of the eighteen honorary scouts of the Boy Scouts of America.

As I said at the beginning, we hoped to be among those pioneers whose efforts would make transoceanic flying a commercial possibility. I think it is possible that the day will be here in five or ten years when great planes, twice as large as the *America,* with multiple engines—sixty per cent of which would keep it in the air—will begin to ply across the Atlantic. Possibly in fifteen or twenty years travel in them will be as common as travel on steamships is to-day. When that day comes the new liners of the air will be in the hands of the Scouts of to-day, and whatever satisfaction I feel in the flight of the *America* is overwhelmed in the thought that experiences such as the flight of the *America* enable us to deliver into your hands that greater day for which you endeavor through Scouting to "Be Prepared."

A Flying Model of the America

By Elmer L. Allen

THIS is a scale-reduction model, approximately one-twentieth actual size, of the famous Fokker tri-motored monoplane in which Commander Richard E. Byrd and his companions made the flight over the North Pole and return in fifteen hours. This airplane has the same constructional features as the *America,* which Commander Byrd more recently flew across the Atlantic Ocean to the shore of France.

Building a flying model airplane of this kind is an achievement of which any boy may well be proud. Accurate models, made to duplicate on a small scale the large machines they represent, are the best possible means of experimenting in the science of flying, and their construction and flight provide practical and highly interesting entertainment.

The first requirement in building a model airplane is a clear, accurate plan. The plan for the *America* is presented in three parts: the "Plan," which shows the ship looking down from a point immediately above the center of the wings; the "Side Elevation," looking from the side; and the "Front Elevation," looking directly at the forward part of the machine. These parts are reproduced exactly one-quarter the size of the finished model; that is, one inch measured on the plan equals four inches on the model. Be sure to multiply by four when measuring on the plan.

The lettered indications, thus: *A* and *g* indicate the various parts of the model and the size and kind of material used for each part. These indications correspond with the letters in the "Key to Parts and Materials" printed at the end of this article. The list of materials required to build this model is as follows:

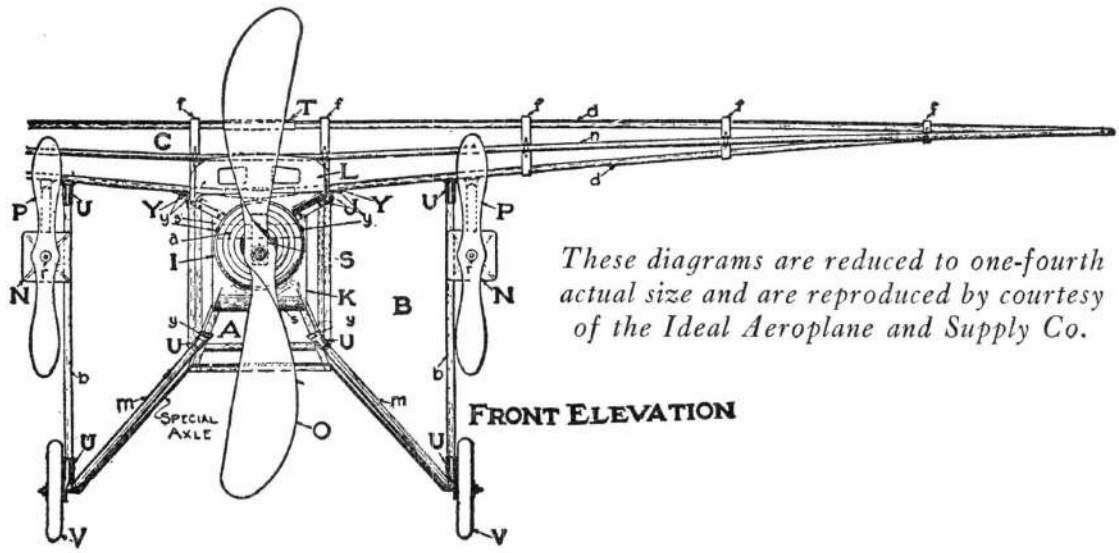
Wood

a—1 piece, 5/16" x 5/16", 24" long.
b—7 pieces, 5/32" x 5/32", 26" long.
c—2 pieces 1/8" x 1/8", 12" long.
d—11 pieces, 1/8" x 1/4", 18" long.
e—1 piece, 5/32" x 3/8", 6" long.
f—8 pieces, 1/16" x 3/16", 16" long.
g—2 pieces, 3/32" diameter, 12" long.
h—1 piece, 1/16" diameter, 12" long.

Reed

m—2 pieces, 3/16" diameter, 13" long.
n—3 pieces, 1/8" diameter, 44" long.
p—4 pieces, 3/32" diameter, 12" long.
s—Sheet Aluminum, No. 34 gauge, 12" x 12"—1 piece.
No. 16 gauge, 6" x 12"—1 piece.
t—Tinned wire, No. 32 gauge, 1 spool.
x—rubber strands for motive power, 3/16", flat strands, 30'.
(Fold to make 18 strands each 18 inches long; tie ends together to make one continuous piece.)
Wood propeller, 10" size.
Wheels, 2" size; 1 pair.
Balsa wood, 1" x 1", 6" long, 2 pieces.
Bamboo paper, 24¾" x 33½", 2 sheets.
Wood veneer, 2 ply, 10" x 30", 2 pieces.
Bamboo varnish, 1 can; Wood glue, 1 can.
Small screws, 1/4", 3 doz. 3/8", 1/2 doz.

A Flying Model of the America



These diagrams are reduced to one-fourth actual size and are reproduced by courtesy of the Ideal Aeroplane and Supply Co.

FRONT ELEVATION

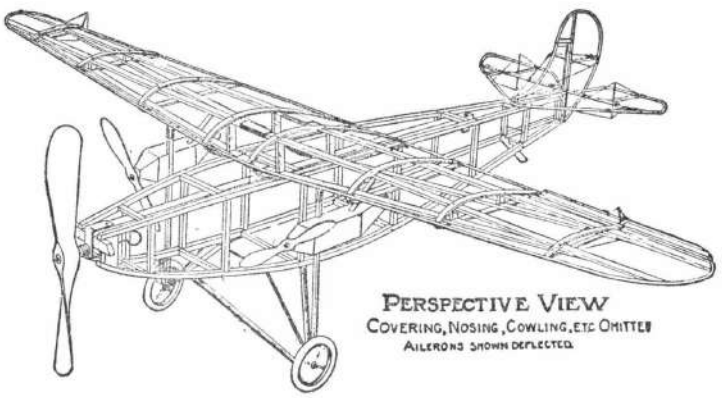
Small nails, ¼", ½"; 1 box each.
Piano wire, about 1/16", 12".
Small tools—Drills, 1/32"; screwdriver, sharp knife.

The first thing to do is study the plan carefully and note what the different indications mean and how the various parts appear in the different views. Note particularly where the different sizes of wood and reed are used, where the aluminum must be placed and such other details.

Build the fuselage first. This is shown clearly in the side-elevation view on the plan. Measure off the distances on the plan for the pieces marked *b* on the plan; four pieces of wood 5/32" x 5/32" each 26" long. Arrange small nails on a flat board the exact shape these pieces must be formed to make the long frame of the fuselage; these are called longerons. Put these pieces in a flat pan and cover them with water. Let them boil for at least twenty minutes. Take them from the water and immediately place them in the form made by the nails in the board. Bend them carefully so they do not split. Leave them there until thoroughly dried out; overnight would be best.

