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# AIR TRAILS

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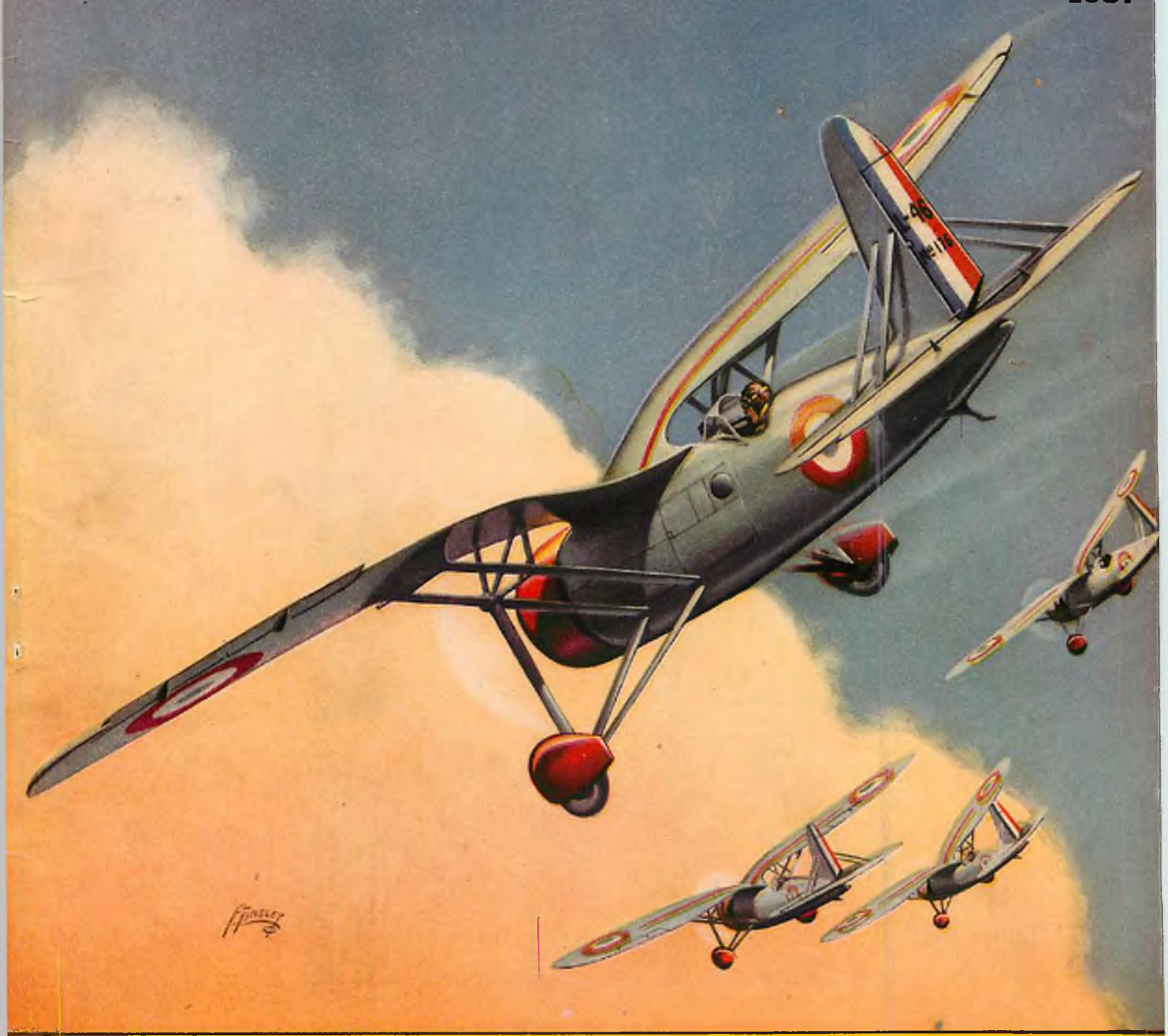
## BILL BARNES AIR NOVEL

THE PURPLE FEZ
by George L. Eaton

MARCH 1937



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*Paul Shea*


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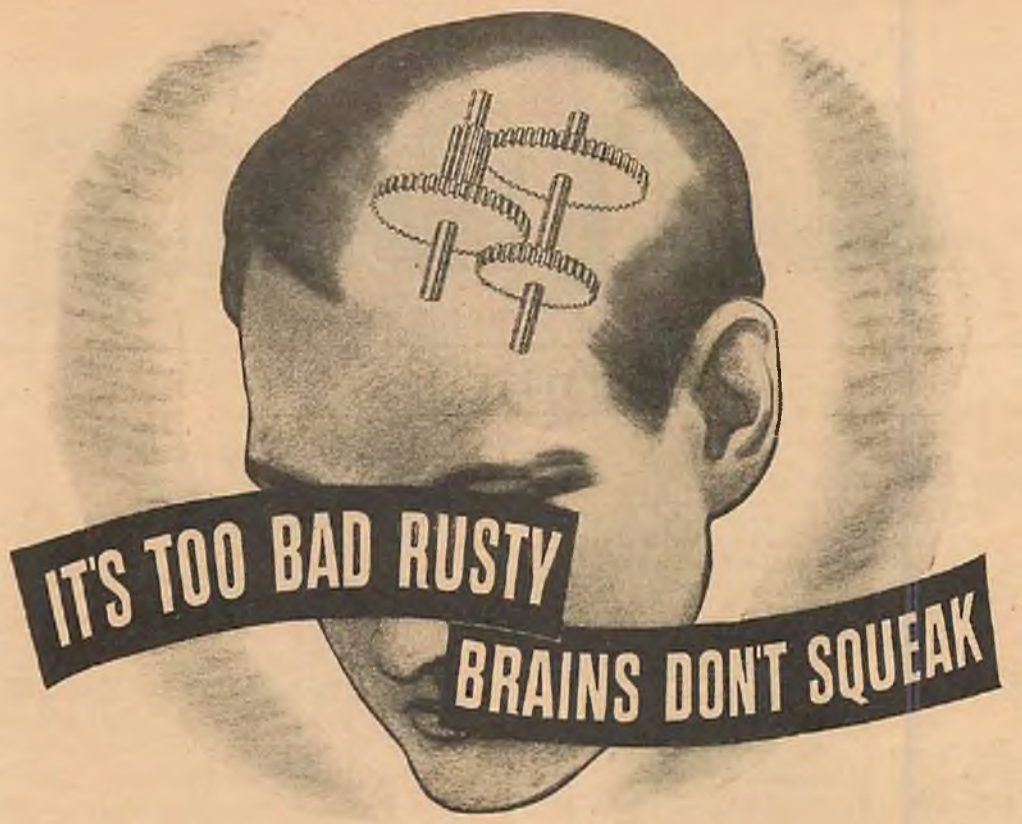


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Volume VII
No. 6

# AIR TRAILS

Reg. U. S. Pat. Off.

March
1937

A STREET & SMITH PUBLICATION

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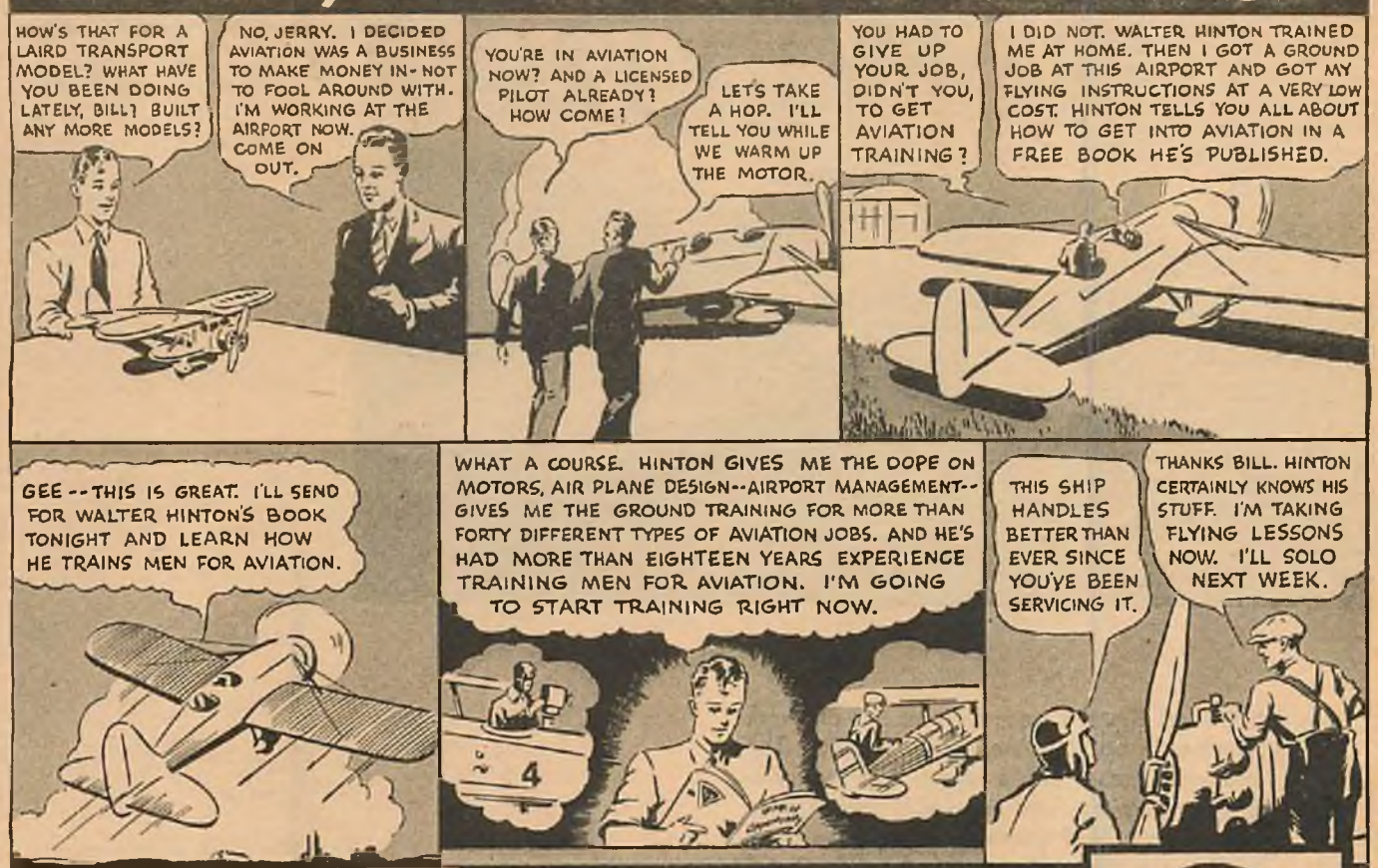


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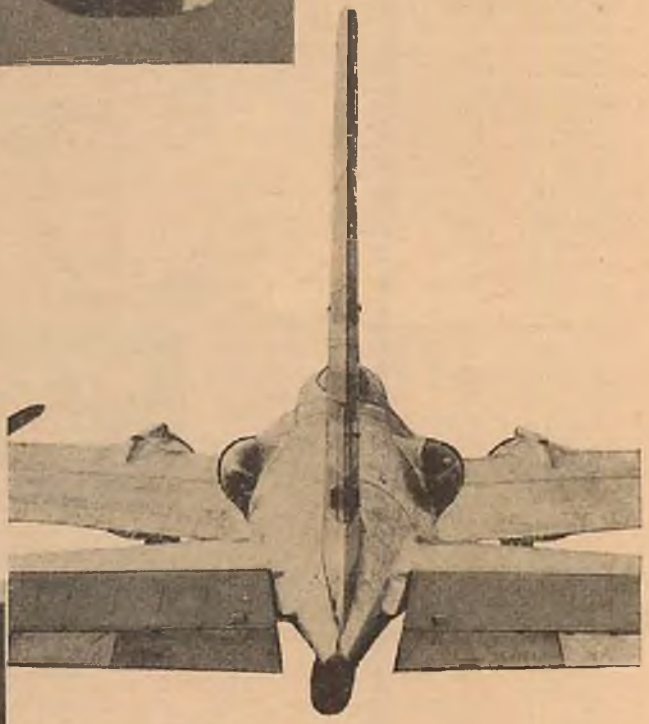
# This Winged World


SHIPS of the sea and ships of the air work together in battle games in the Pacific. The dramatic scene above shows new-type destroyers nearing their imaginary target after coming up behind a smoke screen, while overhead navy flying boats of the 8th Patrol Squadron serve as "eyes" for the maneuvers.

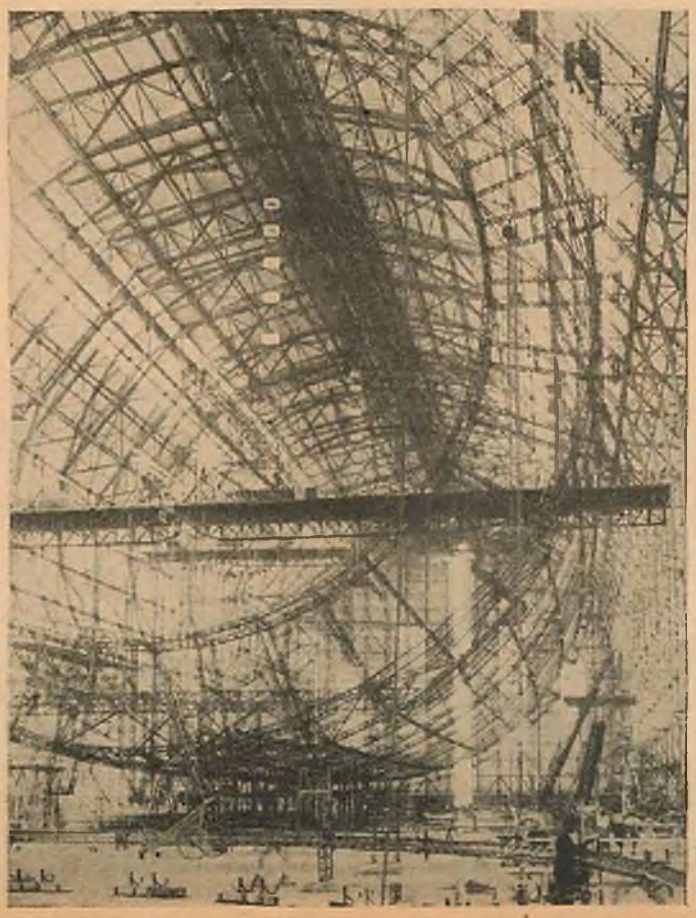


INSECT EYES of the Boeing B-17 bomber in this unusual tail view are merely the two side gun turrets.

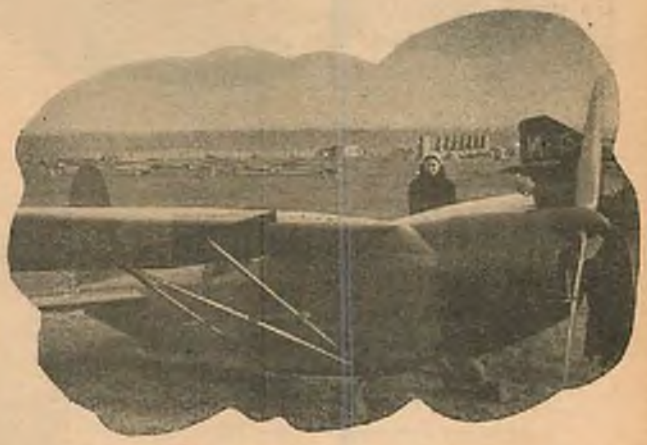
SHIMMERING silver disks above became plain bent pieces of metal at landing (right) in the second mishap for the B-17 during army tests. Damages were slight. The nose-over was really a tribute to the brakes, which locked and skidded the 16-ton plane to a halt in a remarkably short distance.

BIGGEST plane at Paris aircraft show was the new Farman 224 "Centaur II" sketched above. Carrying 32 at 192 m.p.h., it weighs 17½ tons loaded. Four engines, whose nacelles house retracted wheels, are 800 h.p. Gnôme-Rhônes.

"CAREFUL now!" you can almost hear these men say as they ease the body of a Russian transport through the door to the Paris exhibition hall. Similarity to the Douglas DC-2 is a compliment to our air-liner.



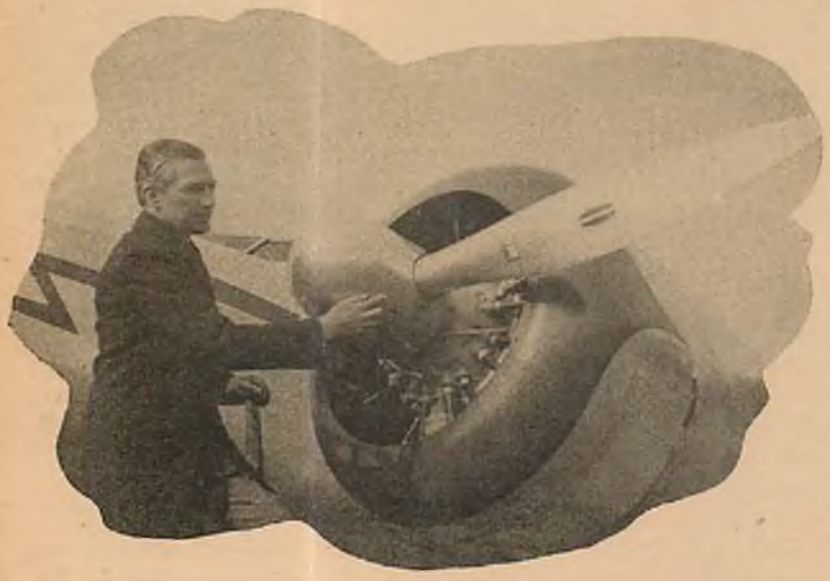
SPIDER-WEB maze is one-half of the framework of the LZ-130, companion airship to the "Hindenburg," being built at Friedrichshafen, the German Zeppelin center.



"LITTLE OCTOBRIST," named for a Soviet children's organization, is the smallest Russian plane. It will carry one adult. Construction is wood, engine 24 h.p., span 19 ft. 8 in., weight 330 lbs, ceiling 8,200 ft., speed 77 m.p.h.

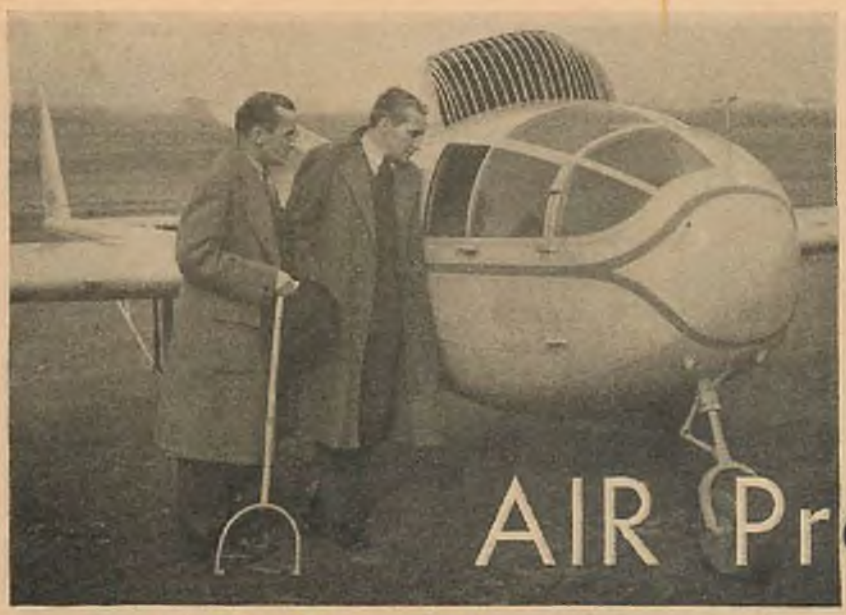
BLANKETING plane-crash fires with heavy carbon dioxide gas is the scheme that's being tried out in the misty scene on the left, at Paris' Le Bourget airport. But carbon dioxide is colorless, you say? Quite so. The mist, mostly——

DRY ICE, or solidified carbon dioxide gas—the "snow" that your drug store packs ice cream in—is sprayed over the flaming plane by special apparatus such as that at the right. The snow evaporates into gas, which keeps air from the flames, literally starving them to death.



ICING is pleasant on pastry but not on propellers, so the new "laboratory" Lockheed 12A for the Bureau of Air Commerce, inspected by Director Vidal, has de-icer equipment. An alcohol-glycerine mixture, pumped through the thin straight tube visible on the Wasp Jr. crankcase, flows on to the blade end under the protective spinner cap and is flung along the blade, melting off any ice formation.

RECORD plane and its designer-pilot, the Seversky Sev-3 amphibian and Major Alexander P. de Seversky, have flashed through the aviation news lately (see Air Progress on opposite page). The famous land-or-sea plane is of all-metal construction with monocoque fuselage and cantilever wing; span is 36 ft., length 25 ft. 8 in., height 9 ft. 9 in.



A summary of aviation news

# AIR Progress

The Campbell "flying Easter egg" auto-engined plane arrives in Washington.

*Flights*

A new record for speed in an amphibian plane over 100 kilometers (62.137 miles) has been set by Major Alexander P. de Seversky in his well-known Sev-3. He covered the course in 17 minutes for an average of 209.4 m.p.h. Previous record was 173.945 m.p.h., established by Coast Guard Lieutenant Burke in a Grumman a year and a half ago. Major de Seversky's record was made at Miami after he had flown to the air races there 1,196 miles from New York in 5 hours 46½ minutes—not the fastest flight, for Howard Hughes holds the record of 4h 21m 32s, flying northward, and the southward mark is the late Jimmy Wedell's 5h 1m 39s—but plenty fast for an amphibian, averaging 205 m.p.h. for the distance. The plane has now been sold to Roberto Fierro, former chief of Mexico's air force.

Spanning the South Atlantic from Dakar, Senegal, to Natal, Brazil, along the 1,280-mile route flown by the French and German air lines, Mme. Marie Bastie set a new record of 12h 5m. The previous record, also made by a woman, was Jean Batten's 13h 15m.

In France, trying for a new women's speed record, Mlle. Maryse Hiltz escaped from a curious accident with little injury. She was thrown from her plane, apparently by a sudden air bump; her parachute opened by itself and she descended in a lake, suffering only a broken rib.

Frank Hawks, testing his new *Time Flies*, made 311 m.p.h. at 8,000 ft. on only 65% of his Twin Wasp's 1,000 h.p. He is confident of 375 m.p.h. later.

*Meets*

The ninth annual Miami (Fla.) All-American Air Maneuvers, scheduled for Dec. 10-12, were jinxed by bad weather. Low ceiling over the East caused postponement of the first day's program and prevented many pilots who were flying to the meet from ever reaching there. In events run off subsequently, Bill Ong of Kansas City emerged as top man with two firsts—a 173.872 m.p.h. win in the 25-mile Green Trophy race for C-licensed planes of 850 cu. in. and under, and a 194.689 m.p.h. victory in the 40-mile Glenn H. Curtiss Trophy for C-licensed planes, unlimited. Both were accomplished in a Beechcraft. He also made fastest time—36m 25s—for 110 miles overwater from Key West to Havana, but handicapping enabled Roy Evans to arrive first in a Monocoupe.

*Transport*

Railway Express, air-shipping agency for most U. S. air lines, followed the lead of independent TWA in announcing that "flying box-cars" will start "freight only" service on the transport lines it represents. . . . During a city-wide power failure, the world's busiest airport, Newark, went dark, but makeshift radio service from parked planes and oil flares for boundary lights brought four air-liners in safely. . . . Burlap parachutes have been developed by the Forest Service that drop without breakage eggs and other perishable supplies for lonely settlements. . . . Brazil has created a problem for Pan American and other lines by announcing that beginning in 1938, all pilots flying commercially over her territory must be Brazilian citizens.

*Transatlantic*

This year the LZ-129 *Hindenburg* will make 18 round trips from Germany to Lakehurst, according to Dr. Eckener's plans; last year she made 10. . . . To assist in developing U. S. airship lines, a move is under way to include airships in subsidy payments that are now made to ocean vessels by the shipping law. . . . The first plane for the Bermuda-New York air line, opening link in the proposed airplane route to England, is being unpacked and set up in Bermuda.

*Science*

Igor Sikorsky, noted designer and big-plane advocate, says that with present technical knowledge it is possible, although not economical, to build 500-ton planes carrying 1,000 passengers. He predicts 50- to 100-ton planes within five years. . . . Engine authorities expect, within the same period, fuels of as high as 50% more power and motors weighing much less than a pound per h.p. . . . T. P. Wright, engineering director for Curtiss-Wright, thinks that in ten years transports will be cruising at 300 m.p.h.

# The PURPLE FEZ

A MAN was going to be killed.

The long grand stand that flanked one side of the flying field was packed with spectators. Crowds milled at the entrance turnstiles and into the standing-room area. A feeling of breathless excitement was over all, heightened by the harsh growling of airplane engines and the shrill, amplified voice of the announcer.

It was the opening day of the All-American Air Maneuvers at Miami, Florida, and the municipal airport was in gay holiday attire.

From every corner of the nation and from Latin America had come a thousand and more airplanes, bearing a thousand and more of aviation's crack birdmen. Famous military aces had come, racing pilots, daredevil stunt men.

And with them had come the man who was marked for death.

AT ten minutes after three on that first afternoon, a squadron of marine fliers had completed a spectacular aerial display and was swooping across the field in a thundering finale. The grand stand became a white mass of waving handkerchiefs as the spectators registered their enthusiastic approval.

High up in the bleachers a swarthy-faced Turk nudged his companion and drew a dirty finger nail across his program. The underscored line was:

3.10 to 3.30: Aerobatic demonstration by famous Mystery Ace.

"The Pasha comes next, Yacoub," he muttered in Arabic.

His Turkish companion nodded. "The traitorous dog should even now be here. Observe, his airplane stands empty and waiting. Perchance, he hath fled to give warning to his infamous brother."

"Nay. The master hath decreed that he will die this

*Out of the Orient, mystery and terror stalk the sky in a great Bill Barnes air novel*

by George L. Eaton

afternoon while high in the heavens." The man's eyes suddenly glittered and he pointed toward a small low-winged monoplane at the end of the field. "Look, Yacoub! Allah is good. The Pasha comes."

A small man, dressed in black flying suit and wearing helmet and goggles, had come from the hangar and was running toward the plane.

The radio announcer had seen him, also, and his voice became crisp with excitement.

"Here he is, folks—the spectacular Mystery Ace! The world-famous nameless wonder! He's getting into his plane down there. Watch him closely! You're about to witness the most amazing, breath-taking aerial exhibition that has ever been performed—— He's in the cockpit now. Watch him! A reckless, flying fool! He flirts with death! No one knows his identity, but tens of thousands know his masterful flying. There he goes across the field. The Mystery Ace! The king of stunt men! The enigma of the skies! Look at that take-off!"

The Turks in the bleachers scowled. "Look well at that take-off, O, Yacoub, for it will be the Pasha's last. Too long hath this betrayer of the master concealed his true identity. He knoweth it not, but within the space of fleeting minutes, he will die."

Dead south the ship raced —the pilot fully realizing that a screaming, silver bullet was following——

ALI HAIDER—the "Mystery Ace"—did know that he was going to die. Had he not, just a brief moment ago, received the fatal symbol? Had not the package been delivered into his hands while he had been donning his flying clothes in the hangar of the airport? And had not his very eyes beheld that which lay inside—a Turkish headdress—a purple fez—a symbol of death?

With true Islamic fatalism he had accepted it. He was going to die. It was as inevitable as the rising and setting of the sun. It was as Allah willed.

For years, ever since he and his brother had fled from Turkey to lead carefully separated lives in the United States, they had each fearfully awaited the arrival of a purple fez. And now it had come to Ali Haider. Verily, it meant that the Society of the Purple Fez had penetrated his disguise, had finally traced him down.

It meant that he, Ali Haider, was going to be killed. When, he could not predict. Perhaps in the blackness of the night with only the hiss of a thrown knife as warning. Perhaps in a month, in a week, in a day——

And perhaps, also, Allah had sent him a premonition of his danger and he had comprehended it not. For since he had arisen from his bed early that morning a strange excitement had been upon him, utterly foreign to his calm nature. And the feeling had increased until he had been nervously overwrought and scarcely able to await the time when he would leave for the airport.

He had endeavored, that morning, to reason within himself that the abnormal emotion was merely due to natural excitement. Was not the time drawing nigh when he and his brother would quietly embark on a transatlantic flight to Turkey? Was not the powerful airplane even now being prepared at the secret place far to the north? Would they not take with them the fruit of years of undercover work, the documentary proof of the activities of the dread Society of the Purple Fez—proof that once placed in the hands of Angora officials would thwart the plot of that murderous organization? Was not that reason enough for being unduly agitated?

Thus had Ali Haider tried to explain away his strange excitement that morning. But now, as he rode his sky-rocketing plane high into the tropical sky, the feeling increased until he was like a man intoxicated with strong drink. He became eager, impetuous and without fear. He was in the air, in the element where he was king, where he was safe from man-made death. Nothing else mattered.

But, no! A sudden dismaying thought impinged upon his inflamed brain. The Society of the Purple Fez had found him. But had they, too, found his brother? Was he, also, marked for death?

There was a good chance that he had escaped detection—so far. But, he had to be warned and only Ali Haider could do it. Verily, fate had to be postponed until that could be accomplished.

And within the breast of Ali Haider then arose sudden rebellion. Perhaps the philosophy of this infidel Western country that man was master of his own fate was correct. Perhaps not only his brother but he, too, could escape.

He would fool these dogs of the Purple Fez. He would not land down there at the Miami airport where death might await. He would cancel his stunting exhibition and immediately speed northward to the secret place and there communicate with his brother. Then they would leave as soon as possible for Turkey.

The altimeter on his instrument board read five thousand feet. He leveled off and headed the ship into the north——

But the throbbing ecstasy that suffused his very body and brain had now swelled into an intoxicating flame. He looked down. He saw, far below, the air field with its packed grand stand. Thousands had come to see him perform. They would even now be waiting with bated breath for him, the great Ali Haider, to begin his sensational maneuvers.