Put together each side of the fuselage first; tack the vertical crosspieces in position as shown on the plan; there are six such pieces. Use the 5/32"x5/32" wood as indicated by *b*. Get them in exactly the positions indicated. Make two sides, both exactly the same. The next step is to join these two sides together with the horizontal crosspieces. There are also six of these for the top and six more for the bottom. Trim the ends of both vertical and horizontal crosspieces to match the curve of the long side pieces. Be careful to get the horizontal crosspieces at the right places; the back edge of each horizontal piece is on a line with the front edge of each vertical piece so the nails do not have to go through the long pieces at exactly the same point. Use both nails and glue at these joints.

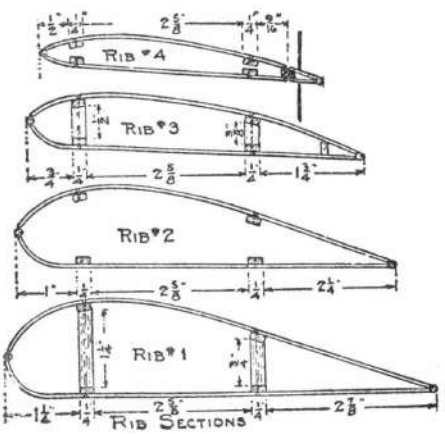
Trim the rear end of the longerons so they are all even and proper length as measured on the plan. These ends must be fastened to a T-section which forms

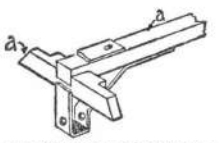


PERSPECTIVE VIEW
COVERING, NOSING, COWLING, ETC OMITTED
AILERONS SHOWN DEFLECTED

the rear end of the fuselage. This T-section can be cut from a short piece (about 1½ inches) of the 5/16"x5/16" wood cut from the long piece. After it is in position trim off the excess wood. Drill holes through the ends of the longerons and through the T-section and drive a ½-inch nail through each hole; also wire the parts together and reinforce with plenty of glue. Make it good and strong at this point. Wipe off the excess glue on the outside.

The front end of the fuselage must also be joined together firmly, but several operations are necessary. Take the long 5/16"x5/16" piece of wood used for the motor stick (*M* on the plan); ½ inch from one end drill a hole in the exact center of the stick. Form a hook out of about 3 inches of piano wire, push one end through the hole, leaving about ¼ inch sticking out. Bend this end over and force it into the wood so it holds tightly. Form the hook from other end, cutting off any excess wire. Make a square hook as indicated at *X* on the side elevation. The other end must be arranged with the mountings for the propeller shaft. Note the small diagram marked "shaft hanger mounting." *a* is the other end of the motor stick. Cut this stick off as indicated





SHAFT HANGER MOUNTING
(PORTION OF HANGER BROKEN AWAY)

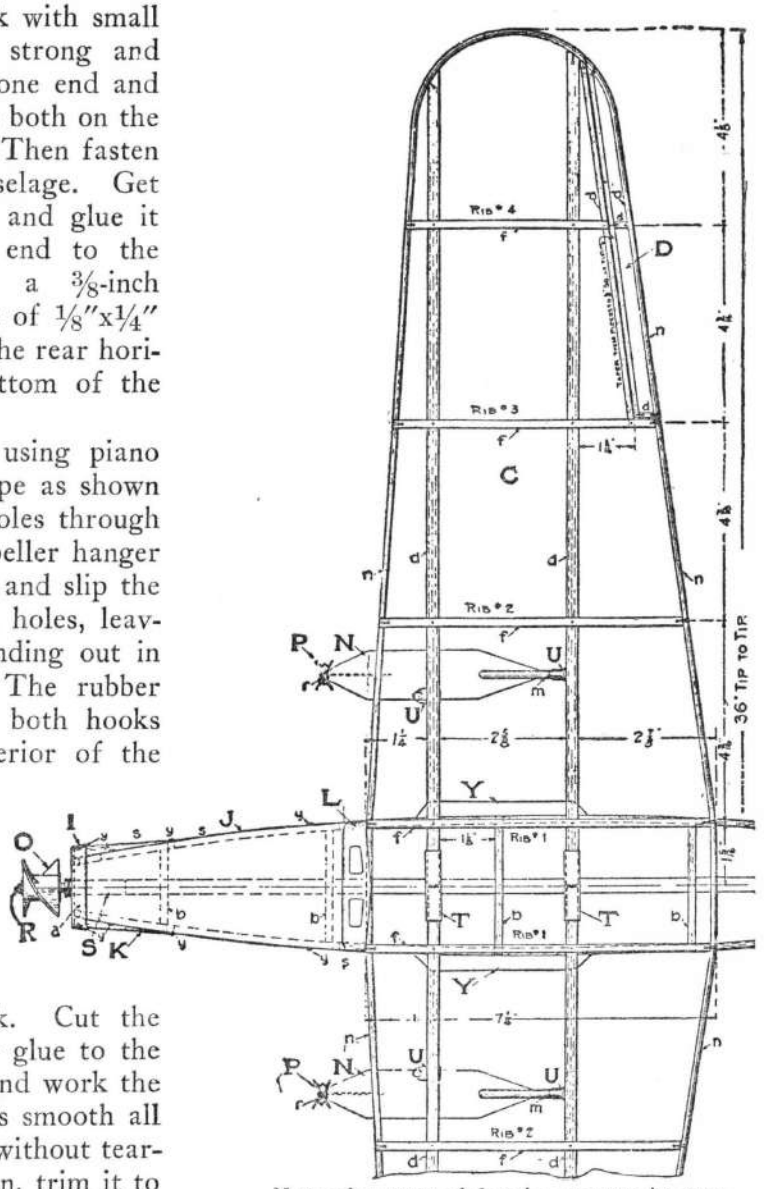
on the plan. Out of the small piece left over form a crosspiece in the shape shown in the diagram just referred to, placing it at the end of the motor stick with the edge exactly flush. Nail and glue it into position. Next form a propeller hanger out of aluminum. Use the heavier piece, cutting from it a strip exactly 5/16 inch wide and 5 inches long. Bend it into the shape shown in the diagram. Drill holes

and fasten to the motor stick with small screws. Get all this very strong and tight. Be sure the hook at one end and the mounting at the other are both on the same side of the long stick. Then fasten the motor stick into the fuselage. Get it in tight at the front end and glue it securely. Fasten the rear end to the horizontal crosspiece with a ⅜-inch screw. Form a tail skid out of ⅛"x¼" wood and fasten securely to the rear horizontal crosspiece on the bottom of the fuselage.

Make a propeller shaft, using piano wire and bending it into shape as shown on the plan. Drill ⅛-inch holes through the lower section of the propeller hanger where noted on the diagram and slip the propeller hook through both holes, leaving at least 1¼ inches extending out in front in a straight piece. The rubber strands can be slipped over both hooks and extend through the interior of the fuselage.

Cover the fuselage with wood veneer, leaving uncovered the front panels on the top, bottom and two sides, and the next to the last panel on the bottom directly under the rear rubber hook. Cut the paper roughly to size; apply glue to the fuselage, not to the paper; and work the paper on the fuselage so it is smooth all over and as tight as possible without tearing it. When the paper is on, trim it to within ⅛ inch of the frame and then work this edge over the frame with the ends of your fingers, using just enough glue to make the edges stick. Try to arrange the paper so the rough edges come on the under side of the model.

Cut and shape the aluminum cowling from the sheet of number 34-gauge aluminum, fastening it over the open sections of the fuselage at the front end. An aluminum nosing could also be fitted over the exposed front end of the fuselage if desired. Mount the propeller with the curved edge facing forward, away from the plane.

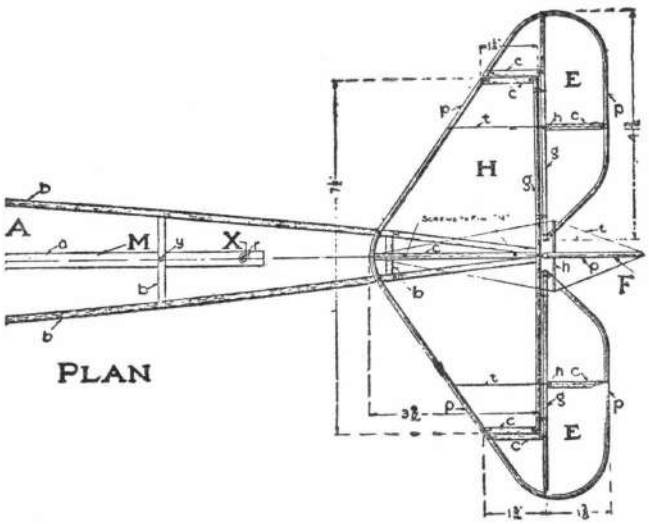


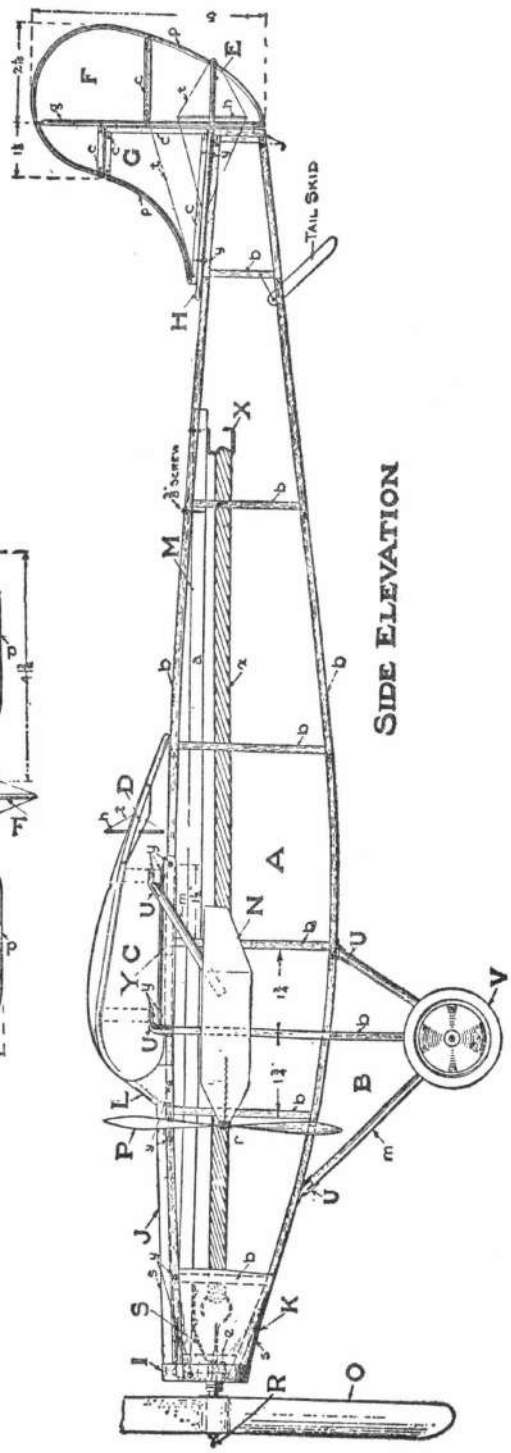
Note other parts of drawing on opposite page.

Turn the fuselage upside down and lay it flat on a table. Cut two plane holders; see *Y* on plan; and fasten them to the top of the fuselage in position as indicated.

One edge is screwed against the fuselage and other extends out at right angles. The plane will be fastened to these extended edges. Lay the fuselage aside now and start oprations on the main plane.

This main plane, *C*, is made in two parts: the right half and the left half. Be sure you make one half for the *right* side and the other half for the *left* side; notice they are not both shaped the same. Start with the spars for the top, on the right plane. The forward one is 17⅛ inches long; the rear one 17½ inches long. Lay them in front of you with the ends exactly even at the left, the longest one nearest you. Now mark on both pieces





the exact location where the ribs must be fastened. Do the same with the top spars for the left wing, be sure to reverse the position so you have both *right* and *left* wings. Now you are ready to form the ribs. This must be done very carefully as each rib is different. Note the small diagram marked "rib sections" in which the correct shape is given for each of the four sets of ribs. If possible, form the top and bottom sections of each rib at the same time. When you have them ready,

lay out the spars again and fasten the ribs to the spars in the position previously marked. The ribs go on the outside of the spars; note the plan and diagram. Fasten them with small nails and glue, but do not drive the nails all the way through on ribs Nos. 1 and 3. Make the lower or bottom section of the plane the same way, using the lower sections of the ribs. Bevel off the ends of the lower spars so they lie flat against the top spars when the two sections are placed together. Now prepare crosspieces to be placed upright between the spar strips in ribs Nos. 1 and 3, putting them into position and driving in the nails which you left partly out previously. Be sure the center ends of the spars are exactly even and all four come together in the center where they can be fastened together with spar sleeves made from the aluminum. Glue and nail them to the ends of the spars. Note on "front elevation" that the forward spar of the top section is perfectly straight from tip to tip.

The ailerons must be made next; see *D* on plan. Take two pieces of wood, 1/8" x1/4", and taper off one end of each until it is 1/8"x1/8". Place these pieces between the rear ends of ribs Nos. 3 and 4, and flush with the ends of the rear spar. Nail and glue them into position. The reed which forms the entering (or forward) edge of the trailing (or rear) edge of the plane must now be fastened around the entire plane. The 44-inch pieces are for this purpose. Start at the point where the tapered aileron support meets the rear spar and run the reed around to the front, across to the other end and to the corresponding point at that end. Drill holes in the ends of the ribs (not too close to the ends) and glue and wire the reed between the points of the ribs, trying to get a perfectly smooth joint on the outside at the entering edge. Do the same across the trailing edge, starting again at the same point and running the reed all the way across to the opposite end. Place pieces of 1/8"x1/8" wood to form the remaining edge of the ailerons and wire them into position. Also place small pieces to brace the ailerons where indicated on the plan.

Now cover the plane with bamboo paper. Do the under-side first, applying glue to the wood and working the paper over the edges and around the curves carefully. Then cover the top the same way. Get the paper as tight as possible without tearing. Coat the paper with bamboo varnish—"dope," as the aviators call it. This will loosen it at first but it will draw tight when dry. To prevent warping, lay the plane flat and hold it down with light weights until it dries.

The landing gear is the next operation. The 3/16-inch reed is used for this. It must be steamed in boiling water and shaped exactly the form indicated on the "side elevation." Both pieces, each 13 inches long, must be shaped the same way. Trim the ends to the desired length and fasten in position on the under-side of the fuselage where indicated on the plan. The terminal fittings, *U* on the plan, can be secured from suppliers of model airplane materials, or the ends may be tapered and glued and screwed to the fuselage. Both side pieces must be exactly alike and placed in exactly the same position on the fuselage. Next form an axle of piano wire the shape shown on the "front elevation" at the point marked "special axle." The lower ends must be horizontal to receive the wheels and the ends sufficiently long to permit them to be turned to hold the wheels in place. The axle must be wired to the lowest point of the curve in the reed supports. Now shape the two pieces of balsa wood to represent the engine housings for the two

side motors. Cut grooves into them to accommodate the supports which hold them in position. Fasten these supports in position with glue; nails are not much good in this soft balsa wood. When the assembly is complete, attach to plane when you are ready to assemble the model.