Could he not tarry for a little while before he headed north—just long enough to give them the greatest aerobatic demonstration that had ever been witnessed? By the sacred beard of the prophet, he would do it! Never before and never again would they see such flying. They would remember the Mystery Ace, those infidels. For this would be his last performance. Upon its completion he would flee.

Half his mind seemed to be warning him to go now.

The plane was in a spin, falling faster and faster.

But the other half was goading him, tempting him, until his fiery enthusiasm knew no bounds. The last trace of restraint was swept aside. He banked back toward the field. He threw the stick forward and the ship went howling down.

He no longer wondered about the strange entrancement. He no longer cared. His cheeks were flushed. His eyes were bright.

Like a plummeting meteor, the stunt plane raced for the landing field. And Ali Haider, snug in the single cockpit, waited—waited until the thundering fall had reached its full velocity. Then, using both hands, he pulled the stick back.

The elevators reacted. The power dive was checked. The ship went screaming up and over in a tight loop, then resumed its headlong plunge.

Again Ali Haider waited. Again he jerked the plane into a second loop. Another followed, another and another.

The earth was racing closer and closer as the mad looping descent continued. Ali Haider estimated the remaining distance. He was very near. He could see the people in the grand stand. Their faces upturned, they would be watching, panic-stricken—waiting for him to crash.

The whirling propeller in the nose of the plummeting ship was now within feet of the green turf of that landing field. Just distance enough for one last loop. They would now be hiding their eyes, those timid ones in the stands.

Then, he looped her again, looped her when only a split second stood between him and eternity. Never before had his judgment been so perfect.

The ship came pelting out of its mad gyration with the landing wheels flicking the top of the green turf.

Ali Haider was shouting in his native tongue. This was his great moment, the peak of his sky career. He was invincible. He was king.

The blood was racing faster and faster through his veins. He forgot all his plans, all his fears. He whirled the ship on a wing tip and blasted it across the length of the flying field in a blurred series of barrel rolls.

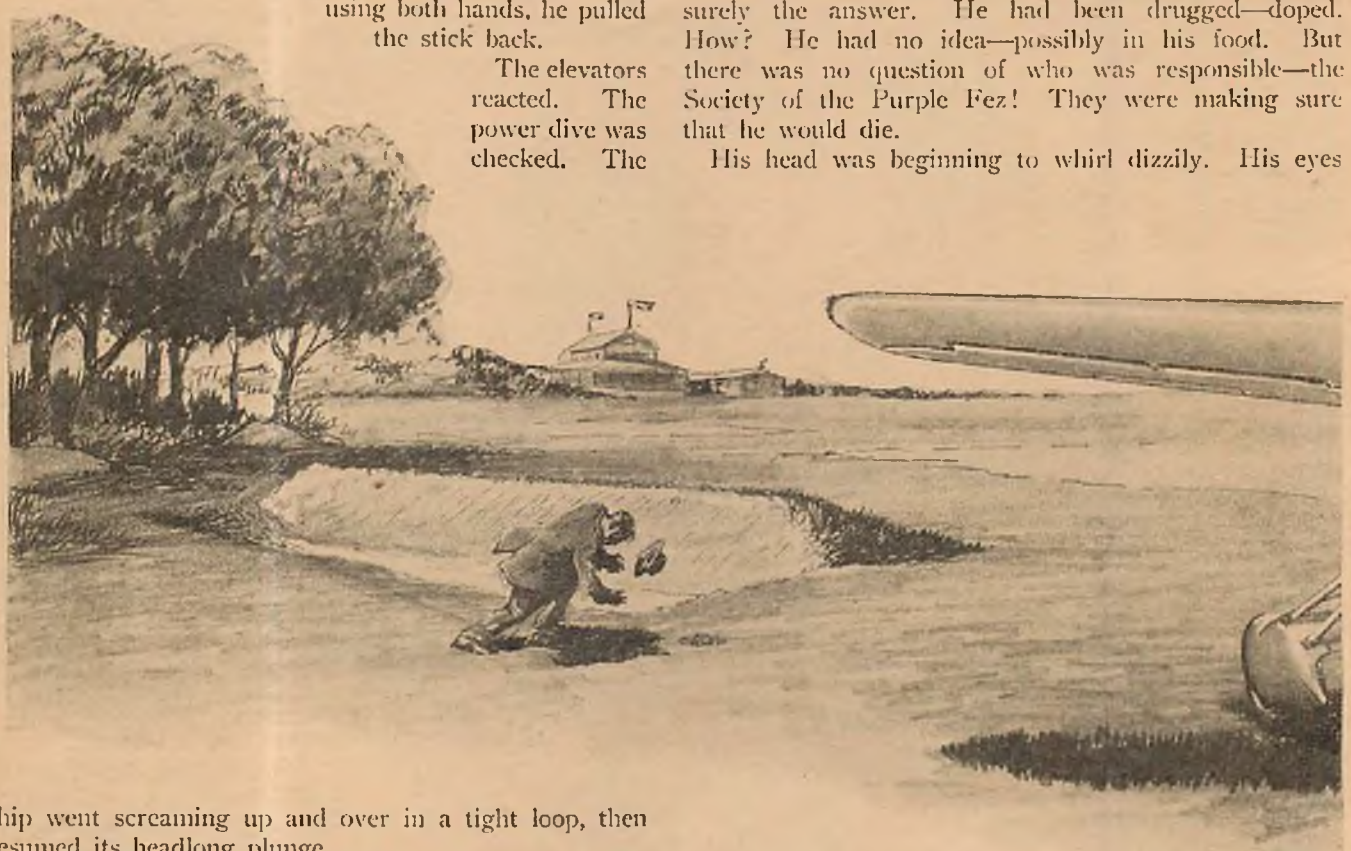
The performance was that of a madman. He went from one hair-raising stunt to another, without pause, without hesitation.

How long it lasted he never knew. But slowly, his brain began again to function. The wild exhilaration was now diminishing rapidly. He had the feeling of coming out of a stupefying anæsthetic.

Gropingly, he sought for the answer to the furor of excitement that had possessed him. He had been like a man delirious from high fever—like a drug addict riding the crest of a dope wave.

Drug! The word pounded into his mind. That was surely the answer. He had been drugged—doped. How? He had no idea—possibly in his food. But there was no question of who was responsible—the Society of the Purple Fez! They were making sure that he would die.

His head was beginning to whirl dizzily. His eyes had suddenly lost their sharp, focusing ability. He felt unaccountably sleepy.



**As Bill watched, Assaf Riza pitched headlong to the turf.**

Instinct alone had caused him to put his ship into a climb, and he desperately held her to it. The savage outpouring of energy had left him weak and sick. He knew now that he was doomed—— He had been a fool to have ever thought that he could outwit the Purple Fez.

And now—now his very minutes were numbered. He could never fly north to warn his brother of the danger. Yet, if such a warning were not sent, the dread society would surely track him down as they had tracked down Ali Haider.

Stupidly, Ali Haider gazed at the instrument board of his climbing plane. A warning had to be sent—but how? And then, with his dull eyes fastened on the colored knob of the smoke release, a slow idea filtered into his brain.

In previous demonstrations he had always ended up his display by releasing the stream of white smoke and writing giant letters against the blue background of the sky. Now that same smoke could be used to send a message to his brother in far-away New York.

Down at the field were newspaper reporters and cameramen. They would describe and take pictures of what he wrote. They always had. And those accounts, those pictures would be published in northern papers. His brother would be sure to see them.

It was the only way. Ali Haider knew that. And he knew that if he did not hurry it would be too late.

He reached forward, turned the knob and saw the spurt of white smoke gush out from behind the ship. Then, with desperate concentration, he guided his plane on a strange course. Climbing and diving, twisting and turning, he fashioned the rope of billowing white vapor into a strange pattern against the blue—a conical shape with the top flattened off.

His eyesight was dimming rapidly. Weakly, he clung to the controls. He reached the top of that geometric design and from its center he drew a white plume. Then, his hand went forward to switch off the smoke control.

But Ali Haider's grasping hand never reached the knob. The blackness of midnight drowned his sight. He had no strength within him. He knew that death was upon him. Through numbed lips he breathed a prayer to Allah.

THE stunting plane came up on one wing, seemed to hang motionless. Then, with a bellow from the engine, it pitched headlong for the field. And behind it spewed out a swirling trail of white smoke. A wave of horror swept over the packed grand stand. Some one cried out shrilly. The oncoming ship was now in a spin, was falling faster and faster.

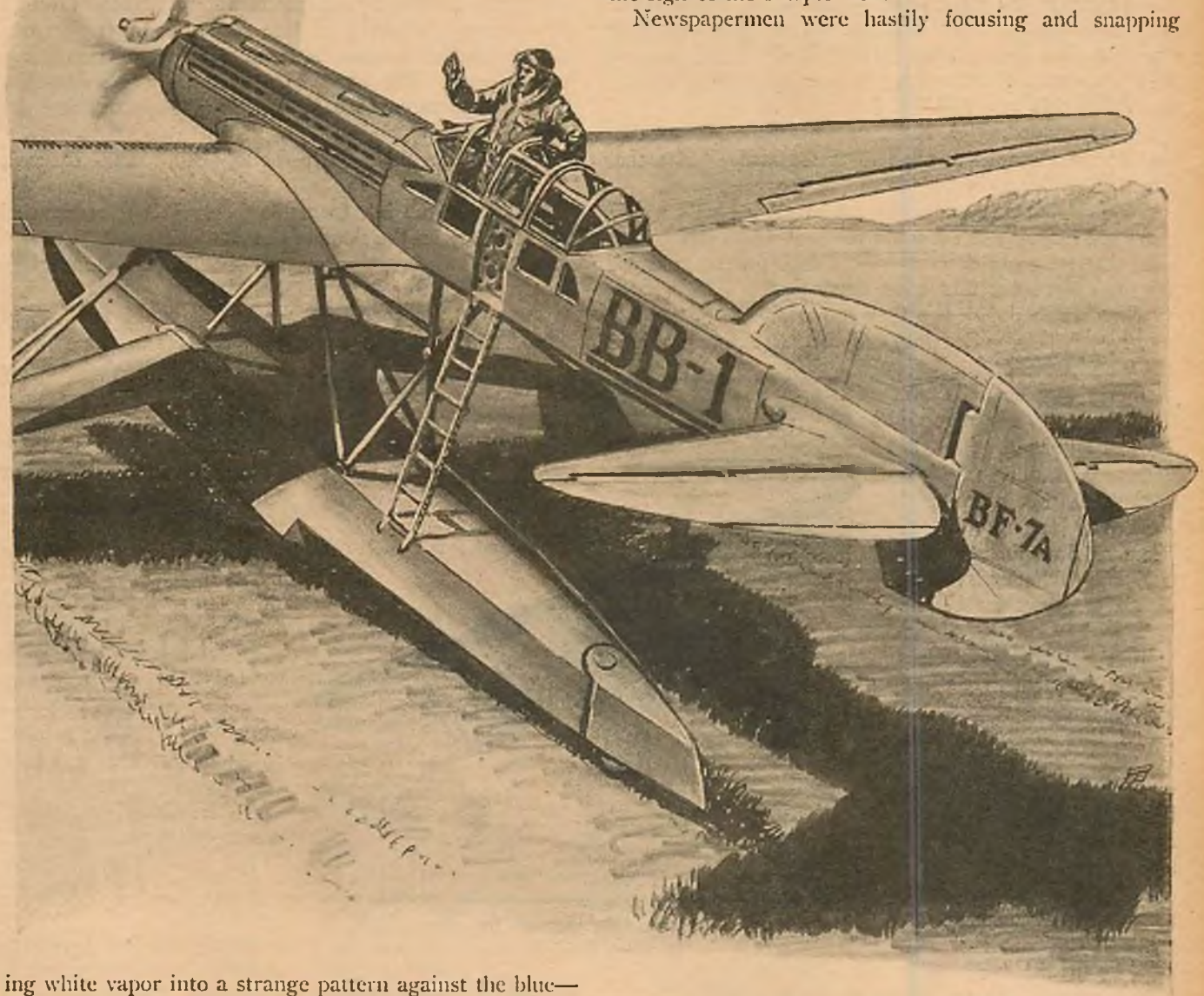
Nor did it ever come out of that awful plunge. It smashed into the earth at the far side of the field with a deafening crash. The entire structure of the monoplane was swallowed by a blast of crimson flame.

The two Turks, high in the bleachers, were on their feet. But they looked not at the blazing wreckage. Rather their eyes were upturned on the mammoth smoky design that hung suspended in the sky.

"He hath drawn a fez!" Yacoub said excitedly. "It is the sign of the Purple Fez!"

Newspapermen were hastily focusing and snapping their cameras. The sensitized plates caught the entire scene. On the ground the blazing funeral pyre of man and plane; in the heavens, hovering over it, tied to it by its smoky rope—the giant shape of a Turkish fez.

It made a good picture.




## II—THE CALL

BILL BARNES saw the wire photo reproduction of the picture in the New York *Star* at eight o'clock the next morning.

The famous pilot sat at his desk in the administration

building of his Long Island airport with the newspaper spread out before him. He inspected the picture absently, preoccupied with his own thoughts.

A double knock sounded; the office door swung open. Bill looked up eagerly.

It was "Shorty" Hassfurther, the veteran ace of the squadron. He said, "Tony told me you wanted to see me, Bill."

"I do. Come in."

Shorty closed the door and sat down beside the desk.

Bill shoved the newspaper aside and took a letter from a drawer. "I just received a coded message about another gold shipment," he said, his voice low. "They want the train protected from the air as before. But this time, you aren't going. I want Cy and Bev to handle it. They'll take off at nine thirty to-morrow night. Same route as the other times—from U. S. Assay Office in Manhattan to Fort Weston. You give 'em their orders. And listen, keep it hush-hush. Just because three shipments got through without any trouble, doesn't mean that this one will."

Shorty nodded. "O. K. But what's the idea of taking me off the job?" He leaned forward. "Has that other thing broken yet?"

"No. But it will soon—or not at all. That's why I want you here. Wish I could tell you more, but I can't until that telegram arrives—— I'd be on the gold job myself, except for this other business."

"How much dough are they moving?"

"Five million. The last shipment. Now get hold of Cy and Bev."

Shorty got up. "Yeah. Right away." He reached the door and swung it open.

Bill said suddenly, "How is the kid this morning?"

Shorty turned back. "Sandy? Saw him at breakfast. His cold sounds worse than ever. Sneezing all the time."

Bill shook his head. "He's got me worried. He's had too many colds this winter—and this one's hung on and on." The pilot's blue eyes were thoughtful. Then he said, abruptly, "I'm going to ship him off to Florida, pronto."

"What!" Shorty came back toward the desk, a grin on his face. "The kid'll be tickled silly. He's been pestering you for weeks to let him go."

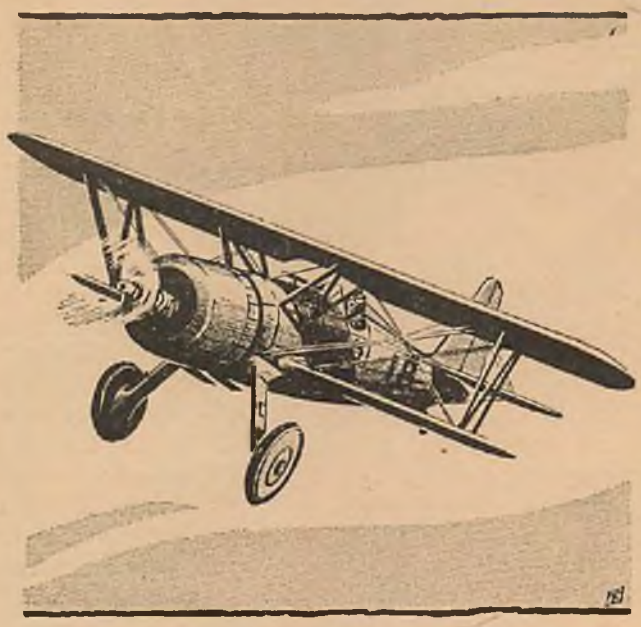
Bill laughed. "I know. He thinks he can get that Florida movie outfit to sign up Alphonso for a picture. But I'm sending him for his health, not——" He stopped suddenly, his eyes going to the open office door.

From the corridor outside had come the sound of a scuffle, followed by shrill cries and the pounding of running feet.

Shorty said, "What's that?"

Bill was half out of his chair when a small shape bounded through the doorway and into the office.

"Alphonso!" Shorty yelled.



The speedy little ship tore through the skies—faster—hurtling toward——

It was. But the small monkey was arrayed as he had never been before. His hairy body was incased in a cutaway coat and striped trousers. An ascot tie was jerked halfway around his scrawny neck. And pulled far down over his head was a miniature silk hat.

"Hey!" Bill roared. "Stop!"

But instead, Alphonso raced straight for the desk, leaped atop it with a great bound, overturning the inkwell and a file basket. Before Bill could grab him, the monkey jumped into the air and seized the chandelier overhead. He clung there, chattering wildly, his beady eyes shining.

"For the love of Nelly!" Bill said as he fell back into the desk chair with a splattering of ink on his bronzed face.

At that precise moment, "Sandy" Sanders, the kid ace of the Barnes flying organization, sprinted through the doorway, his freckled face red with anger. In one hand he carried a small battered suitcase; in the other a leather leash. His hazel eyes widened as he saw Bill. He tried to come to a sliding stop, stumbled and sat down hard.

He said weakly, "Uh—hello, Bill," and sneezed, "*Kaaa-chooooo!*"

Bill wiped the ink from his face. His eyes traveled from the boy on the floor to the chattering monkey overhead and back again. He said slowly, "Good morning, Sandy. Nice to see you again."

Out of the corner of his eye Bill could see Shorty behind him, doubled up with laughter.

Sandy struggled to his feet. "Golly, Bill—— Well —— *Kaaaa-chooooo!*"

"Exactly," Bill said. "Now what's the reason for the Tarzan act?"

The boy lowered the small suitcase to the floor by its improvised rope handle, took a handkerchief from a pocket and blew his nose violently. He said, thickly, "You see, I—I was going to surprise you—— Only he"—the boy pointed to Alphonso, who was now placidly swinging by his tail—"he spoiled everything. *Kaaaa-chooooo!*"

Bill glanced down at the ink-soaked desk. "We can see that."

Sandy had his handkerchief to his swollen nose. He said, his voice muffled, "Remember, I told you about that movie studio down in Fort Lauderdale, Florida, being kinda interested in making a series of short pictures of Alphonso? Well, I've been getting him ready for his screen tests. Bought him those dress clothes and trained him hard. *Kaaa-chooooo*—— This morning I thought that if I dressed him all up and brought him in to see you—*Kaaa-chooooo*—you might let me take him down there—— *Kaaa-chooooo!*"

Bill couldn't restrain himself any longer. He leaned back in his chair and rocked with laughter. "O. K., kid," he said finally. "You win. You can go." *(Turn to page 62)*

# THE FLIER'S DICTIONARY

The eighteenth lesson in the technical terminology of the air. Save your files!

## WIND INDICATORS FOR THE AIRMAN

1 WAVES IN POND BLOWN BY WIND

2 SAIL BOAT

3 CORN FIELD OR FIELD OF GRAIN

4 SMOKE FROM RUBBISH FIRE OR INCINERATOR

5 KITE

6 CIRRUS CLOUDS BLOWN BY HIGH WIND

7 WIND MILL

8 SMOKE FROM TRAINS, STEAM SHOVELS, STEAM ROLLERS, ETC.

9 FLAGS, PENNANTS, OR CORD ON POLE WITHOUT FLAG

10 OUTDOOR FIREPLACE, OR BONFIRE

11 WEATHER VANE ON HOUSE OR BARN

12 SMOKE FROM HOUSE

13 TREES OF ANY TALL, SLENDER SPECIES

14 SMOKE FROM FACTORY OR LARGE BUILDING

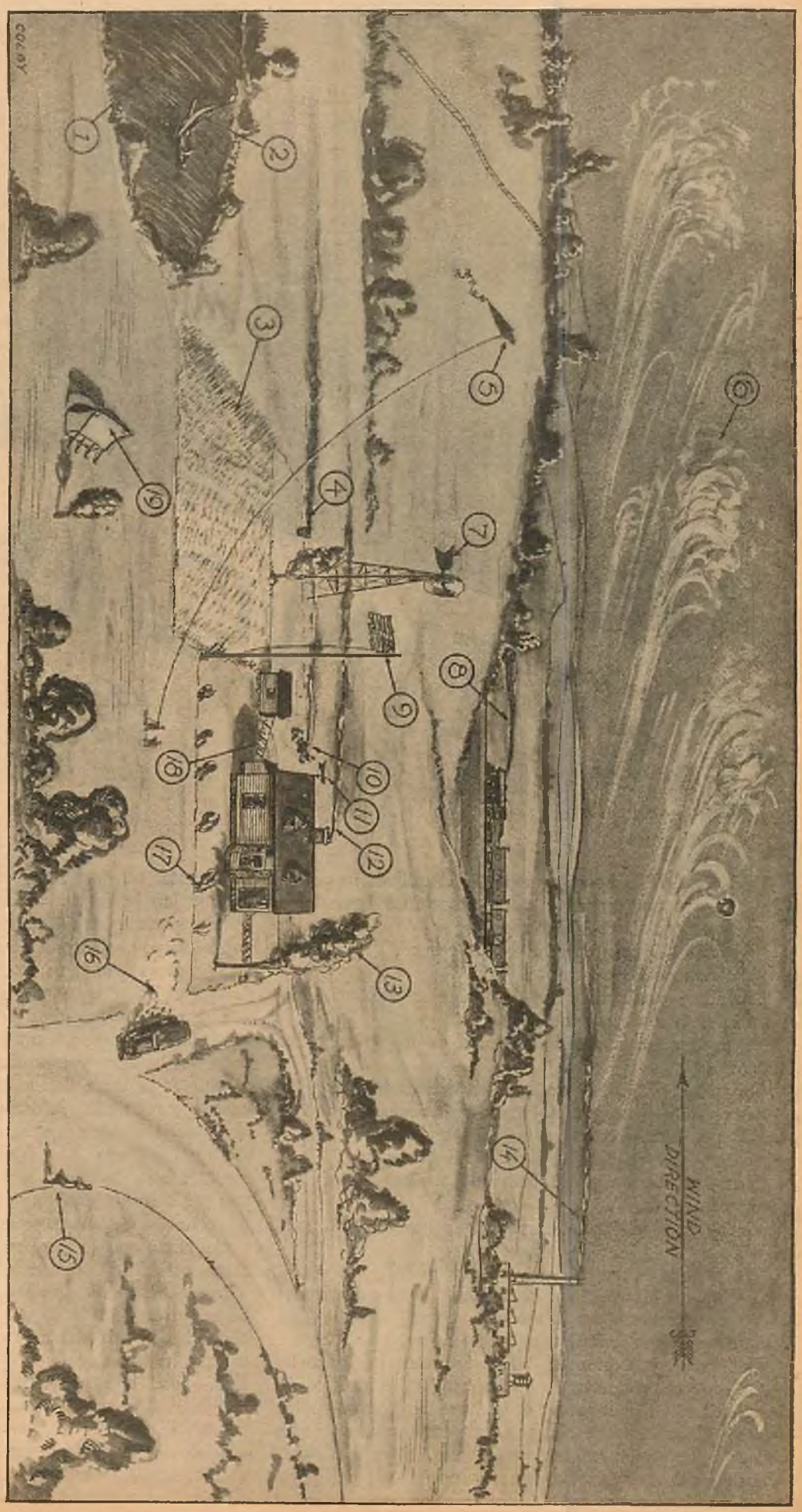
15 AT LOW ALTITUDES, BLOWING CLOTHING

16 DUST FROM CAR, MOWING MACHINE, DUSTY ROAD, OR FIELD, ETC.

17 LIGHT BUSHES OR SHRUBS

18 LAUNDRY ON LINE OR CLOTHES REEL

19 TENTS OR COVERINGS OF CLOTH FOR HAY, TRUCKS, MACHINERY, ETC.



# GETTING INTO

*Here's the expert opinion you've been asking for—the facts on opportunity today!*

AVIATION is booming again. Headlines in newspapers and aviation trade magazines have been shouting about it for months.

"Airlines set new all-time traffic record."

"TWA adds 20 new pilots."

"Airplane production for first nine months of 1936 up 68 per cent over same period last year."

"Army air corps wants more men to fill flying cadet vacancies."

"Shortage of skilled workers in aircraft industry."

"Aeronautical exports for first eight months of 1936 up 55 per cent over same period last year."

"Floor space tripled at light airplane factory."

"Another flivver plane delivered to Bureau of Air Commerce."

"Navy faces shortage of pilots for new aircraft carriers."

Wonderful! Such news is calculated to get a young fellow up on his toes and all adither to be off without delay to take his place in the aeronautical world. You want to get into aviation, and that's fine.

But have you stopped to figure out just exactly what you yourself want to do and might be fitted to do in aviation? For aviation is a thousand things—piloting the *China Clipper* across coral seas; working in an office; taking pictures in Iraq, Idaho, Egypt, Illinois; working on engines in a maintenance shop; designing the newest and slickest ship built to date; running a sheet-metal machine in a factory; flying a neat army pursuit job in formation at 250; operating a teletypewriter; packing and repairing parachutes (and jumping in them); selling airplanes in China or South America, or more likely, in Podunk Center, U. S. A.; and dozens of other occupations.

The chances are that you have not made up your mind just what you want to do in aviation. You may not even be sure you want to get into it as a vocation at all. You can't decide about these things until you have some definite information. You must know the kinds of jobs there are, how easy they are to get, what the qualifications are, how and where to learn, how much it costs to learn, how steady employment is after you get started, how much money you get on each job, the chances for advancement, and so on.

Complete and definite answers cannot be given to all those questions in regard to every job in aviation. There is, however, quite a lot of information that may be of great benefit to a young man trying to decide about his rôle in aviation or trying to get into aviation in case he has already decided in favor of it as a vocation. The offhand knowledge of the writers of this article has been added to by an investigation of considerable printed matter and by conversations with officials of the United States army air corps, the Bureau of Aeronautics of the United States navy, the Bureau of Air Commerce of the Department of Commerce, the

by CLYDE PANGBORN
and LIEUT. W. M. WOOD

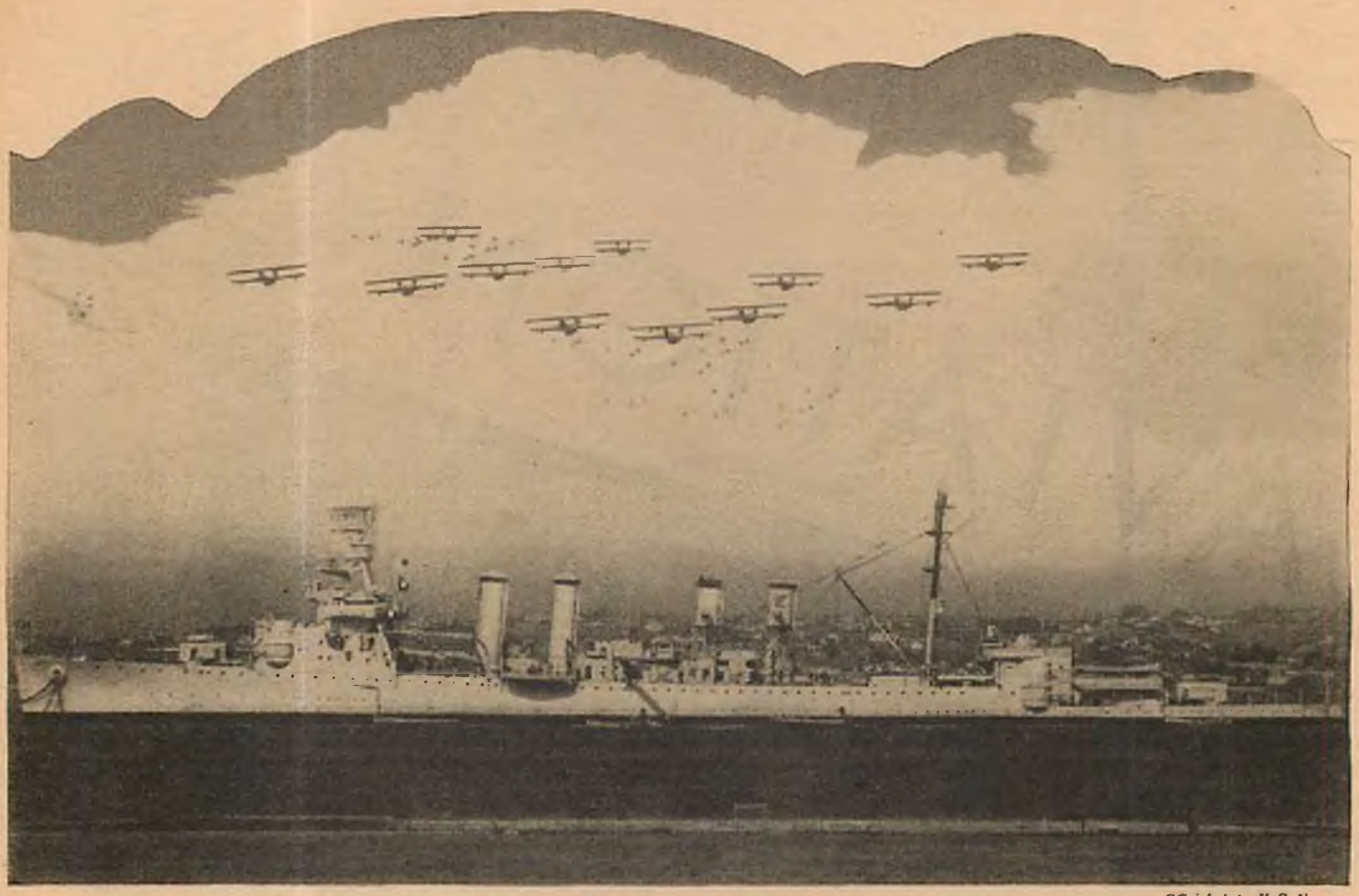
# AVIATION


Center for the army air corps' free training is Randolph Field above; on the opposite page, new cadets get their first taste of military routine.