The elevators, rudder and fin are made and covered the same as the main plane. Follow the plan, using the sizes of wood and reed as indicated, and fastening with glue and nails. Cover the surfaces with bamboo paper, gluing as before. Also paint the surfaces with bamboo varnish the same as you did the plane. The fin—see *G*—should be covered on both sides with pieces of the wood veneer left over from the fuselage. The levers which control these moving parts are made from the 1/16-inch diameter wood, pushed through holes previously drilled where necessary. Round toothpicks will serve the same purpose.

The next step is to assemble the various sections. Put the rear sections on the fuselage first. Hinge the elevators, *E*, to the stabilizer, *H*. Fasten the fin, *G*, to the stabilizer with screws, first drilling holes through the center rib of the stabilizer. Brace the fin with wire, drilling holes each time before putting the wire through the ribs of the stabilizer. Then hinge, with wire, the rudder, *F*, to the fin and also to the T-section which forms the rear end of the fuselage. Now mount the whole assembly to the end of the fuselage, screwing and nailing it into position as indicated on the "side elevation."

Fasten the plane to fuselage next. Lay the plane down on a table upside down. Then lay the fuselage on the plane. Adjust to proper position and screw together, placing the screws through holes previously drilled in the aluminum plane holders which you fastened to the sides of the fuselage. If you have the plane made right, the screws will come in the center of each spar. The plane must be absolutely square with the fuselage and absolutely even on each side of it.

Cut the windshield out of aluminum and fasten in position snugly between the front edge of plane and the cowling of the fuselage. Then attach the assembly consisting of the balsa wood engine housings with their supports. Either drill a hole in the lower ends of the upright supports and slip them over the ends of the axle, or wire them to the axle. Use the left-over pieces of 3/16-inch reed for the upper supports, placing them in holes drilled into the balsa wood, gluing them securely, and fastening the top ends to the under-side of the main plane. Taper these upper ends so a flat surface for nailing rests against the spars of the plane.

Mount the wheels, turning over the ends of the wire to hold them in place. They must turn freely on the axle. Now cut out the two auxiliary propellers, exactly the shape shown on the "front elevation" at *P*. Hold them in the center and twist each end slightly in opposite directions pin wheel fashion, so they will turn in the wind. Drill a hole in the exact center of each and fasten to the pointed end of the housings with a long, thin nail, or pin. These engine housings may be painted black or gray if desired. Mount the 10-inch wooden propeller to the end of the propeller shaft, turning over the end and forcing it into the wood to hold it securely. Now your model is finished. The next operation is to try it out.

Examine it carefully all over. See that everything is tight and true. The plane and fuselage must be perfectly square. Warping in any direction must be corrected. Any twisted part must be fixed. Test it before winding it up. Grasp the

model by the rear end of the fuselage under the rudder. Lift it up slightly and give it a little push. It should roll along straight and perhaps give a little hop off the floor.

If everything seems all right, and the model runs straight, give the propeller about fifty turns from right to left, clock fashion, holding the fuselage with your left hand as you turn the propeller. Set it down on a smooth runway, holding the propeller with the left hand and the rudder with the right hand. Place it on the runway, lift up the rear end and give it a push forward, at the same time releasing the propeller. It should run along the ground for a few feet and then rise off the ground and fly a short distance. Then when the model appears to be all right, when it runs straight and flies in a straight line give it another and little longer test of about 100 windings of the propeller. The final winding should never exceed 140 or 150 revolutions of the propeller.

The controls are important and the control wires must be taut all the time. If the model dives, raise the elevators; if it shoots up sharply, lower the elevators; if it turns or twists and shoots sideways, it is probably warped and must be trued up before it hits something and breaks. The rudder will steer the model just like the rudder on a boat.

If the plans reproduced here are not clear, larger ones which show the same details in exactly one-half actual size (these reproduced here are one-quarter actual size) may be obtained by writing to Elmer L. Allen, 15 East 26th Street, New York City, and enclosing twenty-five cents for each plan desired. There are also various parts of this model which may be difficult to make at home, such as the aluminum propeller-shaft hanger, the propeller shaft itself, the rudder post or T-section, the wooden propeller, wheels, terminal fittings and aluminum nosing. All these may be obtained from manufacturers of model airplane supplies. Complete outfits containing all the required parts, materials and fittings can also be secured from these manufacturers.

Key to Parts

A—Fuselage
B—Landing gear
C—Main plane
D—Aileron
E—Elevator
F—Rudder
G—Fin
H—Stabilizer
I—Nosing
J—Upper cowling
K—Lower cowling
L—Windshield
M—Motor stick
N—Engine housing
O—Main propeller
P—Auxiliary propeller
R—Propeller shaft
S—Propeller hanger
T—Spar sleeve
U—Terminal fitting
V—Wheels
X—Rear rubber hook
Y—Plane holder

Key to Materials

a—	Wood	5/16" x 5/16"	
b—	"	5/32" x 5/32"	
c—	"	1/8" x 1/8"	
d—	"	1/8" x 1/4"	
e—	"	5/32" x 3/8"	
f—	"	1/16" x 3/16"	
g—	"	3/32"	diameter
h—	"	1/16"	"
j—	"		T-section
m—	Reed	3/16"	"
n—	"	1/8"	"
p—	"	3/32"	"

s—Sheet aluminum
t—Tinned wire
x—Rubber
y—Screws

If I Were a Scout

By Clarence D. Chamberlin

IF I were a Scout . . . well, I am a Scout. I have always been with them in spirit, but not long ago at the Interstate Park camps, New York made me one of her scouts, and I am proud of the honor.

But if I were a boy again, and a Scout, as indeed I would be (there were no scout troops at Denison, Iowa, when I was a kid) and if at the same time I wanted to make flying my job when I grew up, how would I make the scout program help me toward my ambition?

First of all, I would try to be a good Scout, and I would advance in my tests to First Class rank. The things that Scouting develops—the resourcefulness, the quick thinking, the ability to look after oneself anywhere—the being prepared for any old thing that came along—that is necessary for success in anything, and aviation needs them as much as, if not more than, any other profession. And you must have a background, an attitude toward life, such as the Scout Oath and Law give you, to amount to anything in any walk of life. During the war they used to say that the one arm of the service that preserved the old idea of gallantry and of courtesy to foe was the air service, and the records of the army of all nations are full of splendid gestures of chivalry from one airman to another. Those are necessities of life that the program of Scouting would lay up for me, without conscious effort, and you may be sure I would take full advantage of it.

Now let me see. In the tests themselves what particular help would I be getting that would serve me when I became an airman? First, those *Tenderfoot knots*. Again and again airmen, especially those flying cross-country, and having to come down in all kinds of fields, have found the ability to tie a good knot and moor his plane in a wind, mighty useful. *First aid*—knowledge of how to take care of fainting, shocks, bruises, cuts and scratches, burns, to dress wounds—the more advanced stuff as a first class scout—that would certainly be real preparation for emergencies as an airman. *Signaling?* A good airman learns that anyway, and if you went to the army training school as I did, you would be required to learn it as a part of the exacting course. Learning the *Compass* would be a direct training for the air, as would be *map reading* and *judging distances*. You see, I would be getting real preparation for the air even while I was qualifying as a Second and First Class Scout.

And don't forget the pure Scout stuff —Scout pace, cooking without utensils, tracking, swimming, hiking, use of knife and ax, observation and knowledge of trees and birds. They would be building my body for endurance, my eye for quick observation and my brain for correct deduction and judgment, my resourcefulness. These the good airman must have. And the thrift requirements—well, you

know few of us airmen are millianaires, and to learn to save your pennies and spend them carefully would certainly be no handicap to you as an aviator.

And then the Merit Badges. I would have my eye on the Eagle Scout Badge, of course, but there are some within its twenty-one badge requirements, and some out of it, that I would go in for hard—wanting, as I do, to be an airman—a good airman—one of the best, for that would be, of course, my ambition, as I hope it will be yours if you decide to go into flying.

Well, let me see. Let's begin at the A's. *Automobiling,* of course. I made my own merit badge program in that as a boy when I became interested in a motorcycle. And I have tinkered around with engines, mostly airplane engines, ever since. There are several of them in my workshop now—or rather were, for I sold them a few days ago. *Blacksmithing?* Mighty useful. In that, too, I took a course of my own. *Carpentry,* the knowledge of a carpenter's tools, would be a fine thing for the practical airman to have, especially if he is jaunting cross-country, in an old plane. New, high powered planes are expensive, and not every beginner can afford them. *Electricity, radio,* advanced *signaling.* I don't need to tell you, who have been reading about long flights across wide continents and great oceans, how useful such knowledge would be. With them behind you, you would have a head start on anybody taking up flying without the training or its equivalent.

You notice, of course, that I purposely avoided one of the Merit Badges. No need to tell you, I would go after the Merit Badge on Aviation with everything I had. With the other things I have mentioned it would just about set me up and get me ready for the business of actual flying. Let me see again how those requirements run:

1. Have a knowledge of the theory of the airplane, helicopter, and ornithopter, and of the spherical and dirigible balloon.

Well, I would not only want to get that, but to keep up with it.

2. Make a working model of any type of heavier-than-air machine that will fly at least twenty-five yards, and build a box kite that will fly.

Important theories of flying were first tested with models, and somewhere back of all our great airmen you will find the kite-flying craze. The Wright brothers, who taught the world to fly as kids, were the expert kite-flyers among their companions, and model making has shown the way to many important developments in flying.

3. Have a knowledge of the types and makes of engines used for airplanes, the best-known makes of airplanes, and feats performed or records made by famous aviators.

There are many well-known flyers who do not know very much about engines—there were many daring pilots during the war who wrote their names in history who did not know so much about the motive power of their planes. They were, most of them, trained quickly for a particular job in the air. But the real airman, who learns to love his ship, and flying for its own sake, wants to know everything he can about engines of all makes and types of ships, and what makes their difference and value. What others have done are, I need not say, a constant inspiration and spur to an airman's own efforts.

4. Have a knowledge of names of famous airships (dirigibles) and some of their records.

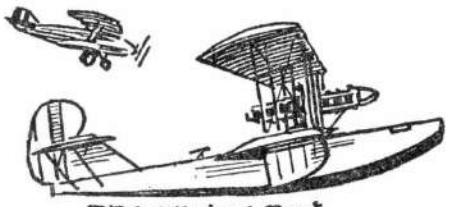
The heavier-than-air machine is very much in the public eye at the present time, but airships have demonstrated their

value. They are an important branch of flying, and but for their costliness would be put to much greater use than they are at present.

5. Understand the difference between aviation and aero-station, and know the types of apparatus which come under these two heads.

The art of flying depends on its science, and the science in turn is helped by the art. These are important branches working to one end.

In the next five years more than five million boys will come into touch with the Scout program. What couldn't they do if only a small part of them were inspired to become airmen and got the preliminary training such as the Scout program provides! What a great future will be in store for America in the air!



The Trail of Twenty-nine

By David Binney Putnam

TO BOYS who are growing up to-day flying is becoming a very commonplace matter. At least we are used to seeing planes, and hearing planes, and talking and reading about them. Air travel doesn't seem much more extraordinary than automobile traveling. Certainly it is about as usual as I suppose automobiling was, say, twenty years ago.

But at that there is a tremendous kick in flying, even if it be a short flight. And when a few weeks ago Dad asked me if I would like to fly across the continent you may be sure there was no delay in accepting the invitation.

He had some business on the Pacific coast and asked me to go along. We used the Transcontinental Air Transport, whose train-plane service has just been started, and in all covered by air about four thousand miles, from New York to Los Angeles and back. And then we did a bit of additional flying on the side. So I feel I really had a pretty fine bird's-eye view of a whole lot of America.

It happens that I was born in Oregon and remember pretty well some of the transcontinental crossings by train. And of course out in that country I heard a lot, and read a good deal, about the old stage-horse days, wagon freighting, and all that sort of thing. Anyway, even as a youngster it was easy to realize what a tremendously long distance separated Oregon from New York. On the train pretty nearly five days was consumed for the trip from the Atlantic to the Pacific.

And now I am just back from a transcontinental journey which took exactly forty-eight hours. And a wonderfully comfortable interesting journey it is—the most spectacular use of air transportation in the world to-day.

We left New York from the Pennsylvania Depot at seven o'clock Thursday evening. After a comfortable night on the train we were at Port Columbus, Ohio, about eight the next morning. There one gets out from the train and walks just across the platform right into the waiting plane. The planes themselves are big tri-motor Fords. A new sort of "covered wagon," which can hold fourteen passengers, and which cruises through the air at about one hundred miles an hour or better. They have three engines so that if one should happen to go bad, the other two could easily keep the plane aloft.

They are really quite as comfortable as a Pullman car, these big passenger ships. The pilot and assistant pilot sit up forward in the cockpit, a little bit higher than the passenger part of the plane, and separated by a door. There they have "dual control," which means that the "stick," rudder bar and all the rest of it is duplicated so that either pilot can fly the ship.

On the T. A. T. planes there are ten seats, although there is really room for twelve. That gives extra room and com-

fort. The aisle runs down the middle. There are very comfortable seats on each side, right next to the window, each seat having a fine clear view. At the back of the plane sits the courier. These couriers are mostly college boys, unusually nice fellows. Their job is to look after the passengers, the luggage, tickets, and all that.

Right at the start the couriers get on the job. The first thing they pass out to each passenger some cotton in a neat little waxed envelope. This is for your ears. There is a good deal of noise in a plane and after hours of flying it is apt to trouble the ears a bit. Then the passengers also receive chewing gum. Some people have a little trouble when the plane goes up to and comes down from high altitudes. Chewing actually seems to help.

Then along in the middle of the morning the courier passes out cold lemonade or bouillon, and at the different stops gives the passengers copies of the local papers. At noon each passenger has set up before him a little individual table for his lunch. This is served on gold plates and with gold utensils. It is all very sporty! And an awfully good lunch too. The lunch itself is put aboard in a big hamper at the stop about noon. There is ice water and hot tea and hot coffee in thermos bottles. And the food itself is quite as good and as beautifully served as if one was at a very fine hotel. Altogether it is hard to realize one may be flying at one hundred miles an hour or more and at a height of from three to thirteen thousand feet.