Department of Labor, and the United States Civil Service Commission. Several air transport companies, aviation schools and aircraft manufacturers have been asked for information, in some cases with pleasing responses. The results of this investigation will be presented in a series of articles in AIR TRAILS, of which this is the first.

TO many young fellows, getting into aviation means getting into an airplane and flying it "you, yourself, personally." In that sense you can get into aviation—become a part of the flying world—without making flying your life work. The truth is, of course, that most people who want to fly will have to fly non-commercially, because most everybody who is young and red-blooded and a lot who are oldish and red-blooded want to fly. There aren't flying jobs for all and competition for the good ones is keen, and only a few persons, with very special qualifications, inherited as much as acquired, can ever hope to be, for instance, the flying captains of the Pan American *Clippers* or the fast TWA Douglas air-liners. Such persons achieve these posts only after years of hard, intensive training and experience. As for making a living in miscellaneous flying, there will always be a considerable number of people who do, just as there are large numbers of people who make their living operating automobile taxicabs and delivery trucks of various kinds.

Getting into aviation, however, for the great majority of people will involve making enough money somehow to pay for flying lessons, and perhaps a "flivver" plane if not a big one. So, before we start talking about the extensive training which is available free of charge in the



Official photo, U. S. Navy

**Battle planes being flown over the cruiser "Omaha" by pilots trained in the navy school at Pensacola.**

military schools to a limited number of individuals with special qualifications, and before we discuss the really professional commercial flying schools which charge you plenty, let us consider for a moment the problems and conditions which the great majority of non-professional flying aspirants must face.

First of all, how much does it cost?

If you buy flying time by the hour from a flying service or an independently operating transport pilot, it will usually cost you from $7 to $12 per hour for dual instruction time and from $5 to $10 an hour for solo flying time in the small- to medium-sized training planes. If you want to sign up for enough time to get a license, you can usually get a reduction.

Perhaps you live near an airport where there is a flying school. Or maybe you can leave your work or regular school for a few weeks to take a course. If so, it will interest you to know that in 1936 the Bureau of Air Commerce found that among a number of schools the average cost of an amateur pilot's course (25 solo hours required for a license) was $276, and the average course length was 10 weeks. The average cost of a private pilot's course (50 solo hours required) was $505, and the average length 17 weeks. Prices of individual schools vary with the reputation of the school, kind of plane used, and other considerations. The chance of earning any large portion of your expenses by working for a school is very slim. You can get a list of practically all persons and schools giving flying lessons in the United States by writing the Bureau of Air Commerce, Washington, D. C.

All right. Suppose you have enough money to take lessons. Next you have to get your student's license, for which both men and women over 16 may apply. This is given you by a doctor who is a medical examiner for the Department of Commerce. There are several hundred scattered around the country, and you can get the address of one from the nearest airport or by writing to the Bureau of Air Commerce. The examiner will make the examination and mark you as physically unfit for flying or, most likely, certify you as physically qualified for non-commercial or commercial licenses, as the case may be. Generally speaking, you can qualify for the student, amateur and private licenses, which are non-commercial, provided there is nothing radically wrong with you and if each eye is as good as 20/50 without glasses or 20/30 with correcting lenses.

When you have your student's license, you are ready to begin flying. Ordinarily about 10 hours' dual instruction is given before a student solos. After that he gets solo time and also more dual instruction, part of which latter may be credited toward solo time. When you have 25 solo hours you can take tests for an amateur pilot's license. These are given by an inspector for the Department of Commerce and consist of a fairly easy flight test and an examination on the Air Commerce Regulations, contained in Aeronautics Bulletin No. 7, a copy of which may be secured free by writing to the Bureau of Air Commerce.

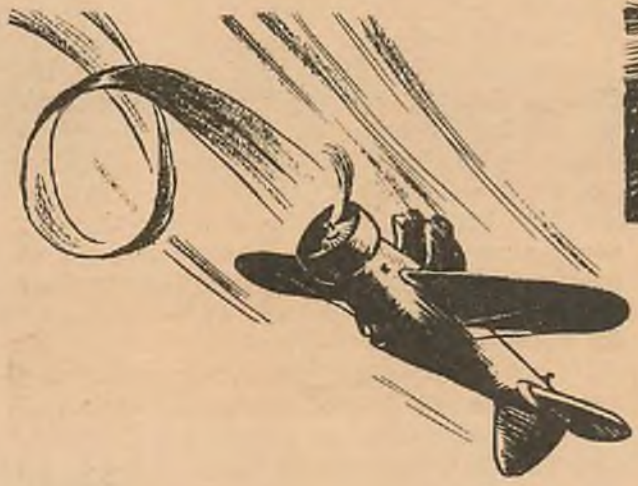
Students and amateur pilots are not allowed to take up anybody at all as passengers except pilots with private licenses or better in dual control ships, with the higher-licensed pilot in command. They may not carry cargo for hire.

*(Turn to page 89)*

# SPLIT-SECOND ACTION

*Hair-breadth escapes, hair-trigger decisions, dangerous moments that come once in a lifetime.*

TWO ARMY FLIERS, IN BOMBING PRACTICE, RELEASED THEIR LAST TWO BOMBS. BOTH BOMBS CAUGHT IN THE UNDERCARRIAGE AND COULD NOT BE SHAKEN OFF. SECONDS AFTER THE AIRMEN TOOK TO THEIR CHUTES THE AIRPLANE WAS BLOWN TO BITS.



MAJOR L. CHRISTOPHER ATTAINED SUCH AN ENORMOUS VELOCITY IN A TEST DIVE THAT IN PULLING OUT, THE PLANE TURNED UPSIDE DOWN AND SLID TAIL FIRST. HE REGAINED CONTROL AFTER ITS SPEED LESSENED.

HANGING BY HIS NECKTIE WHICH HAD CAUGHT IN THE WIRE STAYS, SMITH, A PARACHUTE JUMPER WAS STRANGLING TO DEATH. WATTY GLOVER, THE PILOT, REACHED OVER AND CUT THE NECKTIE. THEN, AS HE HELD ON TO SMITH'S HARNESS WITH ONE HAND, LANDED THE PLANE SAFELY. AND IN TIME TO SAVE SMITH'S LIFE.


FORCED DOWN BY FOG IN THE BAY OF FUNDY WHERE THE TIDE RISES AND FALLS OVER 50 FEET, GENERAL FECHET'S AMPHIBIAN WAS SOON LEFT HIGH AND DRY

WITH THE WHEELS STILL UP. DIGGING UNDER THE HULL HE WAS ABLE TO LET THE WHEELS DOWN, AND TOOK OFF AS A LAND PLANE BEFORE THE TIDE COULD SWEEP BACK

AND WRECK THE PLANE. THIS IS, PROBABLY, THE ONLY TIME A PLANE LANDED AS A SEAPLANE AND TOOK OFF AS A LAND PLANE — AND FROM THE SAME PLACE.

# Runaway

*Clouds—a hushed, empty void of gray mist—a crowded basket with Death as an invisible passenger——*

by A. R. Elrod

WILLIAM BRENT, second lieutenant, stared disconsolately out the window of his room in the Post Inn. A dreary summer rain dribbled from a sky gray with low clouds. Already, at seven o'clock in the morning, the air was a hot and sticky vapor that clung to the broad Mississippi Delta country with the same muggishness that had persisted for three days—ever since Brent and Sanders had arrived.

The earth was wet. The town of Tallorah was silent but for the drip of eaves and the occasional swishing of bare Negro feet in street mud somewhere below. Aggravated almost beyond endurance, Brent looked out upon the scene and shook his head.

"Spores!" he snorted in disgust. "Bugs and fungi on a glass slide! Boll weevil and ozonium and *colletotrichum gossypii* and a couple of pains in the neck! And I had to get hooked for *this* detail!"

First Lieutenant Gene Sanders, sleeping beneath just a sheet, rolled over with a muffled expression of his opinion of being awakened at this time of the morning; and at last, rubbing his eyes, sat up. He was a short, rotund man with a round head gradually losing its supply of wiry, Airedale-colored hair, but a pair of amazingly broad shoulders.

He yawned, and then, deliberately, he asked, "So you don't like this detail, eh?"

The effect was startling. Brent, lithe and lean and angry, whirled so quickly from the window that his uncombed black hair fell down across his eyes. He shouted, "For five days I've been trying to get that idea across to your thick brain!" He paused and, watching Sanders' twinkling blue eyes, challenged with a sudden chill suspicion, "By any chance, did you have a hand in getting me assigned?"

Sanders grinned. He swung his feet out to the floor, stretched and yawned again. With a kind of malicious enjoyment he asked, "So you suspect me, do you? Well, now, Bill, what would I have done down here alone?"

Brent emitted a faint squeak of baffled rage. "If there weren't a law," he threatened, "I'd choke you till your tongue got black!" And then, rather plaintively, he added, "Gene, you know the jam I'm in. I've got to get away from this detail! Quick! If I stay down here a month, I'll go back and find Philippa dated up to marry Don Gray. You can't go off and neglect a girl you're courting—damn, Gene!" With a distracted entwining of his fingers in his hair, he came over and stood glaring down at his superior.

"It would appear"—Sanders grinned placidly—"that you're actually in love—and yet I can't believe it. Old Colonel Schallen has been the commanding officer of Scott for just five weeks, and Philippa has been home from school ten days—and you pronounce yourself in love! Have you a little fever, Bill?" He smirked with cherubic malice. "Anyhow, we're down here, and when you get back to Scott you'll thank me for getting you away. You can't afford a girl like Philippa anyhow, my boy."

There was silence for a moment while Bill Brent struggled with a refractory boot. He had considered Gene Sanders his closest and most trusted friend until this moment; and the knowledge of Sanders' action came as something worse than treachery. It was treason, and it was tragedy. Philippa Schallen was a gloriously beautiful girl, to say nothing of being the seductive and glamorous daughter of the most colorful colonel in the air corps. Bill Brent was helplessly and hopelessly in love with her. He *had* to get back to her. Somehow, by one means or another, he had to get relieved from this muddy, boring detail in Tallorah. Silently he swore that he was going to get relieved if he had to wreck the winch—or something.

He got to his feet, attired now in lightweight shirt and breeches and footgear, stamped his heels a time or two to straighten out his toes, and glowered at Gene Sanders. "You damn goat!" he muttered. "Always butting into something that isn't your affair. If you'd ever been in love, you'd understand. But you've got no feeling—you cold-blooded snake!"

"Snake—with this stomach?" Sanders countered genially, tentatively patting that protuberance. "No, Bill, I've never been in love—thank Heaven. We'd better get out and see the weather map. But I don't think we can do much in the air this morning. Maybe we could get up another rummy game with some of these old cotton planters. Fifty dollars wasn't bad yesterday, hey, boy?" He dived under the shower and, emitting a dozen lusty yells, came flapping wetly out again, toweling himself briskly as he strode back and forth before the window.

Below, the town of Tallorah spread out, the houses standing serene and wet beneath scattered, giant trees. The streets were lanes of rich black mud. Directly across from the inn was the Madison National Bank, and along the short length of Main Street were business houses, mercantile stores, and the post office. Tallorah was an active cotton center, wealthy, this year of 1925, almost beyond imagination. So wealthy and so politically important that the government of the United States had recognized it formally.

The reason that Brent and Sanders had been sent here was that the cotton in this productive delta land was being destroyed more ruthlessly each season by boll weevil and other insect life. The pests were either breeding here or migrating; and in either case, they must be eradicated. So this expedition was a bug hunt on an enormous and rather unique scale. And they, as Brent had cryptically and angrily described them both, were the big bug hunters. It was going to be a disgusting job, if you believed Bill Brent. And he, within


The lines draped vertically around them; they floated.

these last five minutes, had decided that he would stoop to almost anything in order to escape.

Sanders, pacing back and forth before the window, suddenly paused and stared across the street, his dressing arrested at the point of buttoning his shirt. Brent, lighting a cigarette, looked up and watched, and said sarcastically, "I thought I knew something about dogs, but this is the first time I ever saw an Airedale point. You dirty double-crosser, you! What the devil do you see?"

Sanders only grunted mildly. Then, after fully thirty seconds had gone by in silence, Brent stepped forward and looked down, following the other's gaze.

Across the street was the bank, and standing in the doorway of the bank, reading what appeared to be a letter, was a girl. She was unquestionably a pretty girl, what he could see of her oval face between a small blue hat and the wet, upturned collar of her raincoat. She had trim ankles; she was slender, and about his own height, possibly. And as she looked up she was smiling! Smiling at him, he thought—until he saw the movement of Sanders' hand behind him.

He had been on the point of giving her a mock salute, but checked himself and said in a quick, almost unreasonable disappointment, "If you'd hurry up and get your pants on you might get down there in time to introduce yourself."

"I have exactly those intentions," Sanders said, dressing hurriedly. "Boy, who do you suppose she is? I didn't think there was a gal like that in the whole State!"

The object of their scrutiny turned just then, and with a key produced from her purse, opened the front door of the bank and passed through, closing it behind her. It was long before the opening hour of that institution; it was not yet quite eight o'clock.

"Works there," Sanders ruminated. He pulled on his boots quickly, keeping up a running fire of deductive conversation meanwhile. Dressed at last, he patted his hips and said, "Just occurred to me, I need to cash a check! See you after a while." And with that he dived through the door, his footsteps growing fainter as he took the stairs two at a time.

In exasperation and frustrated rage, Brent went down to order breakfast. It was all right for Sanders to meet attractive women, but for himself this detail would last an endless month, during which time, as the flying member of the pair, he would take off each morning at eight o'clock in normal weather and fly till four or five, operating the slides in a bug trap and shouting orders to the winch operator to raise or lower the balloon.

If he could have flown one of the airplanes which droned across these dew-drenched bottom lands at dawn each day, spewing white cords of poison dust upon the cotton crop, it would not have been so bad. But his task was a passive, boring one. Upon the edge of his balloon basket was a boxlike contrivance open at both ends; the interior of the box contained numerous glass slides coated with a sticky substance. All day the wind sighed through that box, bringing with it millions of destructive spores and half a hundred kinds of insects injurious to plant life, and depositing them upon the slides. Every evening entomologists analyzed the contents of the slides and issued orders for the kind of poison to be sprayed by the growling morning planes.

So Brent's task was simply to stand there in the

basket of the kite balloon, changing slides each time the altimeter was varied. He was not interested in spores and bugs and cotton acreage. But, being loaned by the army for the job, he must spend eight hours every day in the basket of that kite—swaying and pitching when the wind rose high, riding stationary in a sultry calm at other times. This prospect made him miserable. The memory of Philippa Schallen made him desperate. He had, he felt certain, lost her for all time.

Sanders came back presently. They ate, then drove in the olive-drab army car through mud and gravel out the road toward the balloon bedding ground. On the way, Brent asked tentatively, "Well, was she married? Don't be a sphinx all day. The only fun I'll have in this town will be to see you get mixed up with something here."

"We're staying a month, but if this rain keeps up it'll take two months—and that will suit me fine," Sanders said. "No, she's not married. She's the cashier of the bank, and she's the prettiest thing this side of the Galveston Pageant of Pulchritude. Name's Judith Gardner. Apparently her old man's got a big plantation and, of course, she doesn't have to work, but feels she's not much use unless she's doing something. That attitude's unusual in this country. This afternoon I'm going to take her and her old man up so they can see their plantation from the air. I've got a date with her to-night. I'll admit I'm hooked. Hooked, and glad of it, Bill. I never felt like this before!"

"You fool!" Bill Brent said. "You don't want to give this kid the rush. You're down here in the shotgun country now, and you'll have to marry her!"

Gene Sanders laughed. He was nervous, Brent decided. His voice was different—unsteady; he was excited, too.

Gene said, "Maybe that would suit me, Bill! Had you ever thought of that?"

"No fool like an old fool," Bill Brent thought; but he expressed no further opinion on that matter then. They came to the bedding ground. Here, like a great black grub, the balloon was lying on the ground, sandbagged against the fresh north wind. Surrounded by a trench that drained away the water which now streamed from the rounding sides, the craft had an elephantine look totally incongruous with aviation. Near by was the winch, a short and stubby truck with odds and ends of curious gear beneath a brown tarpaulin. On the other side was the crew tent, where the night sentry relief slept, and where the telephone switchboard was located temporarily. Underfoot was black, steamy, oozy mud. Overhead was the gray of a misting overcast, with jagged whisks of clouds that almost hugged the ground.

But the rain had stopped now. The wind had swung to the north or north-northwest, and the ceiling was definitely higher than an hour earlier. Sanders, squinting at it quizzically, declared: "Bill, we'll fly to-day, after all. Another hour and we'll have a thousand feet and the mist will have stopped—and up you go."

In an infinitely weary tone, Brent returned, "I'll admit that collecting a lot of bugs with personality intrigues me, but when are you going to take a crack at flying this big crock yourself? I know rank has privileges, but don't you think my feet get tired standing in that basket for eight hours at a stretch?"

"The lieutenant," Gene Sanders returned with a smirking grin, "will take that possibility under consideration. In the meantime, you fly to-day, until I come out this afternoon to take Judith and her father for a ride."

Brent snapped: "It's Judith now, eh? It may not have occurred to you that you'll be violating army regulations on that flight. You don't know, probably, that I could make it pretty tough for you. This is an old balloon, and it has Stevens parachutes—and only two! You know that. Three people in the basket, and something happens—and Lieutenant Sanders will be *Mr.* Sanders, if he's still alive. You'd better think about that, boy."

"I don't think there's a great possibility of danger," Sanders said. "And you wouldn't report me anyhow, you sour little bum!"

Judith Gardner

Bill Brent grinned. He said, "Aw, hell," in a tone of disgust and turned from Sanders to the direction of the handling crew. "Bug hunter!" he mumbled. "If this isn't the sorriest detail I ever landed on I'll eat the bugs I catch up there to-day!"

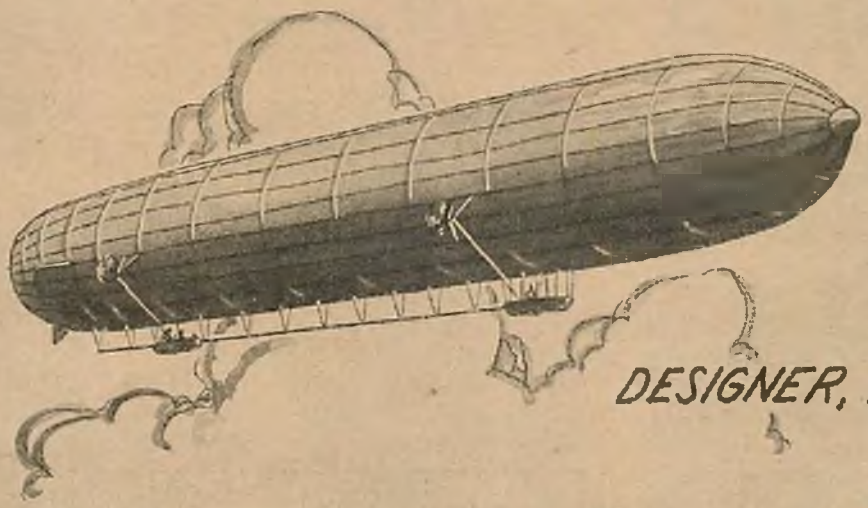
Sanders, working in the tent on his reports, whistled in a tuneless obbligato. Brent, outside in the mist, got the balloon up until it was tugging at the handling guys. He directed the crew in attaching the basket; he checked the valve and rip cords personally, and in twenty minutes was ready to ascend. It was now nine thirty by his wrist watch. The ceiling had gone up steadily during the preparation of the craft, until now it was at least five hundred feet. Within another hour it would be a thousand. As soon as Sanders could go down to the entomological office for the bug traps that would be attached to the basket rim Brent could take off.

Sanders came out, his round face beaming. He said, "Be back in a few minutes. We've got to run thirty tests, and the sooner we get at 'em the sooner you can get back to courting Philippa. How about it, Bill; you fly this crock mornings, and I'll take it three hours in the afternoons?"

"Suits me," Brent said, astonished for a moment that Sanders had agreed to fly at all. "But I'm telling you, Gene, it's potent medicine, taking women up in these. You want to watch your step."

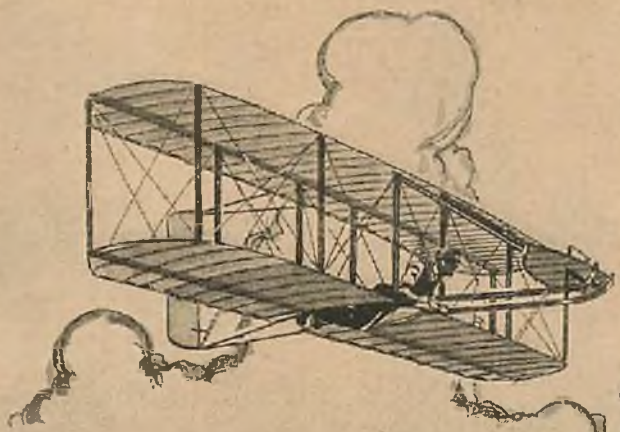
*(Turn to page 83)*

# Pictorial History of Man in the Air



1900 THE FIRST RIGID DIRIGIBLE TAKES THE AIR ON JULY 2, 1900, AT MANZELL, ON LAKE CONSTANCE, GERMANY. COUNT ZEPPELIN, THE DESIGNER, PILOTS THE SHIP.

1901 COMTE HENRI DE LA VAULX, LIEUT. TAPISSIER, HENRI HERVE AND COMTE CASTILLON DE SAINT VICTOR, CROSS THE MEDITERRANEAN SEA FROM TOULON TO ALGERIA IN 9½ HRS.



1902 THE WRIGHT BROTHERS ARE FLYING THEIR GLIDERS UNDER PERFECT CONTROL, – AND PREPARING TO POWER THEM WITH LIGHT ENGINES

1903 DOCTOR LANGLEY'S AERODROME ON SECOND AND LAST TRIAL FALLS INTO THE POTOMAC AND IS HOPELESSLY WRECKED AS REAR WINGS AND RUDDER ARE SMASHED ON TAKE OFF.

COLBY

# Modern Motors

by
Arch Whitehouse
and
Alexander N. Troshkin
*Guggenheim School of Aeronautics, New York University*

THERE are still many popular "mysteries" connected with World War aviation, particularly with the strange equipment used in the aviation branches of the various services. There is the "mystery" of the synchronized machine gun, the adjustable tail plane, the heated Sidcot suit, the tracer bullet, the Prieur incendiary balloon rocket and the cantilever wing system of the Fokker triplane. Mixed in with these queries will be found the question of who downed Baron von Richthofen, what happened to Frank Luke, and why the Allies never thought about giving their fighter-pilots parachutes.

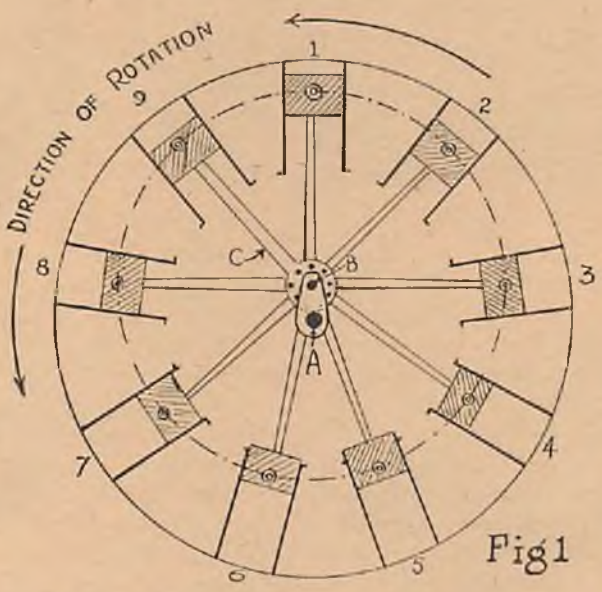
These and a hundred other questions are among the standard mysteries our young aviation fans continue to ponder over and question war-time pilots about. But perhaps the most frequent question is the one concerning the old rotary motor.

How did the rotary motor work?

Even those who flew the planes powered with these motors seem to be unable to offer a reasonable explanation of the engine that whirls around its crankshaft with the propeller bolted to the crankcase. Most of the old-timers seem to have been hurled through engine courses at schools of military aeronautics where they picked up a smattering of information on the old Le Rhône, chattered it off parrot-fashion to some weary-eyed instructor and then promptly flew off and forgot all about it.

Compared to the modern 1,000 h.p. radial, the old rotary seems like some strange invention of a weak mind. Yet back in the early days when airplanes were simply weird contraptions of spruce, fabric, and a lot of wire, these amazing power plants were making aviation history. Back as far as 1913 there was no real stationary engine worthy of the name. They were all too heavy and lacked smooth working cycles.

The rotary of that era was a comparatively smooth-running machine, light in weight, reasonably powerful and, above all, neat and compact. It was not able to stand the pace when it came to increased power, and 180 h.p. seems to have been its limit. It was practically impossible to make a water-cooled radial, and the difficulties of air-cooling them became greater as the demand for fairing and streamlining progressed.




Operation of rotary engine: outer circle is path of revolving cylinders; inner circle is pistons' path. A is center of crankshaft, B center of crankpin, C master connecting rod.

During the last two years of the war, when rotaries reached their highest point of efficiency, they played a gigantic part in winning the war in the air for the Allies. For one thing, we must always remember that the Sopwith Camel, the single-seater that destroyed more enemy planes than any other type on the front, was powered by the Clerget or the Bentley rotary engine. Before that there had been the Nieuports, the Sopwith Pups, D.H.2s, Sopwith 1½-Strutter, Avro, and many others. The Sopwith Snipe, the last of the great machines to use the rotary, was considered the finest and the fastest pursuit machine on the front when the war ended. Even the Germans recognized the value of the rotary and they copied the Le Rhône and used it in at least six types of their famous Fokker fighters.

What, then, did the rotary have to offer over the Hissos, Rolls-Royces, Sunbeams, Liberties, and other stationary types of that day? In the first place, it was lighter than any stationary type of the same horse power—considerably lighter. For instance, the 130 h.p. Clerget weighed 381 lbs. The 160 h.p. Beardmore (a representative stationary motor of that period) weighed 600 lbs. The Hispano-Suiza engines that came along in 1917 were a little better, but they never equalled the power-for-weight ratio of the rotaries. In addition, the rotary motor was comparatively easy to overhaul and repair, and it required no complicated cooling system.

On the other hand, it should be also explained that the rotary engine suffered considerably from unequal cooling, for in those days there were no N. A. C. A. cowlings with fins and flaps to direct air around the cylinders to cool both the front and rear walls equally. They required frequent overhaul (about every 40 hours), they were excessive in oil consumption, and they could not be throttled down with reliability, owing to the peculiar system of carburetion. The torque increased by the whirling mass of the engine was excessive.

Nevertheless, while they lasted and while 160 h.p. was suitable for the speed and power required, the rotary motor was tops, particularly with scout pilots who knew how to make the best use of the extreme centrifugal pull developed by this whirling power plant. Sopwith Camel

*This month we step back to the puzzling rotary — the motor that whirled around a stationary crankshaft — in the second of a series of valuable articles.*

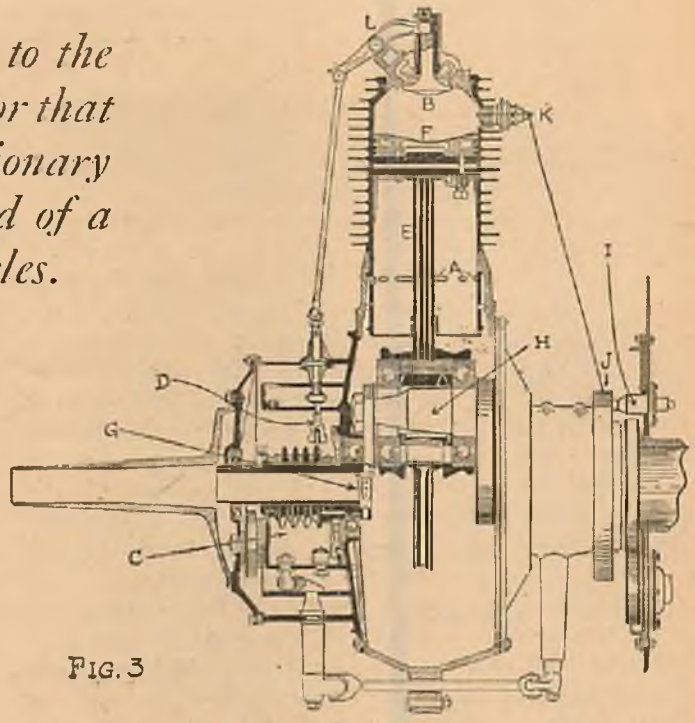



FIG. 3

GNOME MONOSOUPAPE ENGINE

A—Charging ports
B—Exhaust valve
C—Valve cams
D—Valve plunger
E—Master connecting rod
F—Piston
G—Fuel nozzle
H—Crankpin
I—Distributor brush
J—Distributor ring
K—Spark plug
L—Valve rocker arm

pilots, particularly, were unbeatable in right-hand turns, because of the swing of the engine which tended to pull them around in that direction. The Camel "turned on a dime," as the saying goes.

The rotary motion of the rotary engine seems to hold most of the mystery about this engine. To fully understand it, one should first consult Figure 1, which explains the position of the two circles of movement which produce the eccentric, or "lop-sided," movement between the cylinders and the pistons. The main portion of the engine (the crankcase and cylinders) revolves about the point A, which represents the crankshaft. The master connecting rod, to which all the connecting rods and their attached pistons are connected revolves around the crankpin B. Thus the two main groups revolve in two different circles; as seen in the drawing, they are closest at their upper portions.

Thus the pistons reach the top of the cylinders (their top-dead-center position) at the top of the circles. On the other hand, the pistons and cylinder heads are farthest apart at the bottom of the circles.