Each day there are four or five stops so the passengers may get out and stretch their legs and clean up a bit. But as a matter of fact air travel is wonderfully clean and there is none of the soot and dust of train travel. And in the summer it is delightfully cool. Although of course when you come down to earth in Arizona and New Mexico it is anything but cold in the summer time.

On the first day's flying West from Columbus, about one thousand miles are covered. Stops are made at Indianapolis, St. Louis, Kansas City, Wichita, and Waynoka, Oklahoma. You leave the plane and are taken into the lovely town in a very snappy special automobile. There is a chance for a shower bath and a fine clean-up at Waynoka, and after a good supper at the Harvey House the Santa Fé train came along and picked us up.

At comfortable getting-up time we left the train at Clovis, New Mexico the next morning and again boarded the Ford trimotor.

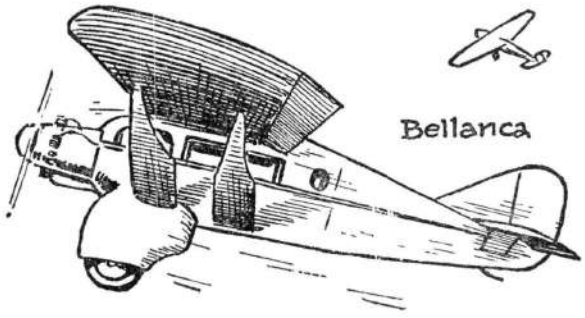
The first day over the middle western states and across the Mississippi and Missouri there was a good deal of sameness about the country. Mostly it was a great area of farm lands, all checkerboarded with fields of corn and grain, with many roads and railroads and cities, the latter thinning out as one reached westward. This western day of the flight started over rolling brown wheat lands, which shortly flattened out into desert country and then up into the foothills of the Rockies. I think the highest land passed over was about 10,000 feet. I know at times the plane itself was 13,000 feet above sea level.

To the north and south of our course we saw mountains from twelve to fourteen thousand feet in height. The scenery was wonderful. Up along the divide great banks of clouds piled up, beautiful to look at as seen from above. And every now and then we would duck right through the clouds, and there were several rain squalls and one quite big thunder

and lightning storm only a few miles away.

Perhaps the most lovely part of the whole ride is the last hour or so. One leaves a country of timber and lakes and meadow uplands; then past barren dry mountain peaks and out across desert valleys, with gorgeous colors. And then quite suddenly down over the irrigated country with miles and miles of orange groves and green fields. And from that into the outlying towns and finally the city of Los Angeles and to the landing port at Glendale. Actually we got there about an hour and a quarter ahead of time, after several stops during the day.

After four days on the coast we flew back home, getting to New York only a little over a week after we had left there. And certainly, now that I have tried it, I never want to cross the continent in any other way than by T. A. T.



By Rocket Plane to the Dead Star

By Dayton Voorhees, Jr.

A story written by a twelve-year-old boy and awarded the medal in competition for a prize offered to the Aviation Class in the Lincoln School of Teachers College, New York.

IT IS impossible to surmount the belt of atmosphere which recent observations have disclosed to be several hundred miles of thickness."

"But air does not attain that height, does it, Professor?"

"No, it does not. But there is a mixture up there which is somewhat like the poison gas which destroyed London in the great war of 1948-1953," said the professor. "If one bit of that got in your lungs, you would be dead in a second."

"But look at this design of mine," said I. "It is hermetically sealed, and if you will come out and look at the finished product, you will see that no gas can come in."

I took him out to my shed and showed him the machine. It was 150 feet long and could carry eight men. It had two shells, a foot apart. Between these shells were the rocket tubes. Each tube was loaded, and ten more rockets for each tube were in the storeroom. The rocket plane was 15 feet wide and was shaped like a long lean cigar. The quarters were as comfortable as we could make them. There were folding bunks, and when they were folded back we had a place to play cards and games. There was a storeroom where the provisions were kept, and a telescope compartment where there was a powerful telescope. On the outside of the plane there were two flippers, one on each side, 8 feet long and 5 feet wide, to help steer it in our atmosphere.

"When do we start?" asked the professor.

"We start as soon as the last balloon has come down with the latest weather reports," I replied.

"How shall we get air?" he asked.

"See this little machine here? It will make oxygen out of salt!"

The next morning we started. We did not know where we were going, but we thought we would cruise around for a while, and then settle down on Mars or some other planet. When we started, we went off with such a shock that everybody was instantly made unconscious. When I woke up, I sat up dizzily and looked around. The *Rocket* was speeding along at a terrific rate. I revived the crew and the professor. The names of the crew were: Ralph and Jack Lewis, Ed Renfrew, Ted Scott, Harry Jackson and Bill Foster.

After we had had a good meal, we started to get our position. I was very surprised to learn that we were just passing the moon. On the second day we had used only ten of the five hundred extra rockets. The rockets were very curious.

They were loaded into the tube the same way a gun is loaded. The powder is hydraulically pressed and a hole drilled at the bottom and when the rocket is lighted, gases shoot out and propel it along.

About ten o'clock of the second morning, the professor came hurrying into the living compartment and almost screamed. "We are in the grip of a powerful current of gravity. It has taken us out of our solar system and that its what is making us go so fast. Our rockets are of no use in preventing us!"

I hurried into the control cabin. It was too true. We were being swept along at one hundred miles a second. I told the crew. "There is nothing to do but wait," I said.

Eight days passed without using a rocket, still in the grasp of the mysterious current. On the morning of the ninth day one of the crew came rushing up to me and said, "Sir, the professor thinks we are in an atmosphere because we have stopped moving. We can see a planet or star or something and we are only four hundred miles from it, sir, and he requests your presence in the control cabin immediately."

I hurried in and shoved the professor aside from the telescope and took a look. Clearly outlined was a high mountain flanked on each side by fields of reddish brown color which we later learned was the color of what we would call grass on earth.

"Start the rockets," I yelled.

Ed and Tom ran to the tubes and lit three rockets. The land came rapidly nearer. I was now using the flippers to guide the ship. In half an hour we landed!

"Nobody must get out until I have tested the air, or whatever they have here," said the professor. He stuck out a tube to get a specimen of air and then retired to his chemicals. In a few minutes he came back and said, "This atmosphere is all right to breathe, but it has more oxygen than our earth's atmosphere has."

We rushed to the hatch and ran out. At first we had slight headaches, but we soon got accustomed to them.

I wanted to find out where we were, and when I was looking through the telescope I could see faintly our sun and our solar system, at least part of our solar system. I could see Venus, Jupiter and most of all, Mars. The world we are now on is not Mars, as we had supposed.

I rushed out and told the professor and the crew.

"Where do you think we are?" asked the professor.

"I think we are on one of the dead stars that astronomers can locate by the reflections they cast on other stars," said I.

"What shall we do now?" asked the professor.

"I think we had better explore, but no one must leave the ship alone; everybody must travel in pairs."

The next morning everyone started out except two of the crew who had stayed with the *Rocket*. The professor and I searched all over without finding a thing. When we came back to the ship there were the other four.

"What did you find out?" I called to them.

"We found out that this reddish brown stuff, like grass, cuts like a razor," said Ted, "but if you wet it, it gets as soft as cloth. What did you find out?"

"We tried to climb a tree at least a foot thick, and the whole tree bent down to form an inverted U. The tree was just like jelly."

So the days passed. We explored all over and not a sign of habitation did we find. On the fifth day I woke up with a

shrill chattering in my ears. I looked out of the observation windows and what I saw caused me to shout to the crew. "Come here, boys, in a hurry!"

They came in with a rush. What a sight met their eyes! The ship was surrounded by the funniest-looking people I had ever seen. They had the bodies of men except that they had no heads. They had mouths right out in the middle of their chests and their eyes were in lumps on their shoulders. They were evidently very strong, but though they were screaming at us in a foreign language, they were evidently friendly.

"Shall we go out?" asked Ted.

"We might as well, since we cannot stay here all the time," I replied, "but everybody must take a rifle with one hundred cartridges and two revolvers with one hundred bullets for each of them."

We hastened to the storeroom and armed ourselves. We opened the hatch on the top of the *Rocket* and all climbed out. Immediately a hush fell on the creatures. Then there was a bustle and one of them with many brown ornaments on his body came stalking out and addressed us in words which sounded like the following: "kiwk-blongik-matikm," which we later learned was the official greeting of this strange planet.

"Shall we go down?" asked Bill.

"I guess we might as well," said I, "but everyone must keep his hand on his guns."

We descended to the ground and were immediately surrounded by the creatures. The one who had first spoken to us came forward. I could see that the other creatures held him in respect. He addressed us again and waited for a reply.

"We can't understand that lingo," said Ed, "but if you would talk English, we might understand you."

The creature then motioned us to accompany him.

"Shall we go?" asked Harry.

"We might as well," said the professor. "They do not seem to have anything to hurt us with."

So we went along. We walked for about six hours and did not feel at all tired, although this was the longest walk we had taken so far. All the time the leader had been coaching me in their language. He pointed out different objects and repeated their names. So at the end of the walk he and I could talk a little together.

Suddenly he stopped and pointed. "Our city," he said.

We entered the city which was composed of some holes in the ground. He took us down one of these holes which opened into a large room with smaller rooms branching out of it. We sat down on funny-looking stools, and another creature placed before us a dish of pink liquid with chunks of black stuff bobbing around in it. Our host motioned for us to eat. It tasted somewhat like chicken broth and the black stuff like lamb. I asked him what it was made of and he said that they took pieces of the trees which were like jelly and boiled them in a strange liquid which they use as we use water. This soup resulted.

After the meal he and his family went to their chambers and left us alone. We talked for about an hour, then began to get drowsy and retired to our chambers.

Day after day passed; the days turned into months. We learned a great deal about this star and its inhabitants. When about six months had passed we thought about going home. We spoke about this to our host and he immediately put up a great cry. But we persisted and finally he let us go. We got aboard the *Rocket* and lit twenty-five rockets at the same time.

We were made unconscious by the shock. When we came to, we were going

very slowly. For fifteen days we fought our way against this current. On the sixteenth day we got into the Earth's gravity. We had some difficulty in locating our base, but we finally did so and landed after seven months of exploration.

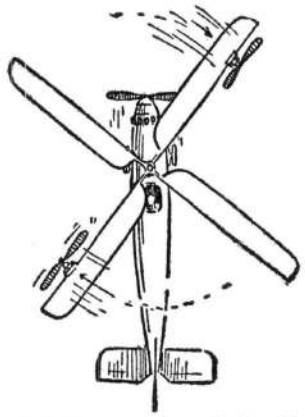
The pictures that we had taken on the new world were given to the National Geographic Society with a detailed account of our adventures and appeared in the September number, 1998.

The Helicogyre

THE recent success of the Cierva Autogyro airplane has directed the attention of aeronautical engineers to the possibilities of improving this type of machine. The important point of this autogyro is that it can rise and descend almost vertically from the ground and requires the minimum distance for landing and taking off. The wind-mill wings in the autogyro are revolved by the action of the wind passing by them as the plane moves forward.

The latest development in the revolving wing airplane is called the "Helicogyre" and in this machine small light motors and small propellers are placed at the ends or near the ends of the revolving wings which causes them to maintain their rotary motion, sustaining the airplane in the air even though the fuselage may stand still.

The French Government has been experimenting with machines of this type called a rotating wing plane and the English Government has been building a similar type of craft at the works of Messrs. Saunders and Cowes. It is a four-wing two-seater with a Bristol "Cherub" motor at the extremity of each, and in addition has a forward propelling engine. This is the invention of M. Isacco and several flights have already been made. The Chauviere Company in France are also building a similar type of rotating airplane which they call a "Gyroptere."



A helicogyre described with this story.

How to Build a Small Monoplane

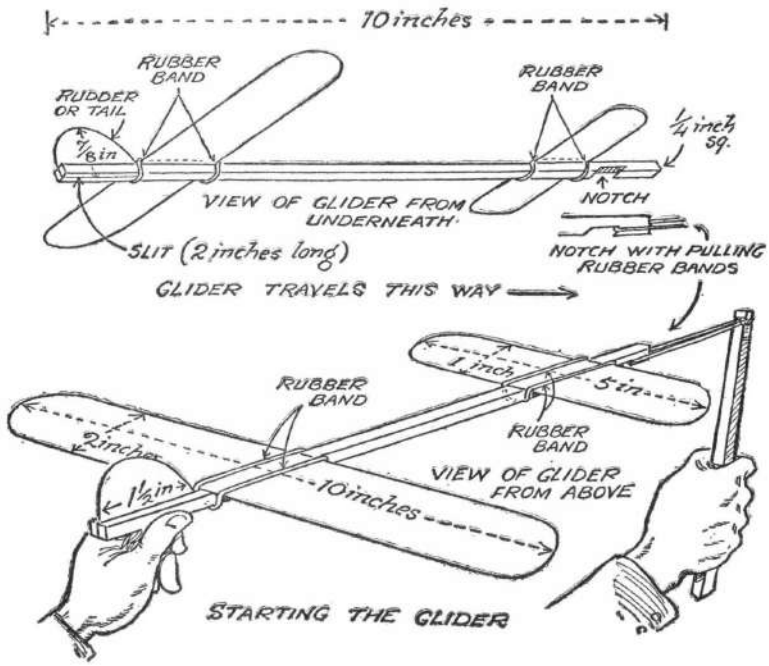
By Kenneth S. Gurney

TO BUILD a small monoplane you need the following material: one light piece of wood, 10″x¼″; one small wing, 5″x1″; one large wing, 10″x2″; one guider, 1½″x⅞″.

The guider can be made from a piece of cardboard or a light piece of wood. The wood can be obtained from orange boxes and other fruit crates. (Note drawings.)

After you have obtained the necessary material named above, take the stick, that you are going to fasten the wings to, and slit the end about 2 inches. (It doesn't matter which end.) Then carefully slide the rudder or tail into the slit. (Note drawing.) Put the straight end of the cardboard into the slit, and leave the rounding end protruding out.

The next process is to procure a shoe box, and cut out the bottom or the sides for the back wing. This is the larger wing of the two, being 10″ long and 2″ wide. It should be cut rounding on both ends, and a rubber band should be used to fasten it securely.



How to Build a Small Monoplane

Now we come to the front elevator, which is 5″x1″, the same material should be used as on the back wing. It is shaped like the other one and fastened the same.

Now we come to the most difficult part in the building of the plane. It is to get the right kind of stick; if your stick is 10″ long and ¼″ square, and very light, your plane will fly splendidly. A notch must be cut in the opposite end of the stick from which the glider is situated, at the distance of ½ inch from the end. (Note drawing.)