Thus we get the first indication of an upward and downward movement inside the cylinders.

Ignoring the induction system for the time being, let us assume that fuel vapor has been drawn into the No. 1 cylinder and that it now has been compressed and is ready for firing. We are still studying Fig. 1.

The ignition is so timed that the full force of the burning on the power stroke is utilized immediately after top-dead-center (see Fig. 4 for this operation). The power is not exerted to push the piston *down* the cylinder in the ordinary manner. The force resulting from the burning runs down through the connecting rod to the crank web at a slight angle. This force against the immovable crankpin reacts back to the wrist pin, which is the pivot attachment between connecting rod and piston. As the piston and cylinder head must move apart to allow for the expansion of the explosive force, the cylinder moves away, following the outer circle whose center is the crankshaft, and the piston follows the path of the crankpin circle. They gradually draw apart to maximum separation at the bottom point.

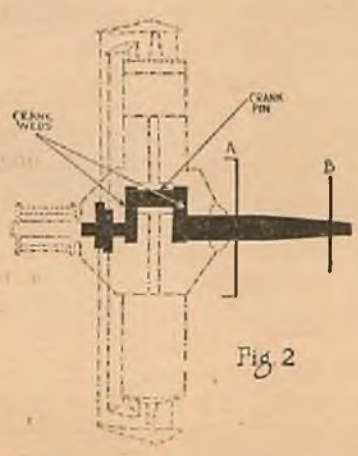



Fig. 2

Black parts are stationary; A and B are engine bearers.

In this manner we get rotary motion.

One must continue to remember that the path of the cylinders is eccentric to that of the pistons to fully understand this motion, and that the power stroke, in forcing the cylinder head and piston apart, actually forces the main portion of the engine to revolve around the main crankshaft.

The operation is of the four-stroke cycle; as we will recall from our first lesson in aircraft engines last month, the piston movements are the suction, compression, explosion or power, and exhaust strokes. As a complete revolution accounts for only two strokes, each cylinder is fired at every *other* revolution. The cylinders are generally fired in 1-3-5-7-9-2-4-6-8 order.

It will be seen from Fig. 2 that the engine is mounted in the fuselage of the plane by means of two metal plates, A and B, fitted to the main crankshaft. These plates are in turn bolted to special ring plates in the body of the plane, and convey the thrust of the propeller to the airplane. Subsidiary fittings such as magnetos and pumps are mounted on the larger of the two supports, but the crankshaft is the only actual stationary part of a rotary, with the exception of two gear wheels. One gear wheel is mounted on the front or short end of the crankshaft and operates the valve or valves. The other is generally located toward the rear of the crankshaft and drives magnetos and pumps. The driven gears in these trains of gears, fastened to the engine body, run around the stationary driving wheels on the crankshaft.

With the exception of the crankshaft and its two gears, then, all parts of the engine rotate. The crankcase is supported on ball bearings and is so beautifully balanced that a gentle push will bring rotary movement around the crankshaft.

We should explain here that the early rotary engines used the single-valve system, from which came the French word *monosoupape* to indicate this type of radial, developed by the Gnôme company. Later types, like the Le Rhône, Clerget, and Bentley, used two valves. Fig. 3 shows the main working parts of the "Monosoupape."

In the original rotary engines, particularly of the Gnôme type, automatic intake valves were fixed in the piston heads and they opened under suction as the piston descended on the inlet stroke, and the fresh charge rushed through them from the interior of the crankcase. As the piston ascended on the compression stroke, pressure closed the valve. There were three main weaknesses to this system. First, the inlet valves had to be made very light and consequently they often broke. If they leaked, or broke when the next spark occurred, a flame might easily flash through them and ignite the gas vapor in the crankcase. Also they were invisible and inaccessible. The first real improvement was devised by the Gnôme engineers, who produced the Monosoupape type.

The Monosoupape engine had an ordinary piston and a single enormous valve set in the cylinder head (see the drawing) which was operated by a single overhead rocker arm and push rod. This single valve served a double purpose. It opened at the beginning of the exhaust stroke and allowed the burned gases to escape.

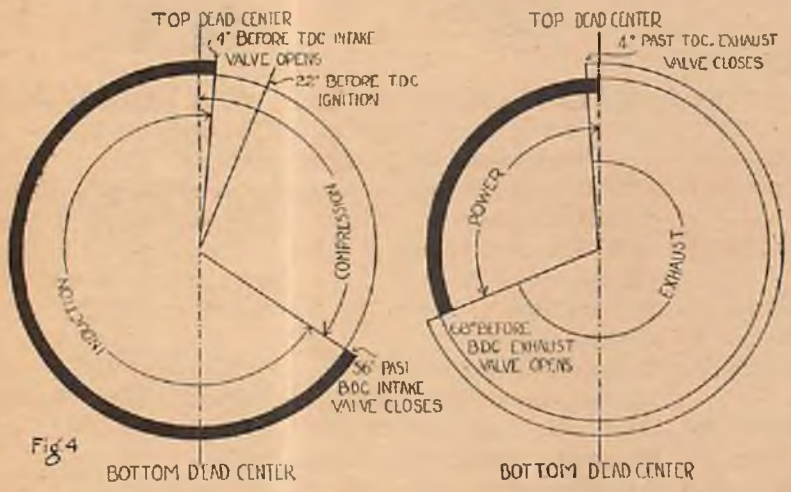



Fig 4

Rotary engine cycle of operation.

But—instead of closing at the top of the exhaust stroke, it remained open for a short time during the beginning of the suction stroke and sucked in pure air. When the intake stroke was partially completed, the valve closed and the piston continued to descend and created a partial vacuum in the cylinder. Then, toward the bottom of the suction stroke, the piston uncovered a ring of holes, cut in the base of the cylinder walls, which were outlets from the crankcase.

The Monosoupape carburetor was set to supply a gas mixture which was so rich in gasoline that it actually was not explosive at all. But this rich gas mixture, drawn through the wall ports, mingled with the pure air already drawn into the cylinder and became a properly mixed explosive charge. Under this system the mechanism was simplified and the risk of fire materially reduced, since the gas vapor in the crankcase was non-explosive.

Later types of the rotary engine, however, used both an inlet and an exhaust valve. The vapor, properly mixed with air, passed through the hollow crankshaft into a circular gas box which was bolted to the rear of the crankcase and rotated with it. Holes were cut in the circumference of this gas box from which inlet pipes or tubes ran to the inlet valves of each cylinder. This system allowed more efficient valve timing.

Another puzzling matter concerning rotary engines is that of carburetion. We have seen how it works in a general way in the Monosoupape, but if we take the system used by the old Clerget, we can get a better idea of operations because it comes nearer the accepted method used in radials and modern in-line engines.

The carburetor was known as the block-tube type and was screwed on the rear end of the hollow crankshaft. It consisted of a rectangular casing with two openings for the admission of air. These air ports were covered with gauze to keep out dirt, and extension pipes were fitted to them and carried to the outside of the fuselage. You have perhaps noticed these pipes on photographs of the old Sopwith Camel. Two drip or drain pipes were fitted to the carburetor casing to carry all surplus gasoline away from the body of the plane. At the crankshaft end of the carburetor was fitted an expanding throttle valve or slide, and attached to the end of this slide by means of a ball joint was a tapered needle which moved inside a jet. Thus, when the throttle was opened, it allowed more air to pass through the carburetor and draw more gasoline through the jet.

Gasoline was pressure-fed from the tank through the fine-adjustment valve to the block carburetor, where it mixed with air. This mixture passed along the crankshaft and went into the gas box of the crankcase. From there it was drawn up the induction tubes, through the inlet valves and into the combustion chamber on the suction stroke.

The ignition problem was another puzzle. In the Monosoupape engine two high-tension magnetos with a double cam or two-break interrupter was located on the thrust plate in an inverted position. They were driven at two and a quarter times engine speed, producing nine sparks for every two revolutions. There was no distributor on the magnetos, but the high-tension collector brush was connected to a distributor-brush holder carried on the bearer plate of the engine. The brush was pressed against a distributor ring of insulating material molded in position in the web of a gear wheel keyed to the thrust plate. Molded in this ring of insulating material were nine brass contact sectors connected with contact screws at the back side of the gear, from which bare wires connected to the spark plugs. The distributor revolved at engine speed, instead of at half engine speed as on ordinary engines, and the distributor brush was brought into electrical contact with each spark plug every time the piston in that cylinder to which the spark plug was located approached the outer dead center. On the exhaust stroke, however, no spark was being generated in the magneto, hence none was produced at the spark plug.

The Clerget used high-tension magnetos which supplied current to a fixed distributor brush which bore against segments on a back plate, each segment connecting by bare copper or brass wires to the spark plugs.

Generally speaking, rotary engines used castor oil, for two main reasons: first, because of its *(Turn to page 89)*


# Letters of an Air Student to His Friend

by George Swift

## "Dear Harry—"

From—Steve Sterling,
Skyways Air School,
Greenvale, Calif.

To—Harry Reed,
Burton, Pa.

Dear Harry,

I've made my first solo flight! And what a sensation it was—in more ways than one. My blood pressure still rises sky-high every time I think of it.

Little did I suspect that morning, as I brought the plane down to a landing, that the great moment was at hand—the moment when for the first time I would fly an airplane alone.

"Sterling," says Kinley, my instructor, "this makes eleven hours of dual instruction for you, doesn't it?"

"That's right," I reply.

Kinley gazes at the sky.

"It's a good day for a solo flight," he says. "Want to make yours?"

I'm taken by surprise. Somehow the idea of soloing hadn't been in my thoughts.

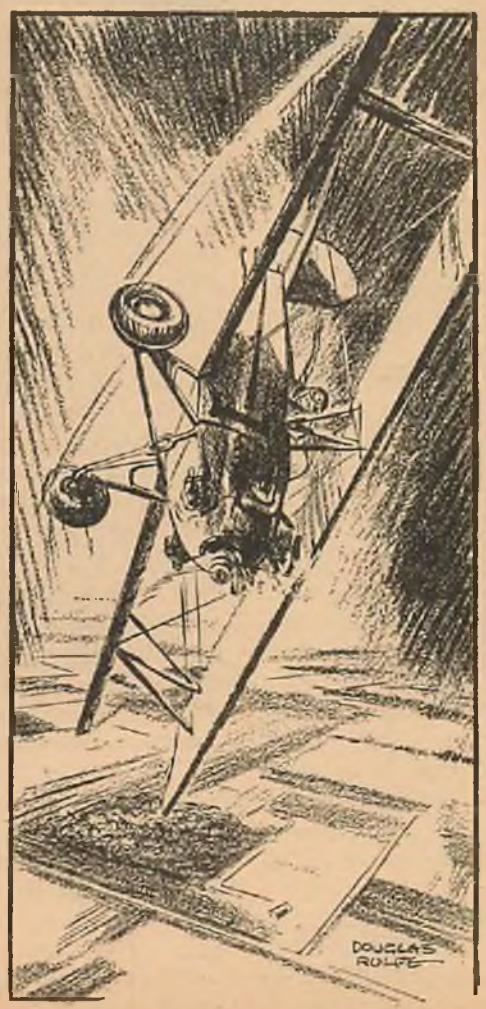
"Sure," I answer, and the next thing I know I'm seated in the plane and Kinley is giving me final instructions, interposed with words of caution.

Then Kinley is stepping away. The field ahead is clear, the motor is running sweetly and all is in readiness for the great event.

I advance the throttle. The ship starts forward, gathers speed. Up comes the tail. I ease back the stick. The vibration of the wheels ceases. I'm off!

What a thrill! Words can't half describe it. Here I am—alone in the air—a roaring motor at my command. The sky is mine.

The plane is climbing—fast. I let it climb. Since the day of my first flight I've wanted to fly high, above the clouds, thousands of feet in the air. Now I can do as I will.




Up I go, higher and higher. The earth recedes, grows dim and hazy. I look up and see that the clouds are near. Then I'm among them, flying between great banks, and ever climbing.

The clouds are left behind and the plane rises through clear, cool air. The earth is now hidden from view. The plane and I are alone in the blue vastness of the sky. Am I getting poetic?

Now the plane is climbing more slowly. I level off and breathe in the invigorating air, drift along contentedly for some time.

At last I am satisfied and let the ship glide downward into the clouds. There I stay a while. I find that it is great sport to race along through the cloud canyons, twisting and turning to follow their contours.

Out of the clouds there is almost no sense of motion, but in them it seems that the plane is flying at terrific speed.

What fun I do have—roaring through darkened tunnels, zooming into dazzling sunlight, leapfrogging over miniature mountain tops, tearing cloud fragments to tatters.

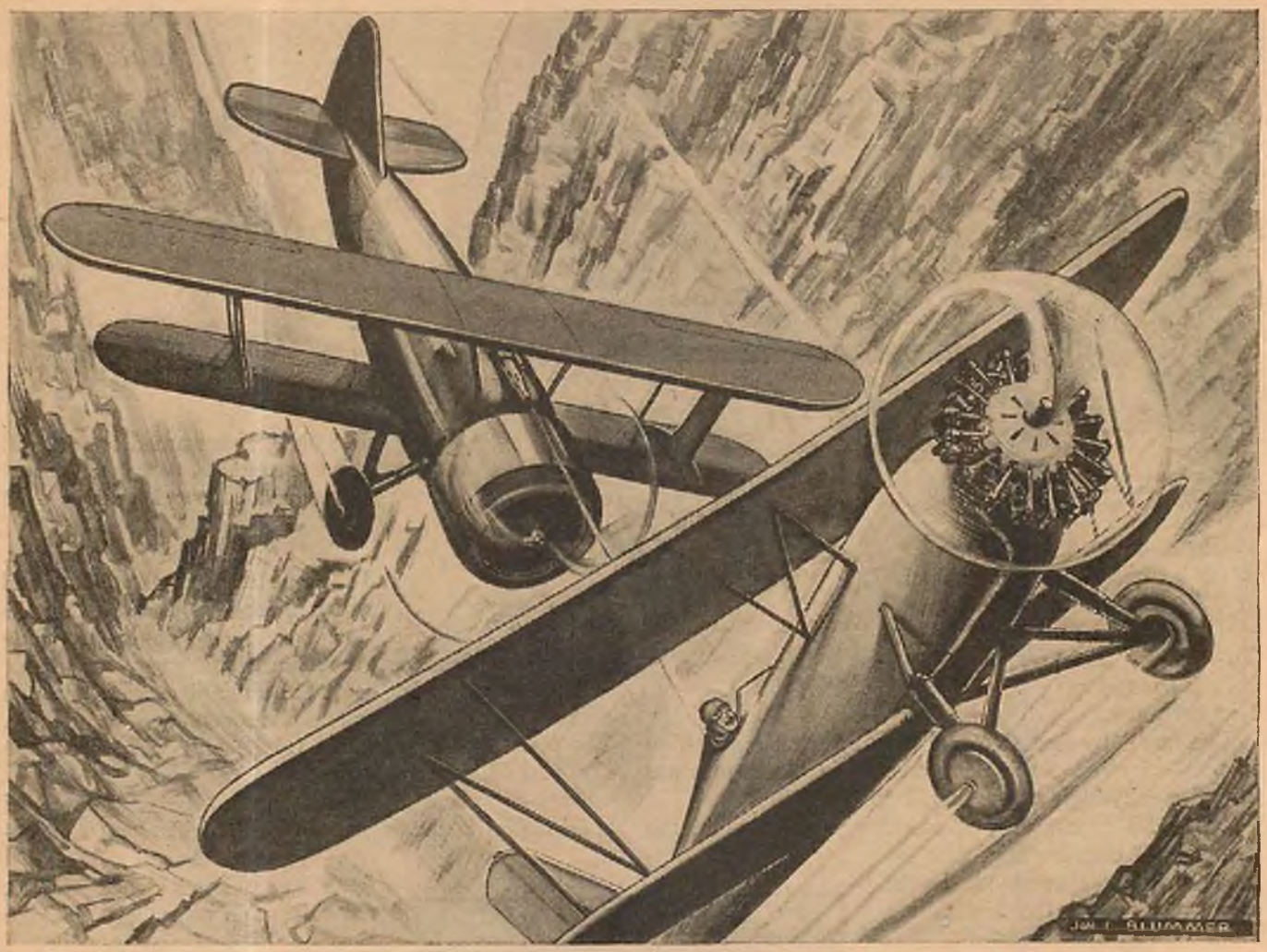
I approach a huge cloud bank at full throttle. Why not fly through it? No sooner said than done. I plunge into the towering mass.

Instantly the sunlight is blotted out. Nothing but gray fog surrounds the ship. Not so good.

I grip the stick firmly. If I keep straight on, I figure, I'm bound to come out the other side. An hour passes—or so it seems. No sign of light.

Back with the stick. I'll try to climb out, I decide. The motor begins to labor and I move the stick forward a little. That's better. But still no sign of light.

My heart is *(Turn to page 92)*



He remembered that other pilot's Immelmann the day before, and he acted purely by instinct——

A GOOD PILOT'S sense of balance is uncanny at times. The tiny bit of sway in the wheel wasn't much, but Blaney felt it instantly. Somebody back there in the cabin had changed position. Somebody had moved back in the aisle, perhaps. He reached down to give the stabilizer wheel a quarter turn to compensate for it, when it happened.

The big transport yawed almost sidewise, as if a Mexican norther had caught it on the wing. Blaney wrenched at the controls and stiffened his feet on the rudder, and, as quickly as it had happened, it stopped. The ship came back to normal flight.

"Take over!" he shouted to Wally Mitchell, his co-pilot.

He felt the stiffness in his knees as he stood up and opened the cabin door. He'd really had to kick hard on that rudder to hold her at all. Better get back and see what the ship looked like.

Blaney stopped, just inside the cabin, and scratched his ear. He counted them again. Seven. But he knew he had taken off from Tampico with eight passengers, all men, bound for Mexico City. Now there were seven. And they were all jabbering at once, in that peppery, staccato Spanish of a group of thoroughly scared Mexicans.

Blaney's Spanish was excellent, as all Caribbean Airways pilots had to know the language. He knew it a little better than most, perhaps, because he'd been flying down here for nine years. But what these excited, waving, screaming Mexican passengers shouted at him was something entirely new to his vocabulary.

"He jumped out the door!" they shrilled. "The door! See—this one! He push it open, and then—*Madre de Dios*—he jump!"

Blaney nodded grimly.

"I felt it," he said. "Which man was it? What was his name?"

"That's the oddest thing about it, *señor capitan*. It was he who carries the pay roll to the Vulture Valley oil-drillers' camps."

"—and he had a parachute!"

With his heart almost in his throat, Blaney swung his thick, powerful body over to the cabin window. His eyes, narrowed to slits and plenty wrinkled in the corners from years of staring at far horizons, bored down into the blue Mexican afternoon. There it was. A tiny little mushroom of white far behind and below showed him where Gonzales and five thousand good American dollars had kissed the air line good-by.

Blaney stood up, rubbed his forehead wearily, and waddled up the aisle toward the control compartment. This might mean his own job, and Wally Mitchell's, too. It might mean a complete change in schedule for the Caribbean Airways, with a dozen more pilots out of jobs. This was the very worst break the air line could get. After nine years——

"Flight 3 to Tampico," he muttered into the radio mouthpiece.

# Up and Over!

*When pay rolls for Mexico took to the air, so did the bandit Ruiz. But he forgot Blaney of Caribbean Airways.*

by Kent Sagendorph

"Go ahead, Flight 3!"

"Blaney calling," he barked in a listless monotone. "That man Gonzales just jumped out over the mountains with a parachute. He took the Vulture Valley pay roll with him. Nice guy. Now I'm holding the bag. Get Dickinson and send me instructions right away."

"Great Cæsar's suspenders!" roared the radio operator. "What'd you let him do that for? How could he jump out and you not know it?"

"Never mind that now, son," barked Blaney. "I'll take the bawling out from the boss. Find him and make it snappy."

Ten to one, Blaney told himself, his old friend Pablo Ruiz was mixed up in it somehow. Ruiz, the one unconquerable bandit in northern Mexico! Ruiz, the ruthless killer of peons and tourists alike, the "liberator" of the oppressed field hand, the *Robin Hood* of the mountains, whose unspeakable cruelty was one of the last vestiges of barbarism in the land. Along the Guadajuato Range, Ruiz was king! And for three years he'd been letting those Yankee oil drillers know it.

Sudden raids on the drilling camp were an old story by now. Holding up company messengers attempting to get supplies to them on muleback had become so simple and so agonizingly regular that the Vulture Valley Petroleum Co., Ltd., had abandoned that. Decisively. When Ruiz began kidnaping the messengers themselves and not only robbing them of the pay roll, but demanding a ransom from the company to get them back, the Vulture Valley executives had turned gratefully to the air line.

They'd helped start it, Blaney remembered. Originally, the line from Brownsville down the coast to Tampico and thence to Mexico City had been laid out and engineered by oil-company men themselves. They'd plunged thousands of dollars on fast, high-altitude planes that would get to their armed and patrolled gates in spite of Ruiz and all his henchmen. Later, when Caribbean Airways began its spectacular rise to international glory, it had acquired the line as one of its main gateways to the South. They'd taken Blaney into the fold along with the line.

Ruiz had shaken a futile fist at the roaring sky, but that was about all he could do. Blaney often thought he'd like a picture of him, balanced forward in the stirrups, horse and man silhouetted in black against the fierce Mexican sunset, Ruiz' fist clutching his rifle, the other raised in profane defiance of the roaring airplane overhead. That would sure be a pleasant picture, Blaney reflected. The only trouble was that Ruiz wasn't content to let that airplane fly peacefully overhead, week after week, with the Vulture Valley pay roll. He'd found a way to chisel in.

"Dickinson to Flight 3!" boomed the superintendent's voice in his ear phones. "Well, let's have it. How'd he get away, and why?"

"Just opened the door and jumped, I guess," Blaney told him. "I felt the ship yank around when he opened the cabin door, but by the time I'd corrected and come down in the cabin he was gone."

"He sold out to Ruiz, of course," Dickinson grunted. "He got that 'chute so he could drop down into the mountains at the right spot and deliver the cash. Well, it'll cost Caribbean Airways five thousand bucks. We'll have to make that loss good. We guarantee safe delivery."

"That's what I sorta figured," Blaney added.

"Only one consolation," Dickinson continued. "He's gone. That particular messenger won't double-cross us again. But from now on we can't take a chance on some other messenger doing that. This is the first and last time. We've got to smash Ruiz—put him out of action!"

"How?" Blaney wanted to know.

"I don't know." Dickinson sighed. "Up to now he's been an indirect asset to us, because it was on account of his bandit gang that we got the contract to deliver that money. Now, if he thinks he's going to make the air line pay tribute the way everybody else does, we'll have to move, and move fast! You skip the Vulture Valley stop entirely. High ball right through to Mexico City with your other passengers. Then get out that old mail ship in the hangar there at Valbuena and fly back to Vulture Valley Field. I'll meet you there in my private ship."

"O. K.," Blaney responded.

"That's all!" curtly announced the superintendent.

Blaney snapped off his set's switches and settled back in the seat. Dickinson didn't waste any time, or any words, either. That was what Blaney liked about him. He came right to the point. When he found out that Ruiz was threatening the line instead of helping it, Dickinson decided to do away with Ruiz. He saw the situation and met it head on. Just like that.

But it couldn't be done—just like that. Ruiz had a sinister, ghostlike band that seemed to appear as suddenly as some magician's trick, shouting, shooting, killing, looting, burning, carrying off horses and food—then disappearing just as suddenly, leaving an empty, burned ruin in place of the homestead of an hour before.

The Mexican government had done everything it could to control the situation. The famed rurales chased him up into the highest and most inaccessible mountain passes and kept him there for a time, but always Ruiz came swooping down from the mountains again, to burn, to pillage and to kill.

Tourists, lugging clumsy house trailers down the new

National Highway to Mexico City from Laredo, fled back to the border after Ruiz had found them easily scared, bulging with currency and defenseless. The army was called out. Well, the papers tactfully reported that the army had "suffered reverses." Actually, whole battalions deserted when Ruiz and his machine-gun brigade started picking them off from the brush.

He made a living out of being a bandit, and he had no desire whatever to start a revolution. Blaney, keeping his roaring transport plane on the radio beam and gazing absently at his instruments, was remembering the times he had rubbed elbows with Ruiz, sometimes beaten him, sometimes lost. There was that time in the early '20s, just after the War, when Blaney was a fresh young kid just out of the air corps and thought he knew all about flying. He tried to dive on Ruiz' camp with full power and have a gunner shoot a rifle out of the rear cockpit. It didn't work. But before the Caribbean Airways came to Mexico, Blaney had been flying pay rolls to the Vulture Valley camps in a two-place open-cockpit job, and never lost a dollar. Ruiz had him licked on the ground. Blaney felt sure he could get that money through safely via the air.

At Mexico City's curious Valbuena Airport, he swung his ship around on the concrete ramp to discharge passengers, then taxied it into the huge, arched door of the operations hangar. There was an old ship in there that Blaney loved like a brother. Years before, in the early days of the air-mail lines, he had flown that ship daily from Brownsville to Tampico, and thence over the eighteen-thousand-foot Sierras to Mexico City, with fifteen hundred pounds of mail and express. It was a Stearman, a name almost forgotten in transport now, but the king of all high-altitude mail planes then. It had a single cockpit far aft for the pilot, and a secure, steel-bound freight compartment stretching between the two wings from the rugged Wasp motor to the tiny cockpit near the tail.

Performance? That thing fairly reeked with it. Blaney chuckled. It would climb to twenty thousand so fast you couldn't get your breath. True, it didn't cruise at anything like the hundred and eighty miles per hour of the new dual-motored transport, but it would clock a good hundred and thirty regularly, hour after hour, as long as there was gas. Being a biplane, it had quick maneuverability and sensitive controls. Blaney could stunt the thing like a Boeing pursuit. On the long, cold trip up the foothills toward Vulture Valley, Blaney fell into a solemn study, musing half aloud to himself about the things the old Stearman would do —if he asked for them.

His nine years of struggle for a foothold in Mexican aviation came back to him bit by bit. He remembered after he had just really started, reading about Lindbergh's historic hop while he was on an exploration job in Yucatan. He began to smile. There was something he had learned there that might help him now. Every other job he had ever flown in Mexico passed in review before his orderly memory. He felt a warm glow of discovery. He felt supreme confidence in himself to do something brand new. He knew he could do it.

And so, after he had brought his old Stearman in for a fast landing at the Vulture Valley camp, eleven thousand feet up in the mountains, he pulled the superintendent aside for a little conference.

"What did you decide to do?" he asked.

"Nothing," groaned the super. "I think we're licked. The camp superintendent up here wants to cancel our contract. He thinks we're in cahoots with Ruiz some way. I don't know what to do."

The burly figure of the camp superintendent, in muddy corduroys and greasy felt hat, came marching over.

"Hey, Blaney," he growled, "here's a proposition. We never lost a dollar while you were flying this gold up here, before Caribbean Airways took over. We'll buy you a ship. You quit Caribbean and work for us."

"You wouldn't do that, would you?" pleaded Dickinson, the Caribbean superintendent.

"Listen," Blaney barked at both of them, "there's another way. We'll carry this fight right to Ruiz, instead of being on the defensive. We'll smoke him out. We'll snatch him, the way he's snatched so many of our men, and take him to Mexico City for trial. They'll hang him higher'n a weather-observation balloon. Let's get Ruiz!"

He lugged him upright and knocked him sprawling with a smashing uppercut.

"'Let's put the bell on the cat,' said the mice," scoffed Dickinson.

"Now, Blaney, you know you ain't got no armed force to mop up them mountain passes!" the boss driller intervened. "It'd take a thousand men. Even if we had the United States marines we'd need at least a battalion. As for this fightin'-in-the-air stuff, how'd you get a hold of a military ship with *(Turn to page 80)*

# AIR TRAILS GALLERY

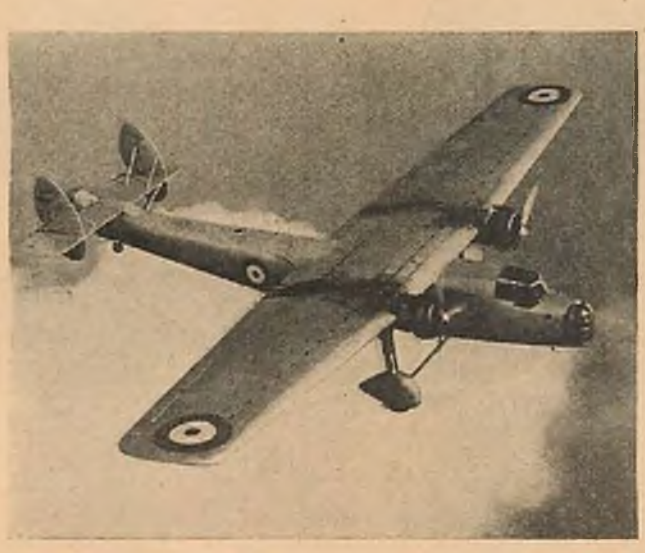
*A Picture Page of Modern Planes for the Collector*

MINNESOTA University aero engineers' experimental tailless plane is almost all wing. It has been undergoing testing on Woll-Chamberlain Field at Minneapolis by Professor John D. Ackerman.

ARMSTRONG WHITWORTH A. W. 27 for Imperial Airways will carry 42, sleep 20. Span is 123 ft., length 110, area 2,450 sq. ft., speed 200 m.p.h. Wheels retract to inner engine nacelles.

NORTHROP A-17 army attack, powered by 750 h.p. Twin Wasp Jr., has 220 m.p.h. top speed, 1,760-mile range, 20,000-ft. ceiling; five machine guns, and bomb racks. Flaps are perforated.

STEARMAN PT-13, army's 225 h.p. Lycoming-powered primary trainer, is similar to navy's NS-1 with 220 h.p. Whirlwind; maker's designations are models 73 and 75. Top speed is 123-125 m.p.h.