Now our plane is ready to fly, but first we must secure two rubber bands cut from an inner tube. These should be fastened to a small stick 6″ long. Now we are ready to fly it. Place the rubber in the notch, in this manner (note drawing), and pull back: your plane should then fly to the altitude of 100 to 200 feet in the air. It will loop the loop, and if the front is turned a trifle, you will be amazed to find the tricks it will perform. Try it and see.

A Few More Pointers, Which Will Give Better Results

1. Fly your plane against the wind, and you will receive better results.

2. Do not allow the wings to become wet in any way (if they are cardboard).

3. Drive the stick that is illustrated in drawing below into a fence post, and you will be able to start your plane with more power.

4. Be sure the wings are evenly balanced.

5. The plane should glide a height of five to six feet above the earth before landing, at a distance of twenty-five feet. If your plane does not accomplish that, your wings are not balanced correctly. You will be surprised in the fun you can get from one.

How to Become an Aviator

By Augustus Post

MANY boys are thinking about taking up the subject of aviation as a serious study, and for many of these boys this knowledge may ultimately lead to a life-work and a future business career. There are many schools devoted entirely to preparation for flying positions and executives in aviation companies; these schools are steadily increasing in number and those already established are increasing their facilities at a rapid rate. Mr. C. M. Keys, President of the Curtiss Wright Corporation, Transcontinental Air Transport and Inter-Continental Aviation, Inc., one of the most widely informed men on aviation transportation and construction to-day, has stated that three-fourths of the risks in flying have been eliminated and air travel will soon be as safe as any other means. This is shown by the fact that the great insurance companies of the world will now write policies at reasonable rates based upon their knowledge of the accurate and extensive records of travel in the air. As soon as the traveling public in America is educated to pay higher rates for greater speed, as they have already been in Europe, we will advance with great strides to put air transportation upon a money-making basis in this country.

Suppose you were twelve to fourteen years of age and you hoped to be in time an airman. What are some of the qualities that you should endeavor to develop, and what are the studies in your school that will help you to attain them?

The first and most important in any undertaking is application. This means that you are able to concentrate your mind upon the subjects in hand and shut out all other things that have no connection with the particular object which you have in view. The study of mathematics is particularly good to develop the power of concentration, and if you have an opportunity to study higher mathematics in school, it will be of great value to you in all departments of engineering, designing and construction work, as everything is figured out on a perfect basis of computation. Geometry is especially valuable, for design, for measuring wing angles and for problems of construction in general, as well as in navigation—finding latitude and longitude.

The next important quality to develop is that of synchronization—the quality which enables you to do one thing after another, keeping perfect time, and to do one thing with relation to something else; this is the basis of rhythm and comes from the Greek words "syn," meaning "together," and "chronos," meaning "time." This quality is what makes a good musician or a good dancer, and it is necessary to be developed in your own muscular system—it is often noted that good dancers are usually good flyers.

The next quality which is of special importance in flying is to have a well-

developed sense of orientation. This means that you are able to tell direction by the points of the compass and relative direction between various points, and are always able to find your way. There is a legend that if guides, Indians, hunters, and men of the wilds of the great outdoors become lost or doubtful as to the direction in which they should go, they take themselves away from the party and go into a sort of trance, concentrating their minds until they feel an intuitive sense of the direction in which they must go; then they start off, following this inner consciousness, and it is usually correct. Their companions must be careful not to arouse them from this subjective state or question their actions, for if they do they intrude an element of doubt and the guide is awakened from this condition and loses his delicacy of perception. The familiar case of a horse finding his way home is another example of this sense of orientation; other animals seem to have it to a marked degree, and the ability of homing pigeons to return to their cotes and salmon to their original spawning grounds after long excursions has always been a mystery to naturalists.

This is closely allied to the development of the tactile sense which governs our ability to balance. You cannot see the air, you can only feel by the sensitiveness of the controls what is taking place in the condition of the airplane. Riding a bicycle, ice-skating, and the practice of gliding are well suited to developing this sense of balance.

Another important study in your school work in preparation for aviation is geography, which develops the ability to visualize the relative position of different countries and places. This leads to the study of navigation, which also requires a knowledge of mathematics as an aid in laying out cross-country courses, to calculate the angles of drift and to determine latitude and longitude. The study of chemistry is also important and will be very useful to help you in understanding the problems of the internal combustion engine, the composition of different kinds of fuel and oils as well as the dopes and other chemical compounds used in the construction of airplanes. Your study of languages will come in very handy, because many of the most important magazines and books about aviation are published in foreign languages, and you may have the good fortune to meet some of the great foreign pilots, and if you know their language you will be able to talk with them.

Drawing, especially mechanical drawing, will help you. In reading blue-prints and making diagrams, places and charts, it will be of the greatest value. Physics is a particularly important study for you, because it has to do with the action of hydraulics, air-pressures, and is necessary in the study of the action of the different instruments used in an airplane that depend upon physical laws, like the barograph, barometer and altimeter.

Elementary mechanics, giving the mechanical laws governing construction and operation of machines used in building airplanes, as well as that of the airplane motor itself, is of course a necessary study in preparation for taking up aviation.

You see that many things that you are now studying in school—or that you have a chance to study—are directly preparing you for your studies later on in an aviation school. They are also part of a good education as well as part of a prospective airman's special equipment. You can be taking the first steps toward being an airman while you are still in high school, studying the regular courses, and if you study with that in mind and put your whole heart into it, you will make a better record in your high school course.

How to Become an Aviator

Above all, keep your health sound, your head clear, and your eyes and ears alert and accurate. You will need all your senses about you when you begin to fly. A good Scout knows how to keep alert.

Walter Hinton, who was the pilot of the *N. C. 4* on its first transatlantic flight and has had a very extensive opportunity to help men get into flying on account of being President of the Aviation Institute, in a recent book on "Opportunities in Aviation," says:

"It is more necessary that a man be a pilot to be a success in this field, than that he be a locomotive engineer to achieve success in the railroad industry. Of the thousands of men and women who are at work in this new industry, less than 5 per cent are actual flyers."

In a ground school you will have the following courses: History and development of aviation, theory of flight, airplane structure and rigging, care, maintenance and inspection of airplanes, and shop practice; theory of gas engines, type of engines (air-cooled and water-cooled), carburetion, ignition and lubrication, care and maintenance of engines, shop practice and trouble shooting; airplane instruments, engine instruments, use, proper functioning, care and construction; structure of atmosphere, pressure, temperature and humidity, weather maps, practical use in cross-country flying, navigation, which includes maps, the compass, its construction, use and care, cross-country application, radio beacons, astronomical methods; use, care and maintenance of clothing, parachute, etc.; air commerce regulations, including classification of pilots, air traffic rules, Department of Commerce inspection requirement, report required.

The course on flying instructions will consist of: Dual Instructions; that is, preliminary flight, straight and level flying, climbs, gentle turns, glides, taxiing, take-offs and landings, stalls, tail spins, and Dual and Solo Practice, consisting of: vertical banks, eights, spirals, preparatory forced landing maneuvers, practice forced landings, wing overs, loops, barrel rolls, cross-wind landings and take-offs.

SCOUTING AND AVIATION

BOY SCOUTS of to-day will be the flyers and engineers of to-morrow. The Scout Program gives the Boy Scout, who is anxious to prepare for a career in aviation, an opportunity to master many of the details of an aviator's position. Signaling, compass reading and mapping are invaluable in aviation. The Army and Navy training schools provide as good training as can be obtained in the world. Commercial schools are also being organized to meet the demand for trained pilots. The Scout should be satisfied with nothing less than the best training obtainable. The foundation for this can be well obtained in the Boy Scout Organization.