BRISTOL 130 bomber-transport resembles Handley Page Harrow shown last month; both are for R. A. F. Length is 67 ft. 9 in., span 96, height 16, gross weight 9 tons. It transports 24 armed troops.

SCARABEE, novel 40 h.p. French light plane, is claimed convertible as auto for travel to airport. Parachute on back releases in flight emergency. Gross is 881 lbs., top speed 80, landing 19.

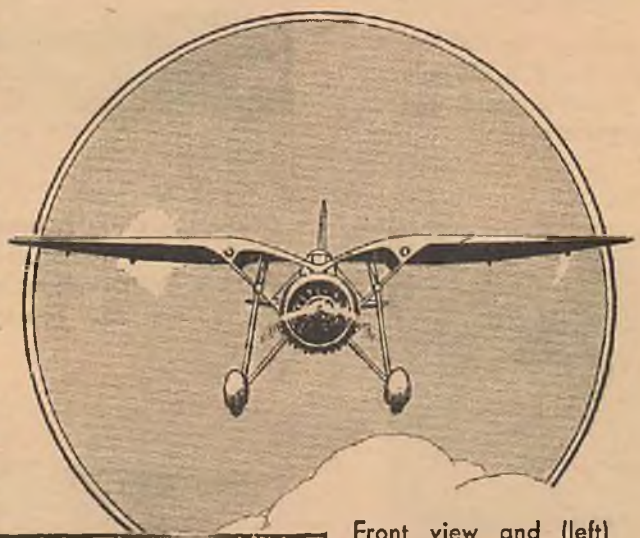
# Gull Wings of France

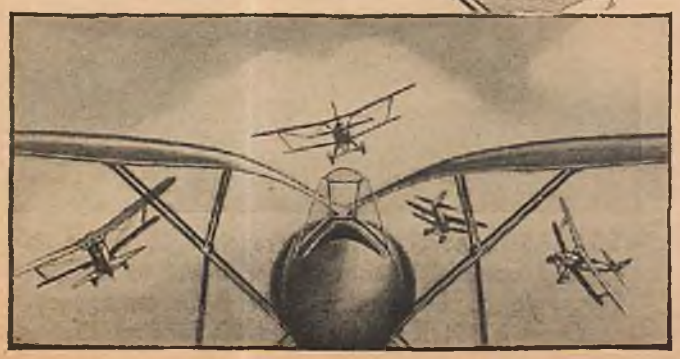
*About the Loire 46 fighter — the plane on the cover.*

by Frank Tinsley

DURING the years that immediately followed the close of the World War, the air forces of the French Republic were admittedly the most formidable in the world. The first line of aerial defense consisted of no less than fifteen aviation regiments (180 twelve-ship squadrons) equipped with over 2,000 airplanes of all types. In addition to these flying units there were 24 balloon companies to assist in artillery observation, as well as numerous batteries of anti-aircraft guns for the protection of military bases, industrial centers, and flying fields.

With the passage of the post-war years, the flying branch of France's armed forces increased in strength and efficiency. During the same period, however, interest in military aviation languished in both Britain and the U. S. A. It was dead in Germany, killed by the Versailles treaty. Italy was busy with the beginnings of her Fascist revolution and the Russian air force—taken in hand by Lenin himself—was being reborn. Educated in the bitter school of four long years of war, La Belle France had become firmly convinced of the value of the airplane, and as part of her effort toward securing her territory against future invasion, she developed an air establishment worthy of her then greatest army in Europe.





Front view and (left) open field of vision looking forward from pilot's cockpit.

Having achieved this eminence of security, the French general staff relaxed its efforts and for several years the Gallic air force remained static. The "brass hats" in Paris forgot that aviation, like time, marches on and that even a momentary halt in aeronautical development signalizes the beginning of a retrograde movement. About this time, the English and American armies began to increase their aerial components slowly and systematically. New planes began to appear in large numbers; they were aircraft that completely outperformed the older French models.

Rumors commenced to circulate through the international whispering galleries concerning the vast aerial armada of La République Française. It was big, the stories went, but it was also practically obsolete! Even the new Russian ships, produced in the industrial turmoil of a changing social order, were superior to the old French crates.

La Belle France, the gal with the tri-colored cocade on her chapeau, dismissed the whispers with a charming Gallic smile. She remained comfortably seated behind the steel and concrete protection of her Maginot Line, completely satisfied with her position. Why should she worry? England was her "bon ami"; so was Italy. Everybody knew that she practically owned the militarily powerful nations of the Little Entente. La Belle shrugged her pretty shoulders. Germany was her only real enemy and it was well known that the Boche was not permitted the luxury of an air force. "After all, what did one think the Versailles Treaty was for?" Yes, La France shrugged her shoulders negligently—and her planes, the same old models of three years ago, grew steadily older.

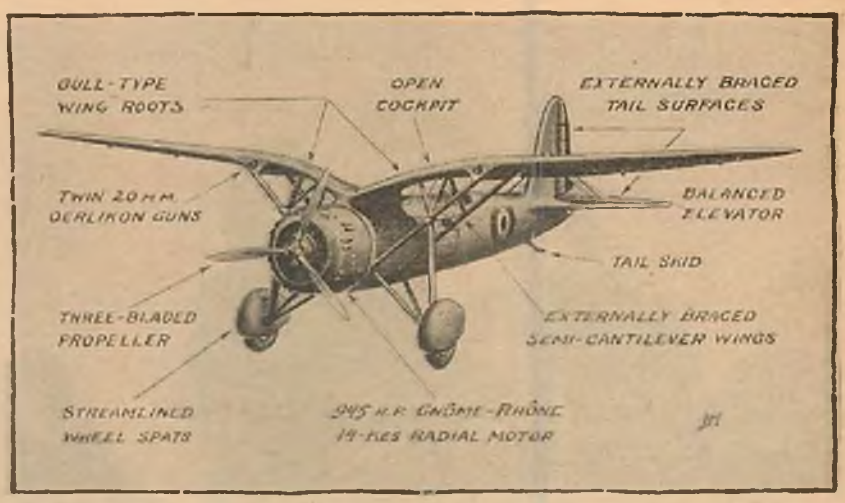
About this time (the early 1930s) a series of aeronautical developments began that were destined to bring about a rude awakening of French military aviation. The first of these was the high peak of efficiency reached by the German civil air lines. Lufthansa passenger planes, most of them easily convertible into bombers, were spanning the continent of Europe in all directions. This was a bit annoying, even though the German ships were easily equalled in performance by the French military models.

The real jolt came with the introduction of the American Boeing bomber and the subsequent rapid development of low-wing, all-metal monoplanes. These new war planes completely outspeeded even the French pursuit jobs. Ever alert to opportunity's knock, the blond boys across the Rhine promptly developed the Heinkel series, a type of high-speed transport similar to the new Yankee ships, and La Belle France suddenly found herself faced with the

threat of a speedy fleet of planes that definitely outclassed anything in her own old-fashioned fleet.

Then Mademoiselle had her final attack of the jitters when Herr Hitler, after tearing up the Versailles Treaty and tossing it out the window, reached into his hat with an air of vulgar defiance and pulled out a full-fledged, ultra-modern swastika air force.

Nor was France alone in her misery. Her "bon ami" across the channel had just suffered the indignity of having his florid John Bull nose soundly tweaked by that rude little Italian boy down on Mediterranean Street. The situation had suddenly become intolerable. These militaristic dictators with their highly organized totalitarian states were rapidly seizing the balance of European power.




Abandoning the ineffectual and politics-ridden League of Nations, the former allies decided to try the threat of force instead of moral suasion. Both France and England now stand committed to the famous old policy of Teddy Roosevelt: "Walk quietly and carry a big stick." Both nations are feverishly rebuilding and modernizing every department of their national defense systems with special emphasis being placed on the aerial arm.

In spite of the fact that the French are a conservative people with but small liking for the innovations of modern life, the progress of Gallic military airplane design has been notable for the willingness of French designers to try any form of ship, however odd-appearing it may be. Pursuit, reconnaissance and bombing planes have been built with every conceivable combination of airfoils, fuselage, and strutting. They have played with biplanes, sesquiplanes and monoplanes, both high and low wing. They have produced tractor and pusher types, with fuselages that range from the conventional forms to mere bathtublike nacelles fitted with booms or outriggers to support the tail surfaces. Some of these unusual types have appeared on past covers of this magazine and have been described in its pages. Among them were the Hanriot H-110.C1 single-seater pusher (July, 1934), Levasseur P. L. 200 reconnaissance seaplane (May, 1935), and the Amiot 143-M multiplace fighter-bomber (July, 1935).

To-day, as a result of the tremendous drive to re-equip France's flying squadrons with ultra-modern wings, various types of highly interesting single-seater pursuit monoplanes are being developed. They range all the way from the more conventional low-wing, all-metal Dewoitine D-510 through several parasol forms like the Morane-Saulnier 275.C1 and the Nieuport 122 to the gull-wing type. In this latter category is the plane that is featured in this month's cover painting.

The latest of the long series of military airplanes, seaplanes, and flying boats produced by Les Ateliers et Chantiers de la Loire in their great dockyard works at St. Nazaire is the Loire 46, an all-metal, multi-gun, single-seat fighter. This firm has become associated with the Nieuport company, and hence some of its planes are sometimes called Loire-Nieuport ships.

The Loire 46 is considered by many to be the best pursuit job in the French service to-day. It is a beautiful example of the true gull-wing type of monoplane and is fitted with semi-cantilever wings strongly braced by a system of external strutting into which the landing gear has been incorporated. The center section of each wing fits into a streamlined fillet built into the top of the fuselage from which it rises sharply in a beautiful gull curve to the points of attachment of the bracing struts. There is a definite taper in chord and thickness from both ends of the wing to this point.

## Loire 46

**Engine: Gnôme-Rhône 14Kes 14-cyl. radial, supercharged, 945 h.p. at 13,940 ft.**

| | |
|---|---|
| Span | 38 ft. 8 in. |
| Length | 24 ft. 7 in. |
| Height | 12 ft. 5½ in. |
| Wing area | 209.8 sq. ft. |
| Weight empty | 2,992 lbs. |
| Weight, normal load (4 machine guns) | 4,015 lbs. |
| Weight, 2 Oerlikon guns | 4,312 lbs. |
| Maximum speed (13,612 ft.) | 248.4 m.p.h. |
| Climb | 3,000 ft./min. |
| Ceiling | 38,540 ft. |
| Range | 465 mi. |

The wing structure consists of two dural box spars connected by a series of compression members to form a central Warren truss. Longitudinal members are then fastened over this arrangement and a stressed-skin covering is riveted to spars, compression members and stringers. The leading and trailing edges are detachable and are fastened by rivets to the front and rear spars. The bracing struts are constructed of tubular steel, faired with dural sheet.

The fuselage is an oval structure of steel and duralumin. It is built up of main and secondary bulkheads connected by four longerons and a number of longitudinal stringers. The principal bulkheads have steel-tube members interconnecting the points of attachment of the wing spars, bracing struts and landing-gear struts. The fuselage covering is of the riveted dural stressed-skin type. The tail surfaces are of externally braced monoplane form constructed entirely of metal. The elevator is designed as a single unit and is equipped with a trimming tab. The stabilizer may be adjusted, but from the ground only. The landing gear is of the divided type and is furnished with differential wheel brakes. It consists of two long-travel Messier oleo struts attached at their upper ends to the front wing struts and hinged to the lower fuselage longerons by dural-faired steel-tube axles and radius rods. The wheels are enclosed in streamlined spats.

The Loire 46 is powered with a *(Turn to page 92)*

There she goes! Spectators near Prague watch the 3,000-foot climb of one of Ludvik Ocenasek's experimental rockets.

# ROCKET SHIPS

## by Allan Finn

Liquid oxygen, a rocket fuel, must be handled with great care.

(Previously the writer has traced the development of the rocket space ship and described its mechanical and engineering problems. In this, the third and concluding article, he sketches their appointed tasks in terrestrial and interplanetary flights.)

IN its decade of somewhat desultory experimentation, modern rocketry has run the gamut of nearly as many fantastic stories as pioneer aviation. The consequence has been to bring it into wide disrepute. It has been said, for example, to have shot contraptions to altitudes of 100 miles or more, carried human beings aloft in Germany and Russia, and extended its development to the point where a moon voyage is momentarily being undertaken in dark secrecy.

Needless to say, all this is pure and simple fiction. To date, rockets have reached a straight upward height of only a mile and a half. Comparatively toylike in design, they have, for the most part, exploded before getting a few hundred feet up.

The question arises at once: Is rocketry a failure? Upon examina-

Its power spent, this rocket floats safely back to earth on a parachute released from the nose cap at the top of its flight.

A rocket "taking off" from Berlin's Tempelhof airport.

tion of the record, no. On the contrary, experiments so far have produced a fundamental value. Quietly pursuing their purpose, rocketeers have, in building devices able to ascend a mile and a half, solved their two basic problems: how to use and control explosive and volatile fuels, and how to burn them properly.

Hence, the question of altitude is practically a matter of the refinement of the knowledge so learned. Nothing has heartened them more than this positive accomplishment. To-day, with the aid of more potent fuels, they believe flights of 25 miles are at hand, flights of 100 miles not far off, and sky-streaking shots between the United States and Europe possible within our lifetime.

As G. Edward Pendray, one of the most optimistic pioneer rocketeers says, there is plenty of theoretical basis and some evidence for the belief that, given enough money, power, and experimental data, they could shoot a rocket to the moon or even to Venus or Mars and return—to-day.

And therein lies the most romantic aspect of rocketry—its ultimate, full-stride field of operation among the stars. Whether it's America's Pendray, England's P. E. Cleator, France's Robert Esnault-Pelterie, or Germany's Hermann Oberth and Willy Ley, rocket men the world over inevitably strike the spark of their inspiration when they wander into the metaphysics of interplanetary speculation.

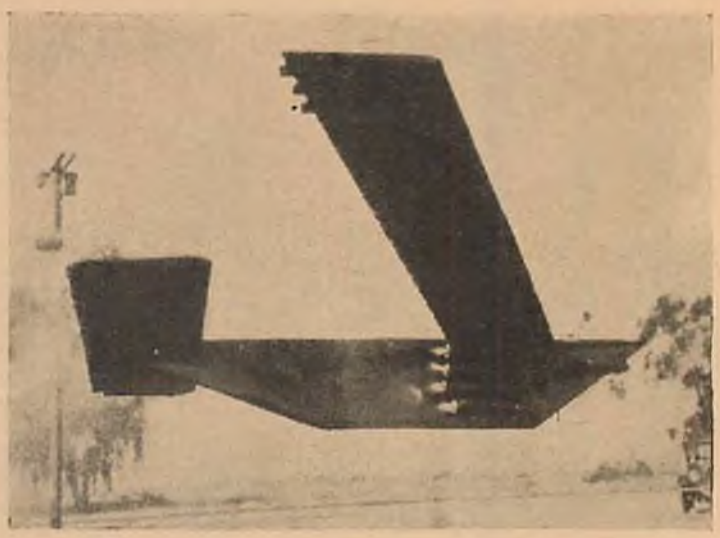
They'll tell you point-blank that the airplane will never get to the stars because in the vast, trackless vacuity of space it would have no traction. With their liquid fuel rocket motors which function at their maximum efficiency in a vacuum, they say they can easily negotiate this void, and at speeds which seem incredible to present-day minds.

They're not ambitious to begin with; to them the immediate ideal goal is that frozen-faced satellite of the earth, the moon. It is almost made to order for them, too. It might be compared,

in aviation, to a hypothetical natural island midway between New York and London, nestling out of the range of storms.

Against the 25,800,000 miles to Venus, nearest planet, the moon is only a trifling 239,000 miles away. Low in gravity force, it is an excellent refueling and jumping off spot for outer-celestial regions. Sharing the velocity of the earth as it swirls around the sun, it has few navigational difficulties.

Moreover, these rocketeers buttress their designs with sound scientific advantages. Devoid (apparently) of water, life, and air, the moon, they say, would make an ideal astronomical observatory and in addition would prove a field rich in research for natural science. This is quite true. To this day, after centuries of telescopic gazing, the supposedly dead moon is full of mystery to us. Out of the great desolate wastes, the towering peaks, the vast circular plains where two weeks of infernal sun alternate with two weeks of polar frigidity, poses a tantalizing big question mark.



Thirty-eight small rockets lifted and propelled Maurice Poirier's 12-foot duralumin plane at Burbank, Calif.

Are these areas volcanic in origin? And what are those white, cracklike streaks radiating out of the surface? Rocketeers climbing aboard their cosmic ships at some future date think they may provide the answers: possibly tell us what is on the other side of the moon, hidden by the fact that it does not rotate on its own axis.

Yet, before such possibilities can whet the interest of astronomer and natural scientist, let alone the public, the rocketeer well knows he must develop a rocket capable of an earth escape velocity of at least 6,664 miles a second. Developed progressively, he knows this force must be attained under present calculations within 8 minutes.

How to concoct a fuel which can supply this terrific motive power is the problem which now keeps many a rocket experimenter close to his secret laboratory. And it is no easy task. As hitherto stated, the power necessary to lift a body out of the earth's gravity grip is about 6,000,000 kilogram-meters for every kilogram of weight of that body.

Scientists testify that to date their most potent known fuel can produce only 1,700,000 kilogram-meters. Without making allowance for air resistance, this fuel could not lift its own weight, much less the pay load and ship.

Until recent years popular solution of the problem lay in Jules Verne's projection of a rocket ship to the moon from the maw of a mighty cannon set against a mountain side. Modern rocketeers never had any illusions about this bizarre scheme. First, they knew there was no known explosive of sufficient force to provide the space ship with the required escape velocity; second, if there were, the shock from the awful suddenness of acceleration would pulverize the moon voyagers; third, the rocket would burst into incandescence through friction of the earth's atmosphere.

To-day's rockets are small, but the future holds no limits.

With a more practical approach, modern experimenters hit upon the novel idea of burning the fuel of a rocket progressively so that it could attain its necessary escape velocity by gradual stages. On the basis of this theory they devised a "step" rocket ship. A tapering, tiered affair. Most of the weight would be fuel, for the ship proper would weigh only 20 tons. To allow for the return lunar voyage, added fuel would bring the grand total almost to an incredible 40,000 tons. Almost the size of the Empire State Building in New York, its cost is calculated at $100,000,000.

Omitting the question of cost, and assuming, as rocketeers do, that this contrivance is entirely feasible, let us take a chance on a blind-date voyage to the moon in it.

They have built it for us on the side of a sloping mountain, the better to facilitate the take-off. As we examine it, we find the first "step" weighs 80 tons, of which 60 is fuel and the remainder is divided equally between shell and passengers and equipment. To this "nose" is attached three other steps—one weighing 420 tons, another of 640 tons, and the third of 35,840 tons. Into these huge shells will be poured a powerful mixture of oxygen and gasoline.

The four of us—for that is our number—have worked out our problems of navigation, or, more properly, astrogation; allowed for the moon's own motion about the earth; inspected our equipment, which includes an oxygen manufactory, a temperature equalizer, radio apparatus, and meteorological and astronomical instruments, in addition to food and water.

Decked out in our specially made space suits and magnetized shoes, we mount to our tiny compartment and wait for the signal to take off. How shall we do it with so much weight? Yes, we'll need a slight "push." Lacking the anti-gravity screens of the super-science writers, we'll have to rely upon some centrifugal force produced, no doubt, by rotary movement.

With a terrifying hiss the motors of No. 4 step get under way, and with the aid of the auxiliary impact, we whirl off to the moon. Our ascent is gradual. We know that parachute jumpers have demonstrated *(Turn to page 88)*

# What's Your Question?

## By CLYDE PANGBORN
### *Wing Commander*

**As soon as possible after the questions are received, the Wing Commander of the Air Adventurers will answer on this page such questions as appear to be of general interest to our members.**

*Question: What qualifications are needed to become an air-line hostess? P. S., Minot, S. D.*

Answer: This profession has become pretty well standardized, so I believe the following TWA requirements can be taken as typical:

The applicant must be a graduate registered nurse. She must have "intelligence, tact, and charm." Her weight must be between 100 and 118 pounds, height 5 feet to 5 feet 4 inches, and age 20 to 26. She must be in good physical health, which is checked by examinations four times yearly.

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*Question: Why does a test pilot open his mouth wide during a power dive, as I have heard they do? W. J., Sharon, Pa.*

Answer: A power dive, usually made from 10,000 feet or so, carries the pilot through different atmospheric densities in a very short period of time. The increase in atmospheric pressure as he descends comes faster than his eardrums can adjust themselves. One's ears get a sort of clogged feeling, just as they sometimes do when you ride down in an elevator in a tall building, or when you go through a tunnel in a railroad train. This is the result of increased air pressure slightly pushing the eardrum inward. The act of swallowing will often relieve this feeling by forcing a little air through the fine tubes, called the Eustachian tubes, that run from the back of the mouth to each inner ear, thus restoring the balance of air pressure outside and inside of the eardrum. Because the outer pressure increases so greatly and rapidly in a power dive, pilots not only keep their mouths open, but usually they yell to build up air pressure inside the ear. If they didn't do something of the sort, permanent injury to the ear might result.

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*Question: Can one buy any kind of a new plane for less than $500? C. M., Indianapolis, Ind.*

Answer: I don't know of any regular make of airplane that can be bought, new, complete and ready to fly, for the sum you mention. There are light-plane kits of materials for home assembly, such as those put out by the Heath Company of Niles, Mich., or kits for the Flying Flea, which are not yet available in this country, for $500 or less, but they don't include motor and propeller. It's also possible to find private builders who will build you a plane for a comparatively small sum, but again probably without motor and prop. At the present stage of airplane production in this country, it's wise to be wary of cheap light planes unless they can meet Federal government license specifications.

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*Question: What is the seaplane speed record? N. D., Purple Springs, Alberta.*

Answer: The record speed for seaplanes is also the world record for all types of airplanes—and incidentally the fastest speed ever made by any vehicle—for the world record holder is the Macchi-Castoldi 72, an Italian twin-float monoplane powered by a 2,800 h.p. Fiat 24-cylinder engine, which was piloted by Lieut. Francesco Agello over a 3-kilometer course (about 1 4/5 miles) on Lake Garda, Italy, Oct. 23, 1934, at an average speed of 440.681 m.p.h. The United States seaplane record is 245.713 m.p.h., set by Jimmy Doolittle on Oct. 27, 1925, at Baltimore, Md., with a 600 h.p. Curtiss R3C-2 racer.

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*Question: What was the largest plane ever built? L. H., Los Angeles, Cal.*

Answer: Russia's *Maxim Gorky* was the largest plane ever to have been built. The *Maxim Gorky* was an eight-engined monoplane with span of 210 ft.; it could carry 60 to 70 passengers. Its top speed was 149 m.p.h., cruising speed 137, and range 1,240 miles. On May 18, 1935, during an air parade, a single-seater crashed into it while stunting, wrecking it with a large loss of life. Now Russia is building several more; the new ones will not be quite so large, however, having a span of 206 ft. 7 in. and only six engines, but they will probably be the biggest planes in existence.

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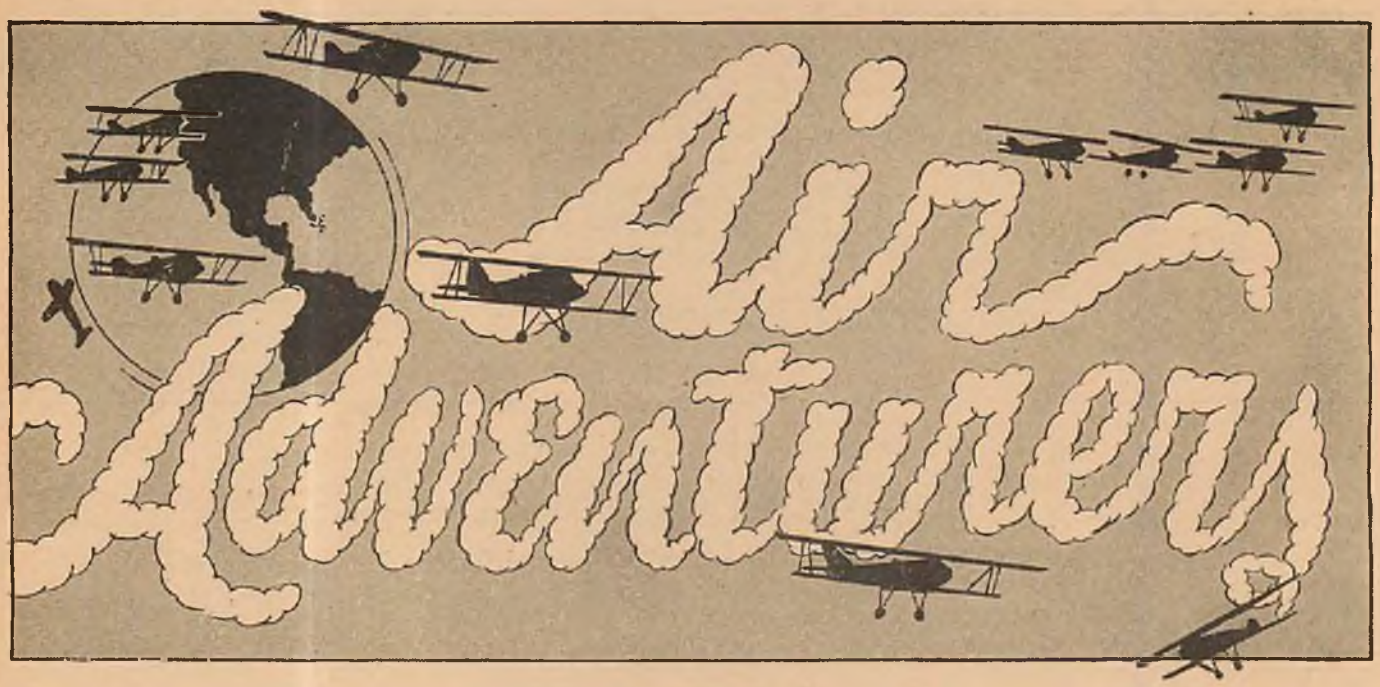
*Question: What make is the 1,000 h.p. single-row engine used in the new Grumman single-seater? Wouldn't this engine have a great advantage over the Twin Wasp and other twin-row engines owing to the fact that it would be lighter? W. H., Bakersfield, Cal.*

Answer: The plane and engine referred to are the Grumman XF3F-2 and Wright 9-cylinder Cyclone G. As to advantages, that depends on what advantages are considered to be. In weight, the single-row Cyclone at about 1,165 pounds has an advantage of about a hundred pounds or so less than the Twin Wasp; in size, the twin presents a smaller frontal area. Then take into consideration fuel consumption rates, ease of maintenance and repair, and many other factors, and you can see how hard it is to decide which engine is most advantageous.




# LANDSLIDE!

WHAT a landslide has followed the announcement of the new ratings in the Air Adventurers Club! I haven't had time to catch my breath yet, but it gives me a wonderful feeling just the same.

New memberships have been coming into the Air Adventurers at such a rate that I knew the time had come for the organization to step up into increased activity.

I know that all of you old members have received my letter with its copy of the Creed and the new rating classifications and have had plenty of time to read it over. I am looking forward to hearing from every last one of you in the next few weeks.

Believe me, when you have established your rating as a Flight Captain and have qualified for all five of the Merit Awards in addition, you will have a preliminary knowledge of aviation of which you can be proud.

In order to further advance this knowledge and to give you the necessary groundwork for any future you may want to select, the editor has started the series of articles by Wing Commander Clyde Pangborn and Lieutenant W. M. Wood on "Getting Into Aviation" in this issue. This series of articles will answer practically every question you may want to ask concerning opportunities connected with aviation, and there are plenty of opportunities in addition to the occupations which involve actual flying.

There's been so much excitement in the office over the sudden vitality shown by the thousands of Air Adventurers that I have hardly had time to think about the other things I wanted to announce.

What I am asking from you will give me a terrific amount of work, but I don't care as long as it is for the good of the club. We've got a wonderful club and one of these days we'll start listing the new Lieutenants and Captains and you'll be mighty proud to see your name among them. Meantime, when Air Adventurers get together there must be news. And I want you to send me that news and any photographs which seem interesting concerning the activities of any of our members.

And now a word to those who have not already applied for membership in the Air Adventurers.

If you are interested in helping the advancement of aviation through your own individual efforts; if you're interested in becoming affiliated with an association which serves to band young Americans together for the purpose of advancing aviation, you should fill out and mail the coupon on the opposite page, inclosing ten cents to cover club costs.

I don't want you to send in the application, however, unless you have thought the matter over very carefully and feel that you can honestly support the ideals of our club, as expressed through the seven points of the Air Adventurers' Creed. We ask you to pledge yourself to build your own: (1) Self-reliance, (2) Courage, (3) Initiative, (4) Loyalty, (5) Integrity, (6) Independence, (7) Obedience.

Adherence to this Creed is the foundation stone on which the organization has been built.

The Air Adventurers Club is affiliated with AIR TRAILS Magazine, which serves as its official organ. The magazine, through your Flight Commander, wants to serve the best interests of the organization, in reflecting its activities and the activities and interests of the members.

Flying is a comparatively new occupation. When I was a boy, we used to go to the county fair and sit in the grand stand to see an airplane fly for perhaps two miles in very sedate circles. We would hold our breath every minute, fearful that the plane might crash, as too often these dare-devil exhibitors broke their necks while demonstrating their skill in the old-fashioned "box kites." We have seen airplanes become a powerful instrument for war and a giant commercial necessity in peace. Only ten years ago Colonel Lindbergh made the first nonstop, solo flight across the ocean, and the whole world thrilled and speculated as to what the future held for aviation.

It is only natural that we, as pioneers in our own way, should blaze the trail to the future because our membership represents the future of aviation in America, in Canada, and to a certain extent throughout the

entire English-speaking world. We are very proud of our membership, small though it is, in New Zealand, South Africa, Australia and England and we are extremely proud of the strong representation the Air Adventurers have in Canada.

This overseas fellowship of future aviators among English-speaking peoples represents a friendship and a bond of common interest which must and shall grow stronger with the passing years.

I don't want you to hesitate to fill out and mail the membership coupon any longer than it takes you to make up your mind that you favor the general purposes of the Air Adventurers. Do it now!

And don't forget, if you have any photographs of yourself or any other Air Adventurer, that you feel would be of interest to your fellow members, mail it in, together with a brief description of the activity it represents. This invitation includes our members wherever they may be. Happy landings!

Your Flight Commander,

Albert J. Carlson

# YEAR AFTER YEAR

FOR three years and more the Air Adventurers have kept pace with our magazine. Starting almost the day the magazine started, and growing in numbers at the rate of more than 100 members a week, every week, winter and summer. We have come to be a powerful organization numerically. The mail addressed to headquarters has increased in volume until it represents nearly a thousand letters a month. And many of these letters contain suggestions for changes and improvements in the operation of the club itself.

The institution of the ranks of Flight Lieutenant and Flight Captain has come as the result of many letters from the Air Adventurers, and Flight Commander Carlson has worked long hours and late to perfect a plan which would not be too hard for the individual member to work out and yet be one which would lay the groundwork for a future understanding of everything which bears on aviation.

Many of the suggestions which have been made cannot be carried out for mechanical reasons. Many of them we would like to carry out, but we know that every Air Adventurer will understand that we are doing all we can.

Our magazine has grown so fast and its influence has spread so far that from a humble beginning three years ago it has now a larger circulation than any other aviation magazine, anywhere. That thought should make us proud, because it means that the people who are interested in aviation approve the progress, and appreciate the hard work which has gone to make AIR TRAILS the leader.

We want this progress to continue and the best way to make it continue is to seek the assistance of the vast army of loyal readers who comprise the Air Adventurers Club.

They have followed Bill Barnes, story by story, in his adventures throughout the world. They have been with him to China, to Africa, to South America, to India, to Alaska, and to the islands of the Pacific. They have flown with him into the country of the Aztecs and watched him build plane after new plane, each of which has been matched by commercial planes within a year or so after Bill has launched his into the air.

These same members have watched while the model department grew from a single model presentation to a department which covers every type of model, including motorized models which are coming more and more to the front.

Model building is one of the best foundations that can be laid for future knowledge of aviation, because it gives one complete understanding of stresses, strains, winds, and flying conditions; and teaches the dangers while leaving the operator safe to watch, learn and correct.

By the same token, the articles which deal with airplane motors lay the groundwork of mechanical knowledge which is necessary to every successful aviator. He must know these things before he leaves the ground and if he can learn them through AIR TRAILS Magazine, he will be far in advance of those who have had no preliminary training when they undertake to prepare for a career. A complete knowledge of aviation history from the earliest Greek legends to the present day is being covered pictorially so that every one of you has the opportunity to know the background of flying.

The Flier's Dictionary has given you the opportunity to become familiar with all the technical terms of flight, of the flying field, and of the equipment and vehicles of flight.

All in all, the Air Adventurer who has conscientiously followed this magazine through these three years should be well equipped to converse with any group of men at any flying field. He should be familiar with every new plane that has come into being, past or present. And throughout the whole three years, he should have felt that he was being entertained, rather than being taught, because our first interest has been to entertain you.

Now we are asking that you help entertain each other by remembering to send in items of interest which will be published on this page.

And don't forget, if you are not yet a member, send in the membership coupon below—right away.

—*The Editor.*

(MEMBERSHIP COUPON)

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

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

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

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

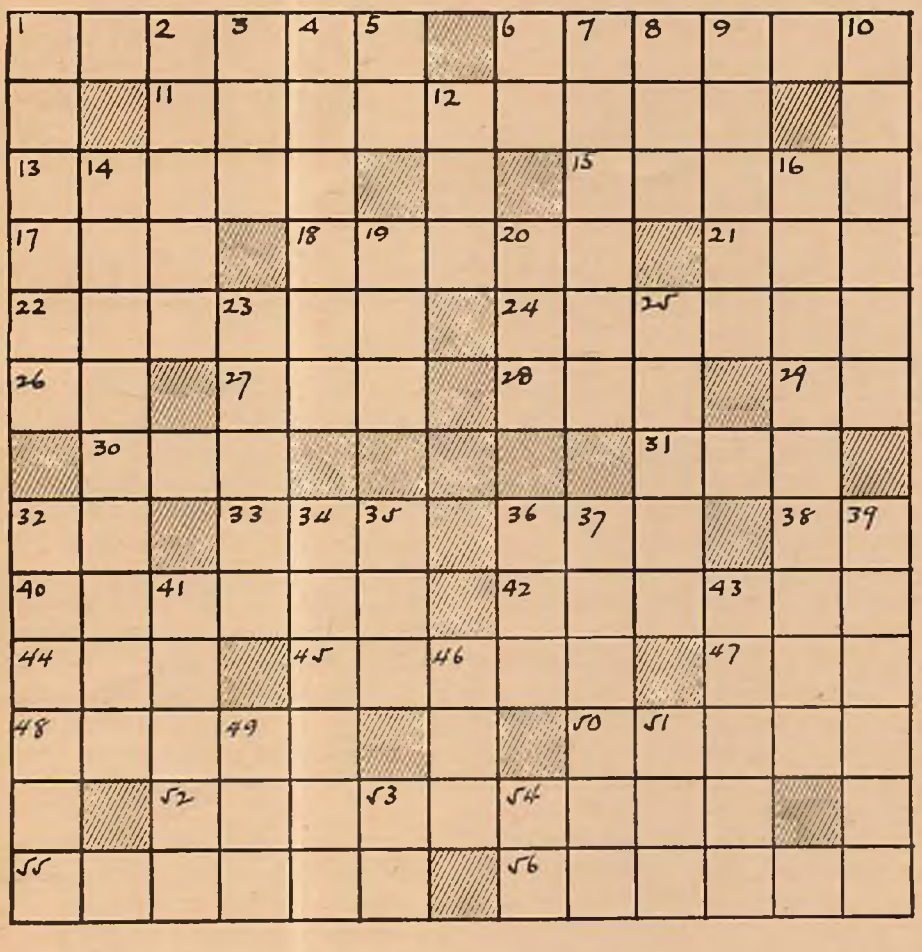
Address .....

.....

☐ Check here if interested in model building.

*(This coupon may not be used after April 15, 1937.)*

# CROSS WINDS



*Can you answer the aeronautical definitions in this puzzle?*

## Down

1—Type of glider that utilizes rising air currents
2—Consult for information
3—Second largest bird, related to ostrich
4—Vertical members in chair backs
5—Designation of British World War plane; best known as type 5
6—One
7—Bill Barnes' plane
8—Length of existence
9—Times of duration
10—Expel from practice of law
12—Balloon rigging that encloses the envelope
14—Causing anxiety
16—Popular American light plane made by Lambert
19—To catch
20—Frozen liquid
23—Declares as a fact
25—Serpentine
32—Name of large American aircraft company that includes Vought, Sikorsky, etc.
34—To this
35—Dignified poem
36—Fermented liquid
37—Tray
39—Meteorologically disturbed
41—Jewel stones of silica
43—Made of oats
46—Abbreviation of U. S. government division that controls non-military aviation
49—Juice of a plant
51—Metallic earth
53—And, in Latin and French
54—Belonging to

## Across

1—Force acting on airplane structures, usually determined mathematically
6—Having wings
11—Airplane tail
13—Appalling
15—Standards
17—Fish eggs
18—Grotesque
21—Disorderly crowd
22—Mistakes
24—Make of American plane, designated C-34
26—Abbreviation for air lines' biggest travel competitor
27—Navy designation of scout-bomber plane type
28—Sea eagle
29—Otherwise
30—Name of small racing plane made by Benny Howard
31—Abbreviation of government's O. K. on commercial planes
32—Ourselves
33—Name of Greek letter "r"
36—Request
38—Glacial ridge
40—Entrapped
42—A plan
44—Mischievous child
45—Revolt
47—Prefix meaning "away from"
48—Tantalize
50—One who elects by ballot
52—Maker of "Lieut. Vaisseau Paris," largest seaplane
55—Tyrant
56—Mental agitation

# The MODEL WORK-SHOP

*Conducted by* *Gordon S. Light*

## Beginnings

HOW did you first become interested in model building? This question never fails to draw out an interesting story. Sometimes it's difficult to remember what it was that touched off your modeling career. But everybody has his story and delights in telling how he became a model addict.

Digesting the stories we've heard, we think Christmas gift models have probably started many people down the balsa-and-tissue trail—from which there is no turning back. Usually the gift model is not expected and by Christmas evening it is in bad shape after a hectic day in enthusiastic but unskilled hands. The model was probably given to little Junior, but father and uncle are just as enthusiastic about it. And the seed of modeling has taken root, to grow into a healthy modeling interest.

When I first started modeling, gift models were notable for their ability to defy all attempts to get them into the air. They were immune to efforts that would send one of our present models off on a nice flight. Any one with sufficient interest and patience to suffer along with his balky model was certain never to leave modeling, even though successful flights were long in coming. Gift models of the present time are more reliable. Their successful flights attract many newcomers to the hobby.

Watching some one fly a model is another lure that few boys are able to resist. A skilled modeler flies his ships with such ease that the novice gets the impression that winding the rubber and then launching the plane is the only side of modeling. This first impression, along with some friendly advice, will usually carry him through the discouraging stage that accompanies the attempt to build and fly his first model.

But the real pioneer in model building is he who starts from "scratch." He digs the information out of magazines. The first model flight he sees is that turned in by his own model. He must assemble his own tools and material. All enthusiasm to build a model must spring from his own initiative.

It is these pioneers who really spread the interest in model building. Their work attracts others in the community and before long an active little group is busy building and flying models. Practically all the present-day model clubs and contest winners are inspired by these builders. These "godfathers" of modeling build and fly models for the love of it. Any advancement in design is cheerfully passed on to younger builders.

Practically every champion can think of some old-timer who has coached him in building and flying. An old-timer probably gets more thrill from seeing a youngster he has helped win a contest than to win the same contest himself.

Aviation itself is an impetus toward modeling which we must not neglect in this discussion. Airplanes attract practically every one, and it's natural to reproduce airplanes in miniature. It's safe to say that model boats have been built ever since man has thought about traveling on the water. Model airplanes enjoy the same position. If all model clubs, magazines, and books were to disappear, and it was forbidden to show a model in public, there would still be thousands of new modelers every year. They would spring up spontaneously, inspired by the desire to create in miniature the beauty of the airplane and enjoy the thrills of flying through the flights of models.

If watching an airplane fly overhead gives you a pleasant feeling inside, then you're a model builder.

### The Contest Calendar

FLYING SCALE MODEL Contest for beginners, all flights by proxy: Louisville, Ky., tentative date, Feb. 26. Models to be judged 50% for flying ability, 50% for resemblance. Prizes of cash, kits, model materials. Rules, entry blanks: Fred Harwood, 1814 W. Burnett Ave., Louisville, Ky.

EXHIBITION SCALE MODEL Contest, Syracuse, N. Y., Feb. 27, by the Syracuse Model Airplane Club. Contest to be held strictly in accordance with N. A. A. rules. Information: Charles Birdseye, 101 Lincoln Ave., Syracuse, N. Y.

The Model Workshop asks the aid of readers and clubs in developing for their benefit a complete, detailed report of all model contests and exhibitions, large or small, everywhere. Listings should be received by The Contest Calendar, AIR TRAILS, 79 7th Ave., New York City, at least two months in advance; news of winners and results as soon as possible.

by Alan D. Booton
and Ralph Pickard

# Fastest War Plane

*That's the reputation of Britain's new job, presented in a fine flying model with optional controls.*

IT is rumored that Britain's Supermarine Spitfire I is the speediest single-seat fighter in the world, but since all performance records are held secret, no certain comparison can be made. It is known, however, that the plane is very maneuverable at high speeds and has proved itself so well that an appreciable number have been ordered. It is a product of the Supermarine Aviation Works, a division of Vickers, and it is powered with a Rolls-Royce Merlin engine. Photos of the plane appeared in this magazine for September and October, 1936.

Prior to this issue, AIR TRAILS has presented several all-balsa flying-scale models that were miniatures of all-metal or plywood planes. We'd like to sum up the advantages of this type. It is next to impossible to duplicate the appearance of rounded metal parts with tissue covering, and to overcome this difficulty, suitable model structures were covered with a special $^1/_{64}$" sheet balsa now available. The finished all-balsa models were lighter (even with automatic controls), better balanced, and were more easily repaired than the ordinary multi-stringer tissue-covered types. Considering the many stringers around the moment arm, the number of coats of dope to finish the tissue, and the heavy tail-surface members that have to be balanced with weight in the nose of the scale-appearing tissue-covered models, it is no wonder that they are slightly heavier.

**SUPERMARINE SPITFIRE I**

The Spitfire model presented this month is one of our typical all-balsa jobs, including optional controls. Read the instructions and study the drawings carefully for the all-balsa construction procedure, and start by making a 4x6" plywood sheet of two layers of $^1/_{32}$" balsa for the formers to be cut from.

A bottom view showing the automatic landing gear extended and retracted.

### FUSELAGE

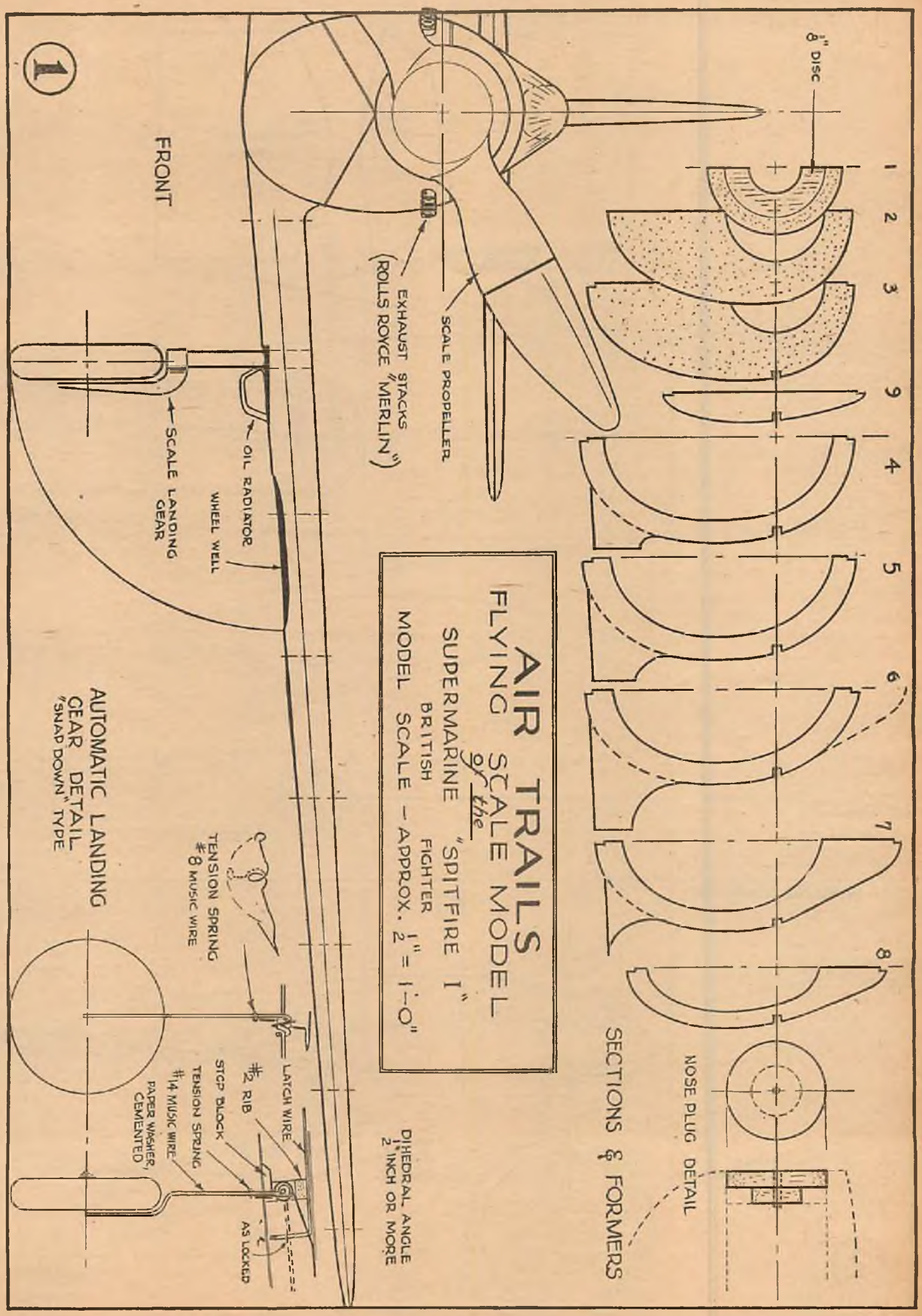
Carve the cowl block, using the top and side views and then the section templates. If you favor building the first half of the fuselage frame on the side-view drawing, split and hollow the cowl block, and then proceed in the usual manner. If you prefer the method by which the two side longerons are cemented to the cowl block and the formers then arranged on them, do not split the cowl block; just hollow it according to the drawings. Be sure the fuselage lines up if the latter method is used. Make the rear-hook device, sew and cement it to former #9. Attach wing panels before continuing.

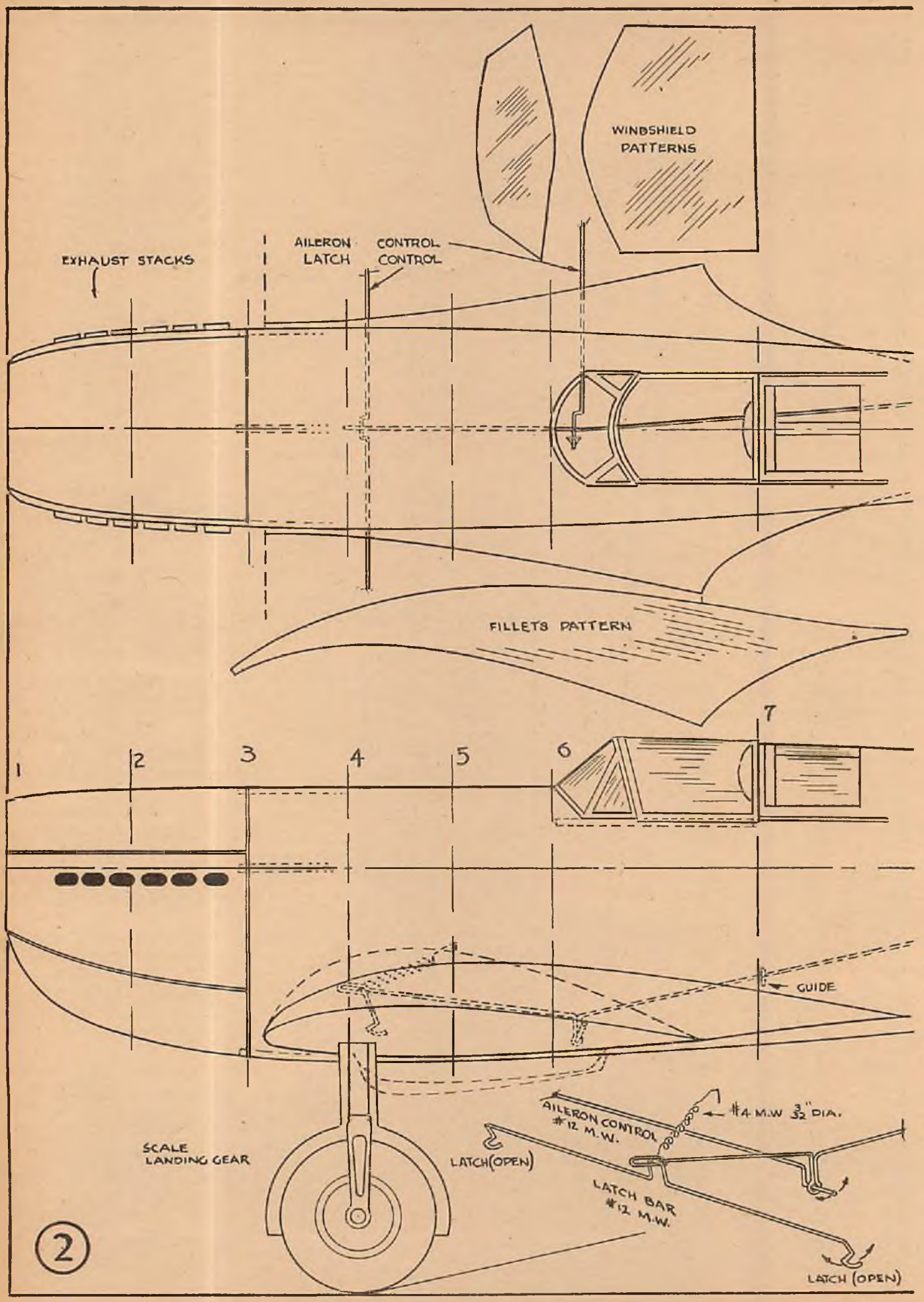
### WING AND TAIL

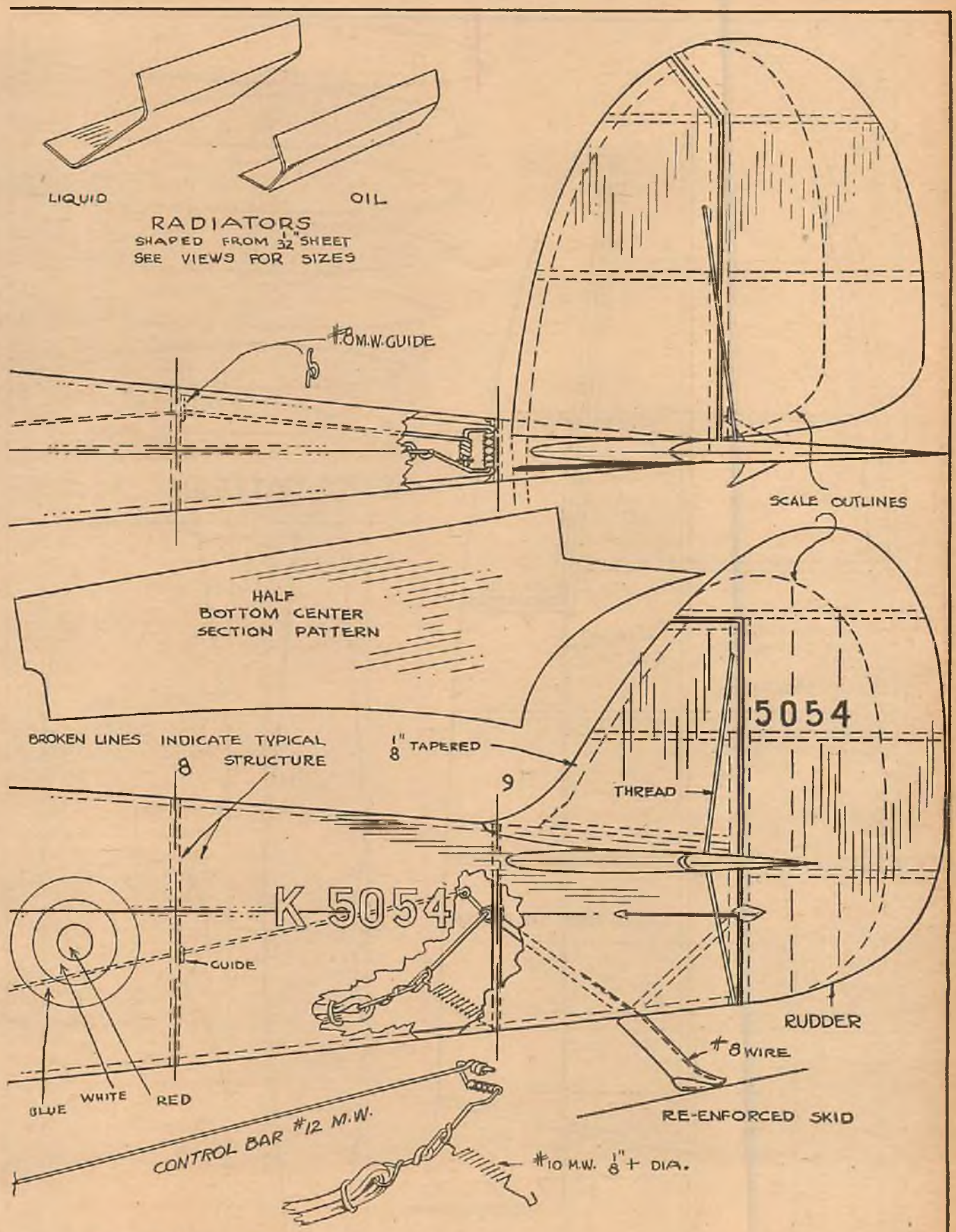
Wing-panel and tail-surface frames are covered with single layers of balsa sheet, instead of the usual plywood, because of abundant frame members. The sheet cover can be replaced by tissue, by the addition of trailing edges, but the balance and appearance will be lost. Cut four $^1/_{64}$" sheet wing-panel patterns according to the broken oversize line. The grain should run from ribs 1 to the tips. Cut the ribs from $^1/_{16}$" sheet and save the remnants from the bottoms to hold the bottom covers up to the respective ribs as the frames are assembled on them. Except for the aileron on the right wing only, the wing frames are interlocking and need no sketching of reference lines on the lower covers; just use the trailing edges as a limit. Cut a pair of stub spars as indicated on drawing #4, when cutting the main spars.

Assemble all frame parts on the bottom covers and pin them securely to the board; block the bottom covers up against the ribs with the rib remnants; pin the covers to the board and then remove the frame parts, leaving the cover patterns as they are.

One frame at a time, cement the ribs to the spar, flow a coat of cement along the bottoms of the ribs and spars, and replace on the bottom cover with plenty of pins. *(Turn to page 95)*


AIR TRAILS
FLYING SCALE MODEL
SUPERMARINE "SPITFIRE I"
BRITISH FIGHTER
MODEL SCALE - APPROX. 1/2" = 1'-0"
1
FRONT
3/8" DISC
1 2 3 9 4 5 6 7 8
SCALE PROPELLER
EXHAUST STACKS (ROLLS ROYCE "MERLIN")
OIL RADIATOR
WHEEL WELL
SCALE LANDING GEAR
NOSE PLUG DETAIL
SECTIONS & FORMERS
DIHEDRAL ANGLE 1 1/2 INCH OR MORE
AUTOMATIC LANDING GEAR DETAIL "SNAP DOWN" TYPE
TENSION SPRING #8 MUSIC WIRE
LATCH WIRE
#2 RIB
STOP BLOCK
TENSION SPRING #14 MUSIC WIRE
PAPER WASHER, CEMENTED
AS LOCKED

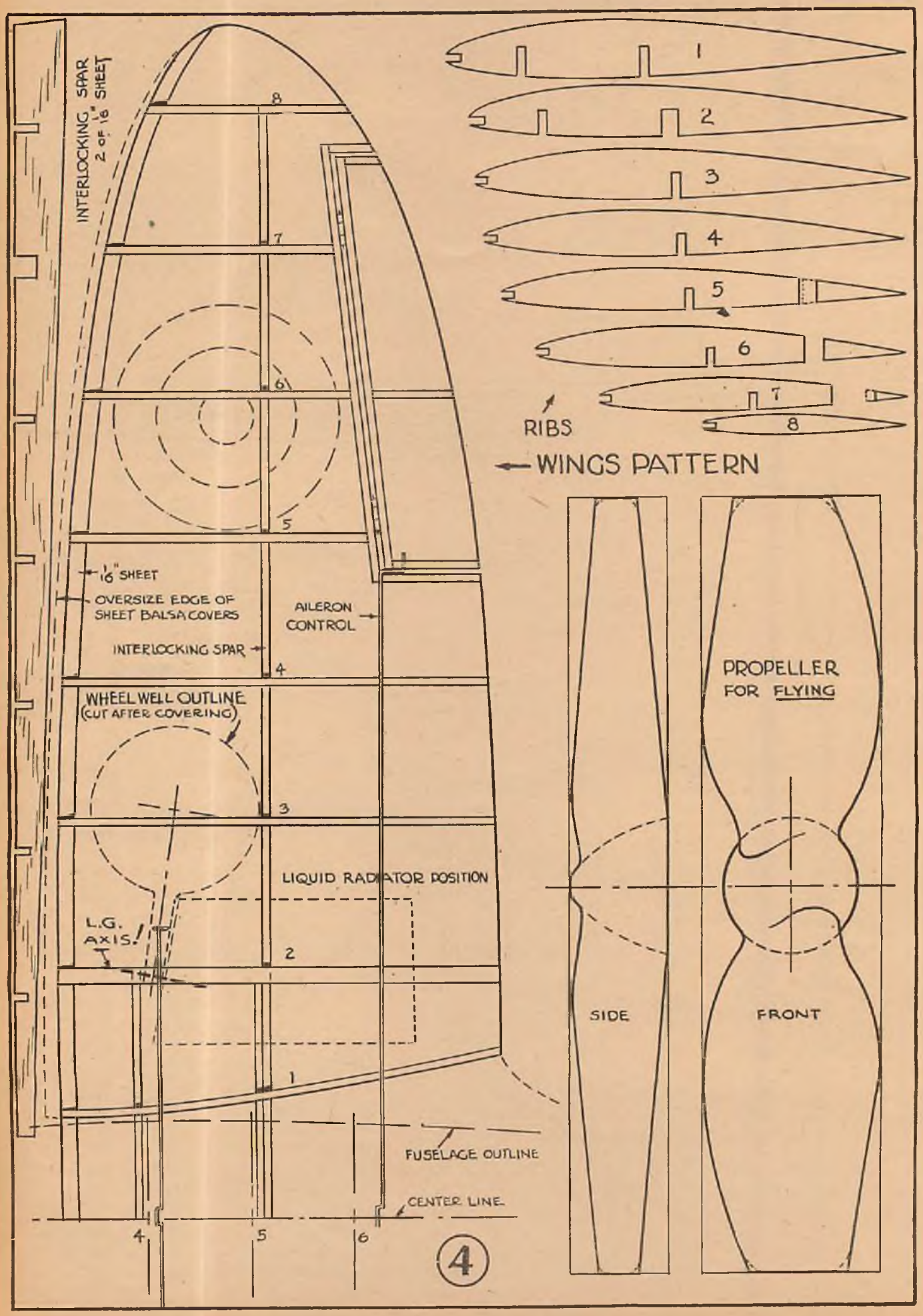

WINDSHIELD PATTERNS
EXHAUST STACKS
AILERON LATCH
CONTROL CONTROL
FILLETS PATTERN
1
2
3
4
5
6
7
GUIDE
SCALE LANDING GEAR
LATCH (OPEN)
AILERON CONTROL #12 M.W.
#4 M.W 3/32" DIA.
LATCH BAR #12 M.W.
LATCH (OPEN)
2




CONTROL DETAIL

3

PICKARD - SCALE, BOOTON - DESIGN.


INTERLOCKING SPAR 2 OF 1/16" SHEET
8
7
6
5
4
3
2
1
1/16" SHEET
OVERSIZE EDGE OF SHEET BALSA COVERS
AILERON CONTROL
INTERLOCKING SPAR
WHEEL WELL OUTLINE (CUT AFTER COVERING)
LIQUID RADIATOR POSITION
L.G. AXIS
FUSELAGE OUTLINE
CENTER LINE
4
5
6
RIBS
WINGS PATTERN
PROPELLER FOR FLYING
SIDE
FRONT
4

# The Discussion CORNER

*The model art progresses through exchange of ideas. The Discussion Corner is a monthly sounding board for your opinions. This month readers discuss* streamlining. *For April the subject is* color visibility. *Other topics are listed below. Think about them, then write your opinion in 150 words or less and send it to The Discussion Corner. One dollar is paid for each answer printed.*

MODELS should be streamlined to the highest degree possible, but they should be simple in line and construction. Surfaces must be smooth and flowing, with razorlike trailing edges to keep skin friction and turbulence at a minimum. Increased weight rules allow more weight for efficiently shaped wings of high aspect ratio and true airfoil, elliptical or rounded fuselages, and highly polished surfaces, yet still permit high rubber-weight to structural-weight ratio. Such refinements as adjustable-pitch propellers and retractable landing gears are up to the individual.

Cleaning up every detail is of utmost importance, especially for long flights. Indoor glider flights of 58 seconds have been made possible because gliders have been improved in minute details (finish, fillets, shapes, airfoils, etc.). Every improvement, no matter how small, brings a corresponding improvement in flight.——EDWARD LIDGARD, Chicago, Ill.

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In a flying model streamlining is of secondary importance. Flying qualities should never be sacrificed for streamlining, because it is effective only at high speed not attained by rubber-powered planes. This does not mean that a model should not be streamlined, for streamlining greatly improves appearance. However, proven construction standards should not be broken simply for better appearance. Streamlining of small details is best left alone, for there will be less work and weight in the finished job.——GORDON SORUM, St. Paul, Minn.

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"Cleaning up" will improve performance. By reducing drag, a streamlined job requires less rubber than one of abrupt lines; this weight saving may be put into structural use. Fewer strands also allow more winds to be stored. Smooth lines on the fuselage and its appendages, use of "feathering" or retractable props and landing gear, and improvement of all cross-sectional areas will increase the angle of climb, flatten the glide, heighten speed and all-around performance.

Theoretically streamlining has little effect on our models due to low speed, but with flights recorded in fractions of a second, very little difference in flight will often decide. Streamline wherever possible, because each little improvement may offer a little advantage and when summed up, the difference may be considerable.——JOE HERVAT, Detroit, Mich.

A model should be streamlined to some extent, such as nicely sanded leading and trailing edges on the wing and tail assembly. I do not believe in ultra-streamlining a model, because most models do not go fast enough for it to do any good. There should not, however, be any flat surface (such as a flat nose block) that runs head-on into the air stream, as this will hinder a model more than anything else. Small details do not require careful streamlining, but corners should be rounded.——MAXWELL ANDERSON, North Warren, Pa.

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Streamlining should be confined mostly to covering and struts. The covering should be smooth, without wrinkles or bulges, and leading and trailing edges on all surfaces should have a streamline shape. If the wing covering is wrinkled, a lot of lift is lost, unnecessary drag is produced, and the plane will stall at lower angles of attack. With streamlined struts and good covering, the plane will not only look better, but will make longer flights.——ROBERT KRAMER, Philadelphia, Pa.

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For contest flying, streamlining should only be carried out when no extra time or material is involved. The present-day paper-covered ship with square fuselage section is unsurpassed for performance and ease of construction. All-balsa-covered models are always beaten by the simpler types. I have seen a national meet won by two ships with square wing and tail tips, and wrinkles in the paper covering.

The super-streamlined model may be efficient aerodynamically, but practically it is usually disappointing. An "efficient" ship should enable the contestant to go home with the prize. Improved performance is due to other factors and very seldom to cleaner lines.——JOE BLOOM, Roxbury, Mass.

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### *This Month's Topic*

**To what extent should a model be streamlined? Is careful attention to "cleaning up" the smallest details justified by improved flights?**

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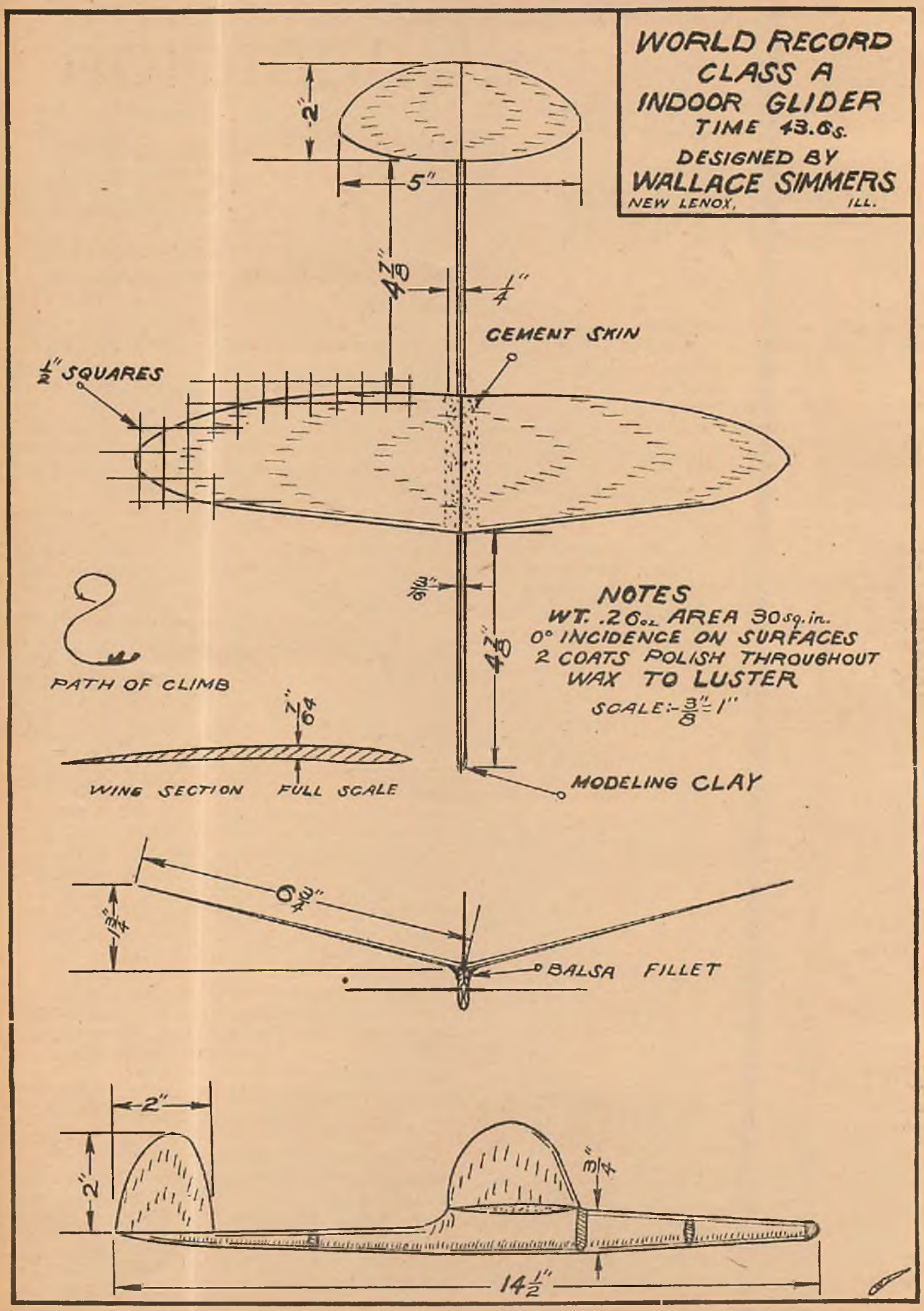
COMING UP are these topics:

For May—*Would adjustable-pitch propellers be of advantage in outdoor models? If so, how should the pitch vary?* Answers must reach us by March 1st.

For June—*What trouble do you experience with gas models? Is it in construction or motor operation? Has increased expense kept you from building gas models?* Answers must reach us by April 1st.


WORLD RECORD
CLASS A
INDOOR GLIDER
TIME 43.6s.
DESIGNED BY
WALLACE SIMMERS
NEW LENOX, ILL.
2"
5"
4 7/8"
1/4"
CEMENT SKIN
1/2" SQUARES
3/16"
4 7/8"
NOTES
WT. .26oz AREA 30sq.in.
0° INCIDENCE ON SURFACES
2 COATS POLISH THROUGHOUT
WAX TO LUSTER
SCALE:- 3/8" = 1"
PATH OF CLIMB
7/64"
WING SECTION FULL SCALE
MODELING CLAY
6 3/4"
3/16"
BALSA FILLET
2"
2"
3/4"
14 1/2"

# Champion Glider

*Now you can duplicate the model that set the official N. A. A. record for its size.*

by Wallace Simmers

*Class A and B indoor glider record holder.*

THE performance of indoor gliders has increased so much during the last year that it probably has been difficult for many builders to keep up with the record ships and their performance.

Careful duplication of the model described in this article will give you a high-performance glider. The original is the record holder. Its highest official time has been 43.6 seconds, but it has surpassed this record several times in unofficial flights, the longest being 46.1 seconds. One thing we recommend in glider construction is not to finish any part of the model with the words "That's good enough," but continue until you've reached the ultimate in good shape and smooth finish.

A record-breaking glider must be built from the best grade of wood. The best type for the wing is semi-quarter grain. This is named from a method of cutting balsa which gives the wood a speckled or flaky appearance. This wood is the strongest for its weight and does not have a tendency to warp. One sheet of 1/8x3x18" will be enough for the wing.

After you've selected the material, start by cutting the wing halves to shape, making sure they are identical. Next shape each half to the indicated wing section. This section should be carried through both halves of the wing.

Sand with the finest sandpaper obtainable—#10-0. The wing halves should be identical in shape, size, and weight. Several materials can be used for polishing the wings, banana oil, microfilm, or a balsa polish. Give each wing two coats of polish with intermediate sandings. The last coat may be finished by rubbing it with the back of the sandpaper.

The Champion.

After the wings are polished to perfection, give them a coat of wax, being careful to see that none gets where the cement is to be applied. The halves should be cemented together at the proper dihedral angle.

## TAIL SURFACES

The tail surfaces are made from the same type of wood as the wing. A piece of sheet balsa $2^1/_8 x^1/_{32} x 12''$ will be sufficient for the elevator and rudder. These are sanded to a streamline section. The method of finishing and polishing is the same as with the wing. Be careful that the tail pieces do not warp when they are polished.

## FUSELAGE

A piece of medium hard straight-grained balsa $^3/_{16}$x1x18" will be needed. The hard balsa is used as it must take many bumps and shocks. The fuselage is shaped to the sections shown on the plans. The wood should be sanded, finished, and polished just as carefully as the wing and the tail, several polish coats being used to minimize skin friction and strengthen the fuselage.

## ASSEMBLY

After all the parts are dry, they should be cemented together in their proper positions (see plan) taking care that they are lined up accurately. Be generous with the amount of cement, as the added weight will more than pay for itself with added strength.

The glider.

After the parts have been lined up and cemented, allow time to dry. Then add a balsa-wood fillet where the wing joins the fuselage. This fillet will add strength and reduce the danger of "throwing off the wing" when you give the model a hard launching.

## ADJUSTING AND LAUNCHING

"I had a real record breaker, but it dove in and smashed beyond repair." How many times have you heard this familiar phrase?

Because the "pay-off" comes on crates that make record flights and not on the ones that could have, we are going to try to give you some hints that will help you adjust and fly your ship with a minimum of crack-ups.

After the model is finished and you've rechecked the wing and elevator settings, balance the model on the tips of your two index fingers, supporting it at the wing tips. Any necessary change in balance can be made by adjusting the amount of clay on the nose of the fuselage. Modeling clay available at the 5-and-10-cent store is used.

The model is then ready for a trial glide, which is made from about 4 feet altitude. If the ship glides satisfactorily, it can be given a faster launching, keeping it banked the way it naturally turns. After several of these launchings, the best setting can be obtained. The model is then ready for its first hard launching. But try numerous easy launchings to acquaint yourself with the model before trying hard throws.

When you decide to try for some altitude, do not hesitate when you throw the model. Try for maximum height, as the model has an excellent chance of recovering before it could dive into the ground, giving you a chance to make adjustments. A "halfway" to a medium height will hardly give the model chance to recover, and the crash into the hard floor of an armory or auditorium will result in serious damage. Then, *(Turn to page 96)*

# Contact!

*The distinguished AIR TRAILS gas model takes on wing, flaps, tail and prop in this second and final article.*

LAST month we finished the rather lengthy job of building the Sky King's fuselage. This month our work is easier. The first test hop is not far off, and unconsciously you'll speed up construction to bring the great day nearer. But let's finish our work carefully before we begin daydreaming about the flights ahead.

The Sky King, complete and ready to fly; at right, making the take-off run.

The technic of building the wing is practically the same as for rubber-powered models. Balsa is used throughout, except for a few pieces of pine in the center section. The first step is to cut a full-size wing rib template. Our airfoil section is the C-72. A metal template can be easily made by cementing the rib shape on to the metal and cutting it out with tin shears. Cardboard may be substituted for the metal. If you're using cardboard, however, it is advisable not to cut out the notches for the spars, since it will weaken the template. Merely indicate spar positions on the balsa with a series of holes punched through the template.

Twenty-four ribs are cut from $^3/_{32}$" balsa. Join the ribs together by a short piece of balsa which fits through the spar notches and sand all the ribs to the exact shape.

Start assembly of each half of the wing by cementing the ribs to the spars at the space intervals noted in the drawing. Make certain the notches for the spars are sufficiently deep to fit the bottom of the spar flush with the bottom of the rib. The leading edge is a balsa piece ⅜x¾" cut to a rounded shape. It is cemented to the front of each rib. Keep the wing frame flat on the workbench during the entire assembly operation and check frequently to avoid twist or warp. The trailing edge is a balsa piece ⅜x1¼" cut to a triangular shape. A small plane or sharp knife and sandpaper are the tools for this job. It is butt-jointed to the rear ends of the ribs, liberal coatings of cement supplying ample strength.

## The SKY KING

The curved wing tips are built up from sections of ⅜x1¼" balsa, joined together with the grain running lengthwise. The tip should be built up in rough form and cemented to the ends of the ribs. Now cut it to exact shape. The rear section is cut away to a sharp edge and the front edge is rounded.

The tip ribs themselves are originally full-size ribs cut down to the proper length. The depths of these ribs are reduced as well as the lengths. With rough sandpaper, lessen each tip rib until the ribs taper smoothly from the last full-size rib to the wing tip.

The root portion of each half of the wing is covered on top with $^3/_{32}$" sheet balsa. It extends to the second ribs, strengthening the wing and making a smooth joint when the wing is joined to the cabane section.

Dural attachment plates are fastened to the ends of the spars. These plates are shown full size and are shaped so the wing is set at 11 degrees dihedral. They fit into the cabane, where they are bolted.

### CABANE

The two spars running across the cabane carry the whole weight of the model. They are the same size as the wing spars, and should be made of straight-grained pine. The wing must be disassembled many times during the life of the model, and it is necessary to fit the holes in the spars with brass tubing of ⅛" inside diameter to prevent wearing. Four screw eyes, used for attaching the cabane to the fuselage, are screwed and cemented into the spars at the dots marked on the drawing. The three ribs used in the cabane are cut from ⅛" pine. The shape is identical to the other wing ribs, except that the leading edge is brought down to a point instead of being rounded.

The top of the cabane is covered with $^3/_{32}$" sheet balsa, with silk added. The wing halves are attached to the cabane by ⅛" bolts. The cabane itself is attached to the fuselage with four rubber bands, 3" long and made of 8 strands of ⅛" rubber. The ends of each band are fitted with S hooks bent from $^1/_{16}$" galvanized wire, which is easier to handle than piano wire. The S hooks fit into the screw eyes in the cabane and four additional screw eyes secured in the bottom of the fuselage directly below those in the cabane.

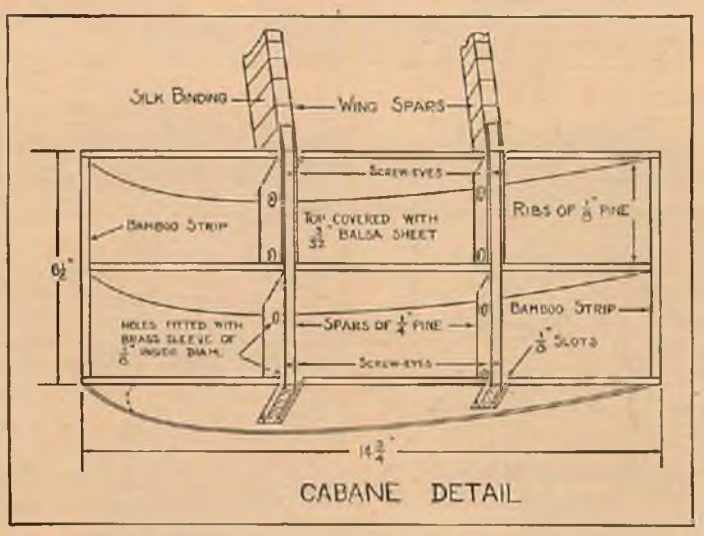
Two small balsa blocks are cemented to the fuselage longerons just back of the trailing edge of the cabane. The purpose of these balsa blocks is to prevent the wing from sliding backward during flight.

### ELEVATOR AND RUDDER

The M-6 airfoil was selected for the elevator because it seemed a happy compromise between a streamlined section and the Clark Y airfoil—two sections widely used in tail surfaces. Our choice was borne out by flight

tests. The model has a steep climb without the tail-low attitude that usually accompanies a streamline-tail section. Yet the recovery from stalls—encountered when the motor cut out in a climbing position—was quicker and more positive than that of an excessive lift tail.

The elevator and rudder are built separately and permanently joined after covering and doping. The tail unit is then attached to the fuselage with a demountable fitting, as illustrated, designed so the elevator setting will remain fixed even though it is necessary to detach the tail.



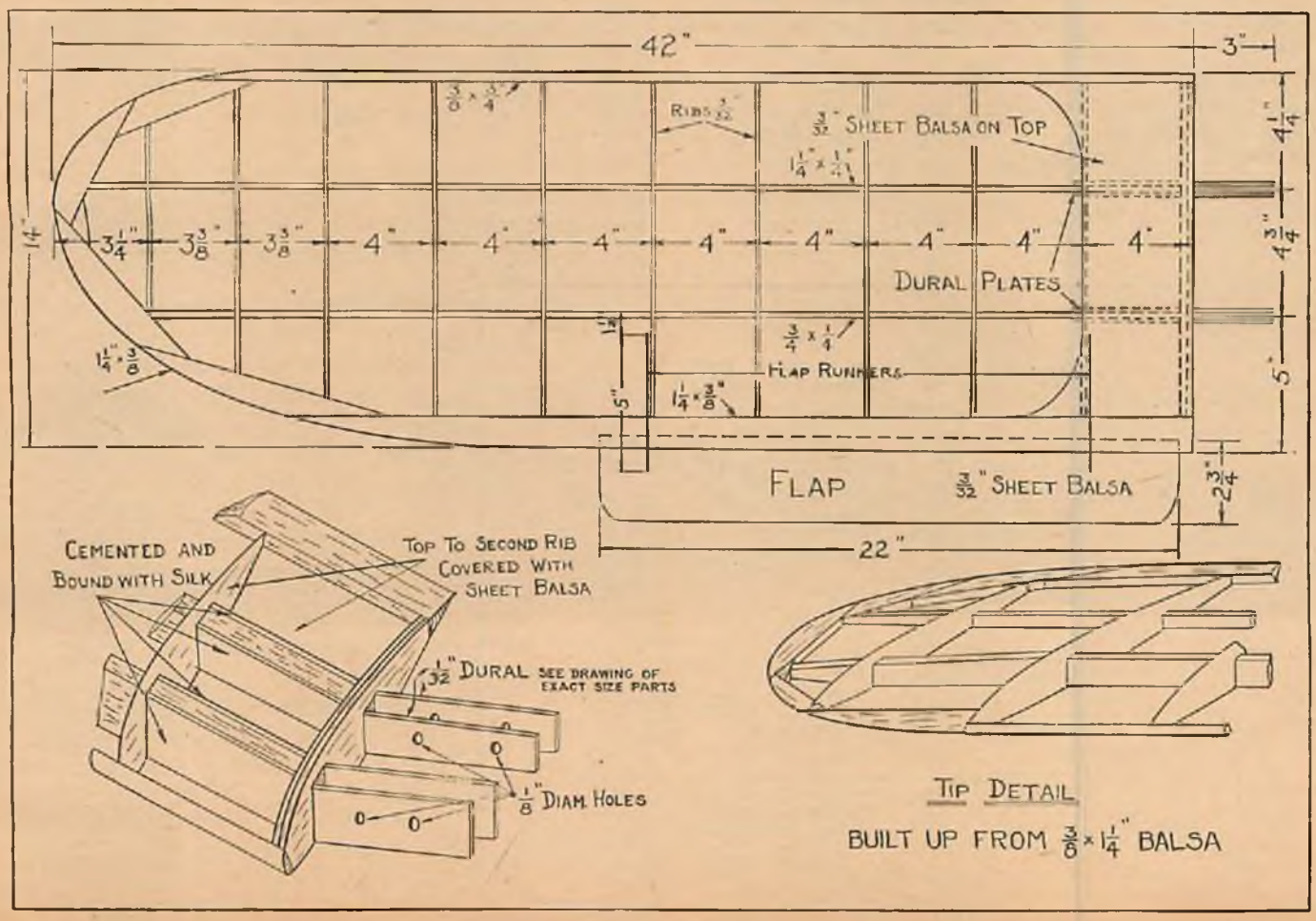

Balsa is used throughout the elevator and rudder. Two spars are used in both. The rib shapes and dimensions are given in the wing drawing. The trailing edge is balsa $^3/_{16}$x$^7/_8$". The curved portions are built up in the same manner as the wing tips.

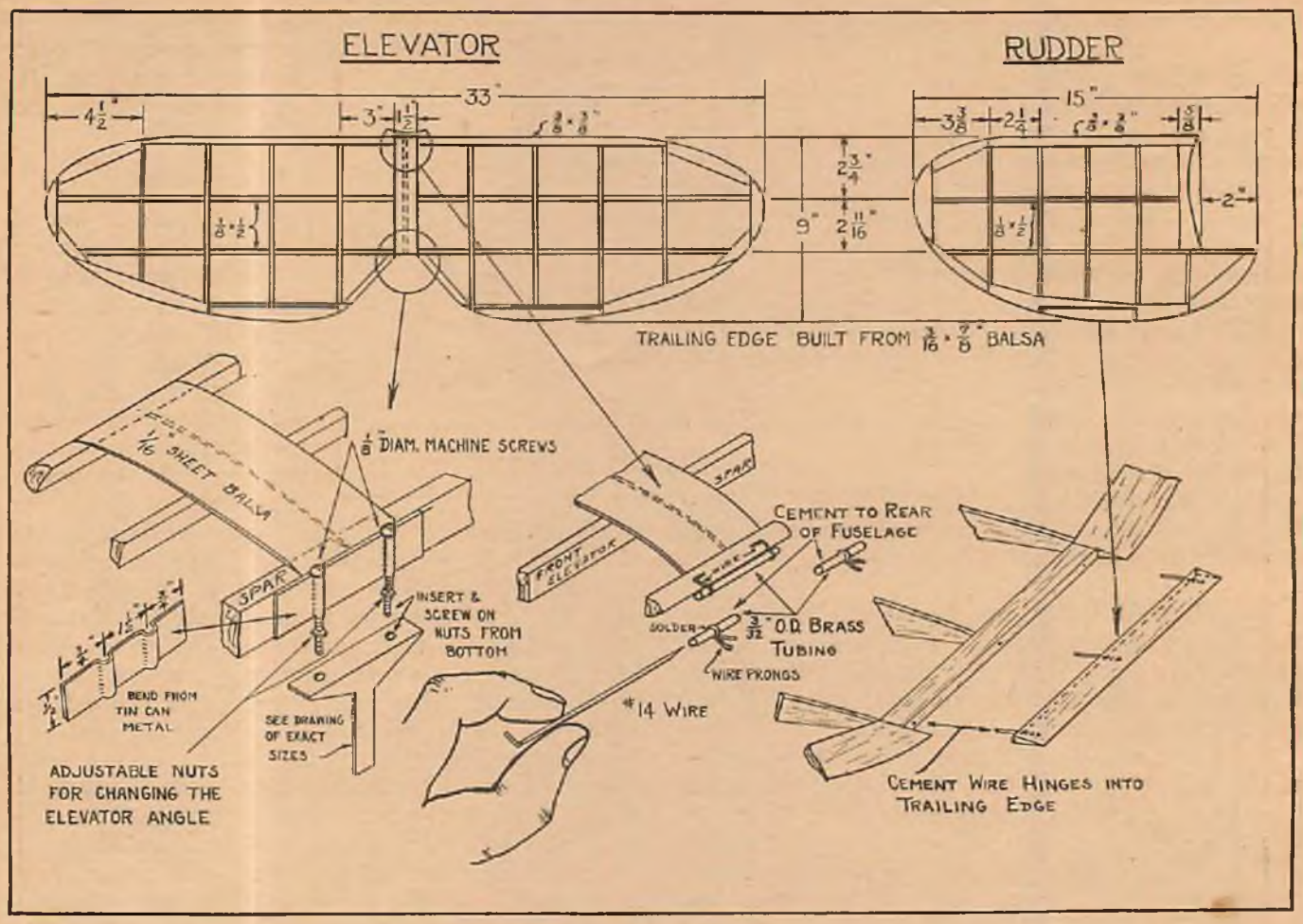
From the drawings you will notice where sections of the trailing edges of both the elevator and rudder have been cut away. These sections are made adjustable to provide an easy and accurate way of making delicate adjustments in the tail settings without disturbing the setting of the main part of the elevator and rudder. The "tabs"—as they are called—are hinged with three short lengths of soft copper wire which are inserted through the tab and the rear edge of the main tail surface.

## COVERING

You have a choice of two materials for covering—bamboo paper or silk. The extra strength of silk makes it attractive for a model of this size. In covering with silk, first pin it to the wing, smoothing out the wrinkles and making sure the weave runs straight along the length of the wing. Apply the banana oil from the top of the silk. It will penetrate and soak into the balsa. The extra silk should be trimmed off to the edge of the wing. It is not necessary to overlap the top and bottom coverings. The silk should be fastened to the sheet-balsa covering at the ends of the wing and at the center of the elevator. Use your finger tips to rub out the wrinkles. The rudder and elevator are covered and doped before joining.

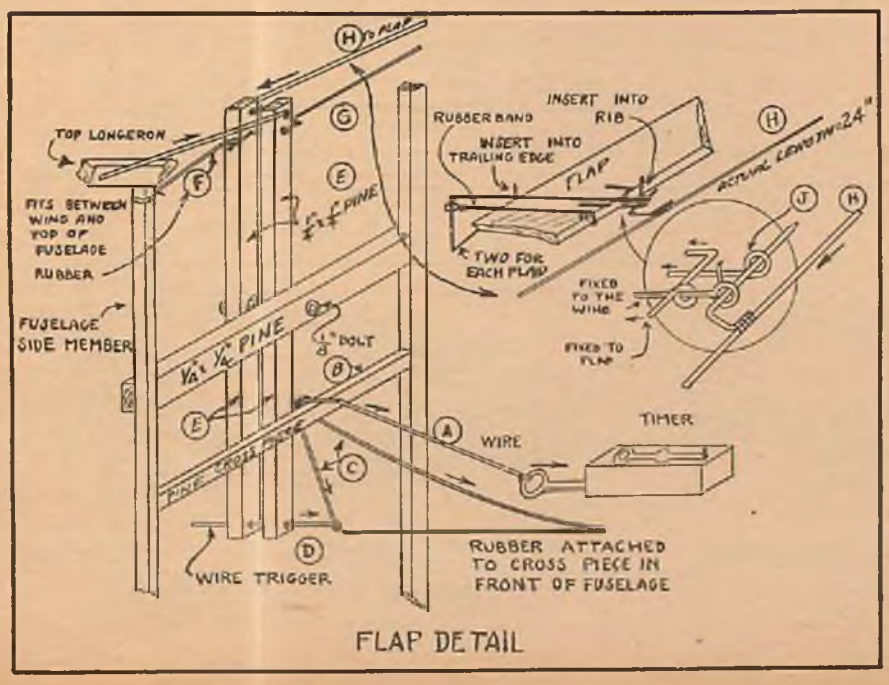
The silk should be treated with at least two coats of dope. While each coat of dope is drying, check frequently to prevent warping. Any "bagginess" in the silk remaining after two coats have been applied may be removed by coating the wrinkled portion with additional coats of dope. Ample drying time should be al-






lowed between coats. Wrinkles which fail to disappear immediately after doping will stretch tight after a few more hours of drying.

The color scheme is largely a matter of personal choice. We found red fuselage and rudder with yellow wings and elevator to be attractive. The only recommendation is that the fuselage be a dark color. The oil and gas spray blown back from the motor by the slip stream will blemish a light-colored fuselage.



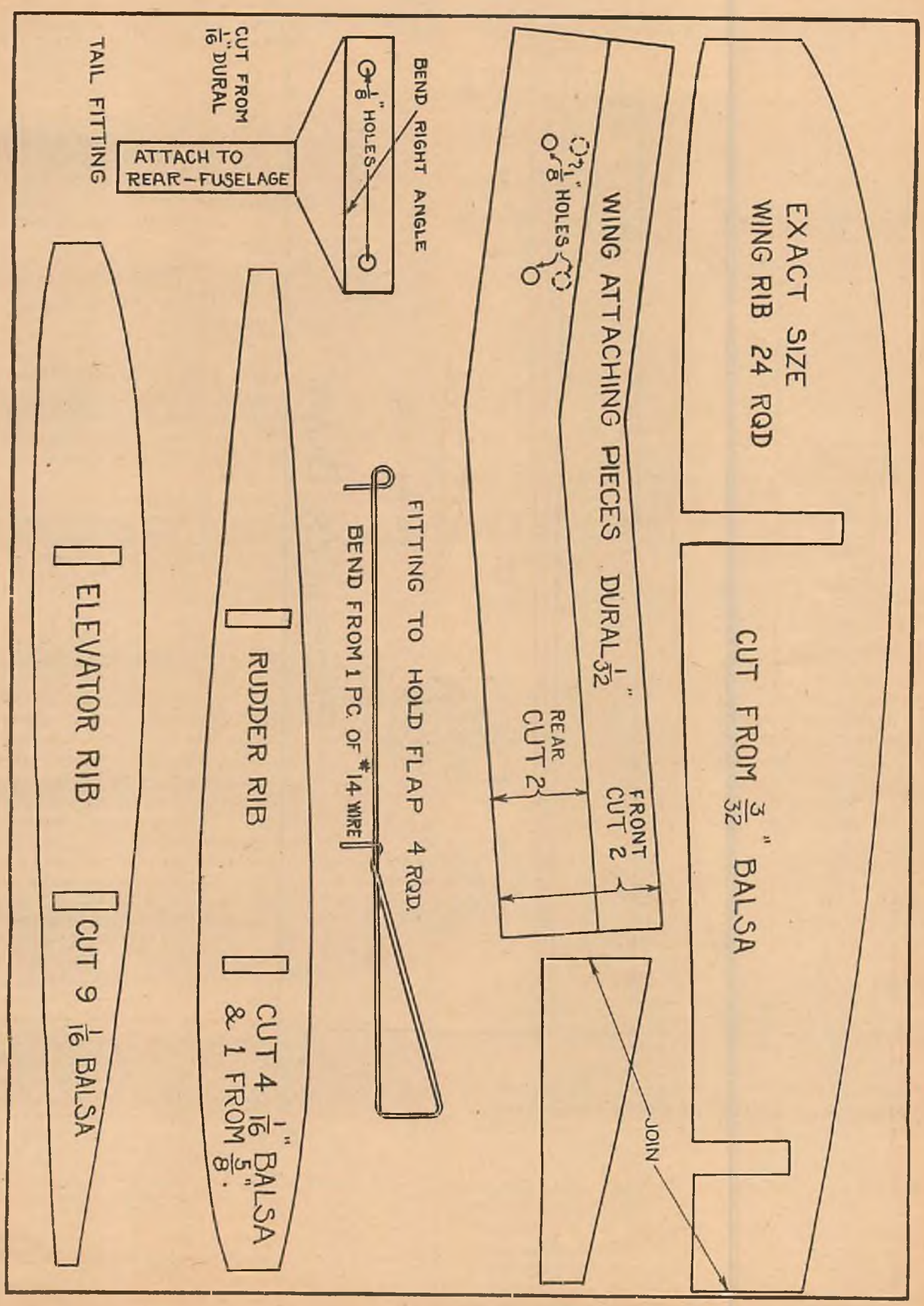

FLAP DETAIL

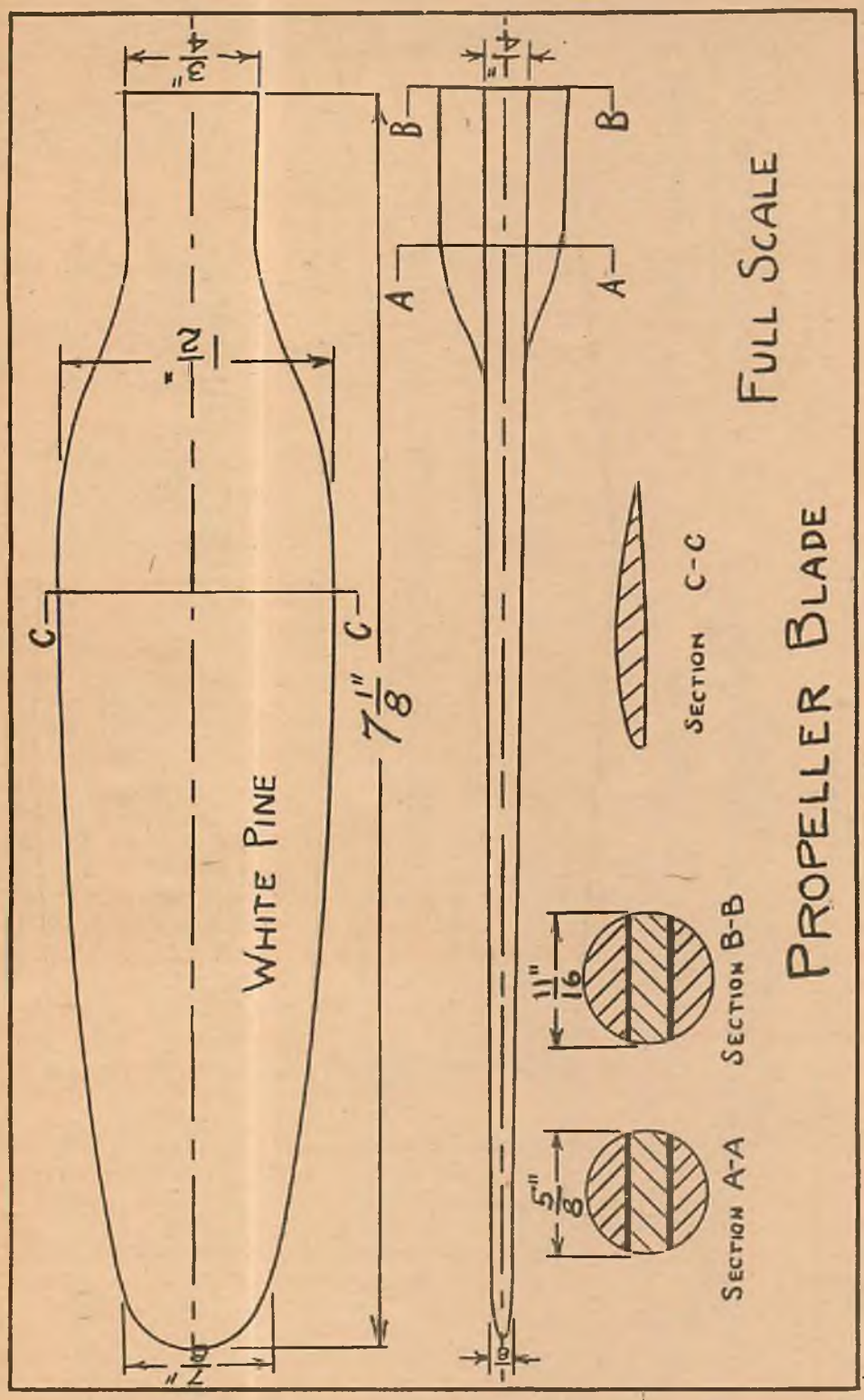
## FLAPS

The flaps resemble Fowler flaps, which are the most effective type. Fowler flaps not only deflect downward, but move backward from the trailing edge. While it is difficult to operate such a flap on a large ship, we had no trouble adapting them to the model.

The time for extending the flaps is regulated by the ignition-switch timer. Usually they were lowered a few seconds after the motor stopped. But other than as an interesting experiment, wing flaps seem to have little practical use in a model. The glide and sinking speed of the model without flaps is good enough to satisfy the most exacting modelers. The advantage of flaps is that they should permit a reduction in wing area. With "clipped" wings, the model should climb steeply, and with flaps this high altitude could be stretched into a long, flat glide. But it's worth while to build the flaps if only to have the thrill of watching them operate in the air.

The automatic timer actuates the flap mechanism. As the timer unwinds, it slowly pulls out a wire arm, A, which rests on a pine cross brace, B, inside the fuselage. As the wire arm moves forward the rubber band, C, is slowly forced off the end of the wire arm. When this band is released, it snaps forward to the front of the fuselage, where it is attached,


EXACT SIZE
WING RIB 24 RQD
CUT FROM 3/32" BALSA
WING ATTACHING PIECES DURAL 1/32"
1/8" HOLES
FRONT CUT 2
REAR CUT 2
JOIN
BEND RIGHT ANGLE
1/8" HOLES
CUT FROM 1/16" DURAL
ATTACH TO REAR-FUSELAGE
TAIL FITTING
FITTING TO HOLD FLAP 4 RQD.
BEND FROM 1 PC. OF #14 WIRE
RUDDER RIB
CUT 4 1/16" BALSA & 1 FROM 5/8".
ELEVATOR RIB
CUT 9 1/16 BALSA




at the same time pulling a wire trigger, D, out of the bottom of the two vertical arms, E. The top ends of these arms are joined to the sides of the fuselage with rubber bands. These bands, F and G, exert considerable tension, tending to pull the bolt-pivoted arms to the sides of the fuselage. Fastened to the top of the vertical arms are wire rods, H, which extend outward along the bottom of the wing. These rods fit through eyelets, J, in the front of the flap and the bottom of the wing, and hold the flap in the closed position. Rubber bands pull the flap into position when the rod is released.

Wire fittings for attaching the flaps to the wing are shown in the drawing of full-size parts. Bend the four fittings from #14 wire. They are attached to the bottom rear of the ribs indicated in the wing drawing.

The flaps can be regulated to snap back at any desired time by lengthening or shortening the wire arm, A. The angle of the flaps can be changed by bending the wire fittings which hold them.

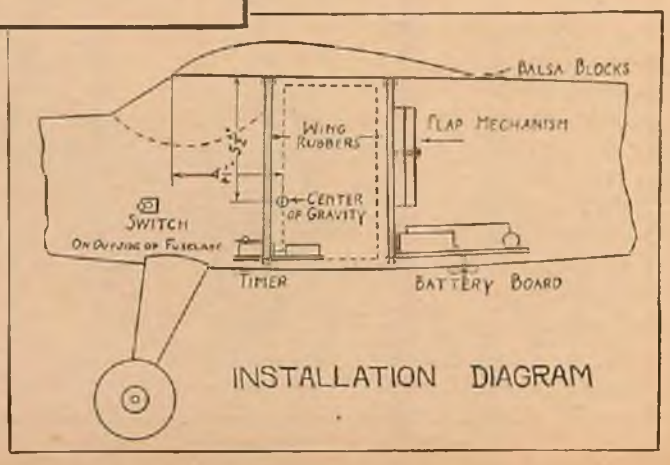
### PROPELLER

A full-size blade template is shown in the drawing. When fitted into the hub described last month, the diameter is 15". The blade is cut from a piece of white pine or bass ¼x1½x7⅛". Small pieces of wood are cemented to the blade end, which is cut to a rounded shape and fitted into the hub.

We experimented with a wide range of blade settings, from relatively flat angles of about 6 degrees to high-pitch settings of 13 degrees. The most efficient blade angle from the standpoint of motor efficiency was about 10 degrees. With this setting the motor turned up about 3,200 r.p.m.

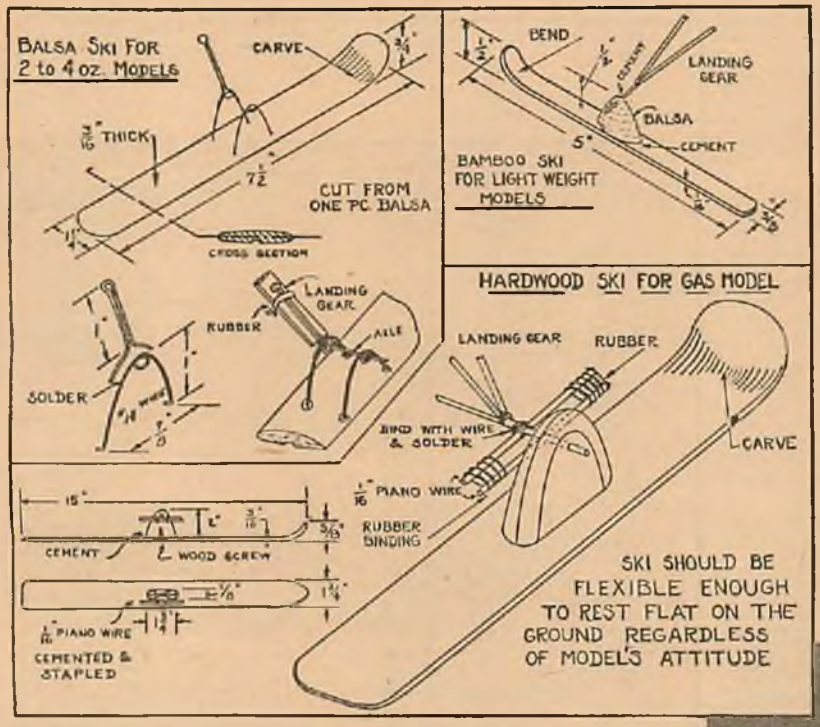
### BALANCING

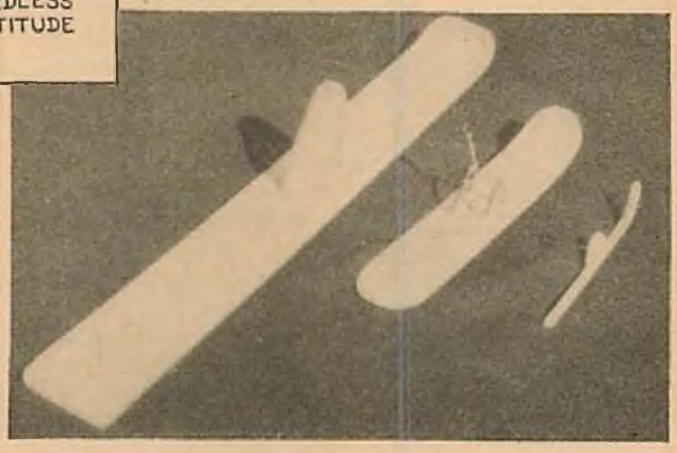
The incidence of the wing is built into the fuselage; that is, when the cabane section is flat on the top of the fuselage the wing has about 1.5 degrees. The elevator should be set at zero degrees incidence. This can be checked in the following way: Set the elevator at an excessive negative angle. Place a long, straight piece of wood alongside the fuselage, one end resting against the bottom surface of the elevator and (Turn to page 93)



# Winter Sport

*Put skis on your models, overshoes or skates on your own feet, and have flying fun on snow and ice!*



INTEREST in flying outdoor models usually wanes with the first signs of winter. Cold weather and snow usually force the modeler into a sort of hibernation, and it takes the warm breezes of spring to bring him outdoors again. But while the modeler is warming his feet at the kitchen stove, he's missing some of the best model-flying weather. During winter there are many days which are calm and warm. In the latter half of December this year we had fully a solid week of such weather. The sun was warm and bright, the smoke was leaving the chimneys vertically, and the thermometer was over 50 in the shade. This weather probably caught many modelers napping—that is, those who had retired indoors and had neglected to keep their outdoor models in repair.

Your model editor has always flown models outdoors the year around, and has found that winter flying offers some definite advantages over warm-weather flying. Lakes and ponds are usually frozen over in winter, and the ice makes an ideal field. Even if there is no lake or pond available, there will still be more room for model flying in winter than summer. All the meadows and lawns will be frozen. There'll be no corn or wheat fields to cramp your activities. And you'll find farmers and golf-course caretakers are more hospitable.

Flying models with skis is the thrill of winter flying that compares favorably with hydro flying—the high point in summer modeling. We've equipped all varieties of models with skis from the smallest stick model up to a 7½-foot gas model. In the accompanying drawing we've shown the three sizes necessary for all sizes of outdoor models. The important thing about skis is the way they're attached. The fitting should be flexible so they rest flat on the ground, regardless of the attitude of the model; that is, whether the plane is landing or taking off. For a small model, the skis can be rigidly attached, since the landing gear itself will be sufficiently flexible. But for the larger models some sort of rubber mounting is necessary. Two such types are illustrated.

Small skis can be bent from bamboo. Larger ones must be carved from solid blocks of wood—balsa for rubber-powered models, pine or bass for gas models. It's sometimes convenient to use propeller blocks for ski material, as the dimensions of the block are usually of the correct proportion.

The surface of the skis should be sanded smooth and finished with several coats of banana oil. The oil serves the twofold purpose of providing a smooth finish and waterproofing the skis against the snow.

A ski-equipped model is a valuable addition to an afternoon of skating. Besides the thrills of smooth take-offs and landings, you can skate after the model—a pleasanter way of retrieving it than walking after it, which is a necessary evil of summer flying. For gas models you'll need an extra-large lake. And before you "dust off" the first flight you'd better make sure the ice is solid for skating after the model. Bad luck thrives in cold weather as well as warm. Just as the model is certain to land in the only tree in a large field in summer, it is sure to come to rest on the only spot of weak ice on the entire lake.

Skis operate better on ice than snow, unless the latter has a hard crust. The model will be bogged down in light, fluffy snow, and for take-offs you'll have to pack down a runway.

For cold-weather flying, rubber-powered models have a definite advantage over gas models. They never develop any of the hard-to-start tendencies that sometimes plague gas motors. An automobile *(Turn to page 93)*

# French Fighter

*The gull-winged plane on the cover yields a solid model of graceful beauty.*

by William Winter

THE Loire 46, a speedy French fighter, is distinctive because of its gull wings and slim-waisted fuselage. In its design the emphasis has been on a combination of speed and visibility rather than on speed alone.

The same sweeping lines that distinguish the real ship stamp the model as a thing of beauty, well worth the expenditure of patience in building it. The result of a thorough job will be a revelation of grace in your collection.

The material sizes are listed for convenience. Refer to them throughout.

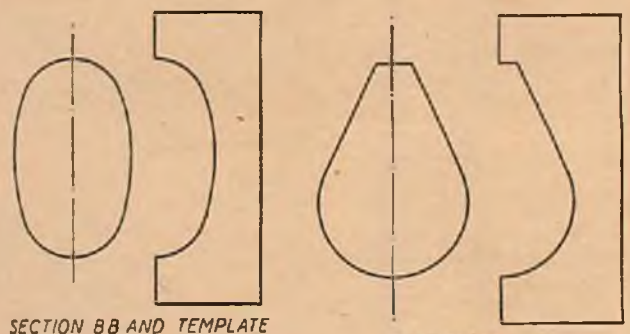
Trim the fuselage block to its required outside dimensions. On the side of it draw the profile of the body and trim the excess balsa. Mark the side contours of the fuselage on the top of the block and again cut away the surplus wood. Shape the partly finished block to the required cross sections illustrated. You can paste the given templates on stiff paper or cardboard and use them to check the work in this operation. The cockpit may be slightly cut out for realism. Sand the completed fuselage to a satin finish.

**LOIRE 46**

Square the cowl block, marking on it the circle seen in the front view. Trim away the surplus wood and shape to conform with the plans. Cut out the front face slightly to accommodate a dummy motor, which may be made out of half-round wooden cylinders, utilizing some scrap for the crankcase.

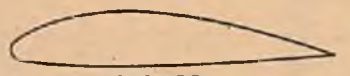
Trace the outlines of the stabilizer and rudder on $^3/_{16}$" sheet, cut and trim each unit to its required cross section as shown on the top and side views. Both the stabilizer and rudder taper in thickness toward the tips. Smooth the finished tail surfaces with fine sandpaper. Attach each to the fuselage with thickened cement. Stubs of straight pins may be inserted between the fuselage block and the tail pieces to facilitate the operation. All struts may be of balsa or, for strength, bamboo. Streamline them and sand before cementing in position. For filleting purposes, use plastic wood or a similar moldable substance.

The wing panels, one left and one right, are drawn on soft ½" sheet and cut out in (Turn to page 96)

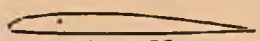



SECTION BB AND TEMPLATE
PASTE TEMPLATE ON STIFF PAPER

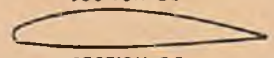
SECTION AA



SECTION DD



SECTION EE

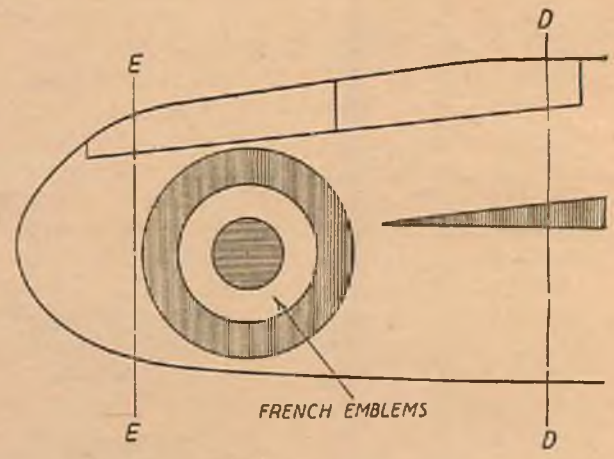


SECTION CC

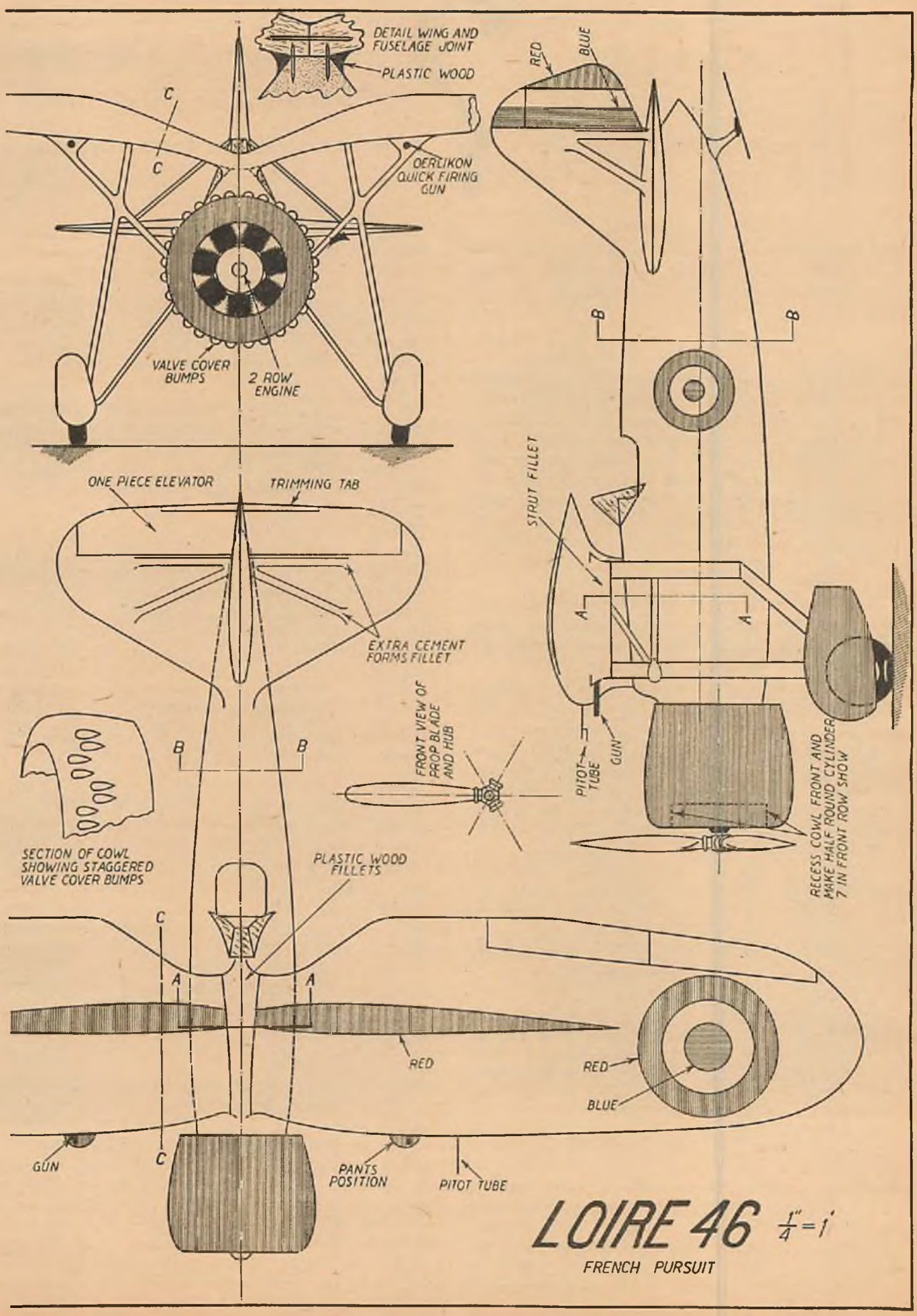
| SPECIFICATIONS | | PERFORMANCE | |
|---|---|---|---|
| SPAN | 38' 8" | MAX SPEED | 248 M.P.H |
| LENGTH | 24' 7" | CLIMB | 3000 FT/MIN |
| HEIGHT | 12' 5½" | ABSOLUTE CEILING | 38,500 FT. |
| WEIGHT EMPTY | 2292 LBS. | RANGE | 465 MILES |
| WGT. WITH 2 OERLIKON (TOTAL) GUNS | 4,312 LBS. | | |
| WGT WITH 4 MACHINE GUNS AS ALTERNATIVE ARMAMENT | 4015 LBS. | | |

**POWERPLANT**

14 CYLINDER, 2 ROW GNOME-RHONE, SUPERCHARGED
945 H.P. AT 13940 FT.




ASSEMBLE WING HALVES ON BENCH


DETAIL WING AND FUSELAGE JOINT
PLASTIC WOOD
C
C
OERLIKON QUICK FIRING GUN
VALVE COVER BUMPS
2 ROW ENGINE
RED
BLUE
B
B
STRUT FILLET
A
A
ONE PIECE ELEVATOR
TRIMMING TAB
EXTRA CEMENT FORMS FILLET
FRONT VIEW OF PROP BLADE AND HUB
PITOT TUBE
GUN
RECESS COWL FRONT AND MAKE HALF ROUND CYLINDER 7 IN FRONT ROW SHOW
B
B
SECTION OF COWL SHOWING STAGGERED VALVE COVER BUMPS
PLASTIC WOOD FILLETS
C
A
A
RED
RED
BLUE
GUN
C
PANTS POSITION
PITOT TUBE
LOIRE 46 1/4" = 1'
FRENCH PURSUIT

*Have you a question on model building or flying that bothers you? Bring us your problem and we'll answer it in the interest of readers everywhere. Replies by mail require return postage.*

## JOINING THE N. A. A.

*Question: How can I become a member of the National Aeronautic Association? Where should I write for rules and regulations of the N. A. A.? L. M., Euclid, O.*

Answer: N. A. A. headquarters are at Dupont Circle, Washington, D. C. Information about membership, together with rules, can be obtained from this address. If you're under 21, you'll probably wish to join as a junior member, which makes you eligible for N. A. A. contests at only a fraction of the cost of regular membership.

In a short time the N. A. A. contest committee will probably make some important changes governing the design of contest models. But until this set of revised rules is available, the old rules will acquaint you with contest technique, as this portion of the rules changes little from year to year.

## DECORATING THE MODEL

*Question: How can you paint a straight thin stripe of one color on the side of a fuselage which later is to be doped another color? M. F., Vancouver, B. C.*

Answer: Decorating a finished model is a difficult job for the best of us and unfortunately, if you're building a scale model—either flying or solid—the color scheme, together with the striping, is usually the most important step in duplicating the appearance of the large ship. This makes your work more difficult than in an original design, where you are free to use any sort of decoration which will "dress up" your model.

One way to stripe is to cut the stripe from tissue instead of trying to paint it. Color it before fastening it to the fuselage. Use a fine grade of tissue and use banana oil sparingly when attaching. Now paint the fuselage, carefully brushing the dope up to the edge of the stripe. This method will produce a better appearance than a painted stripe—unless, of course, you have a steady hand to guide the brush.

The question of decorating a model is too lengthy for detailed answer here. We suggest you watch for the discussion of this subject in a future installment of the "Builder's Guide"—a feature of our Model Workshop.

## ELECTRIC MOTORS

*Question: Could a 6-foot model be powered with a small electric motor? S. J., Milwaukee, Wis.*

Answer: An electric motor with sufficient power to fly a 6-foot model, together with the necessary batteries, would be too heavy to use in a model airplane. A gasoline motor scores higher than an electric motor on all counts. You should have no trouble in getting one suitable for your model. The use of electric motors is restricted to turning the propellers of exhibition models.

## FUSELAGE FORMULA

*Question: What is meant by fuselage cross-section area and the rule, $\frac{(\text{length})^2}{100}$? L. H., Pewaukee, Wis.*

Answer: Fuselage cross section is the width of the fuselage multiplied by its depth, and is measured in square inches. Cross section is measured at the "fattest" part of the fuselage—usually about one-third back from the front.

The rule of $\frac{(\text{length})^2}{100}$ was devised as a means of insuring sufficient cross-section area in contest models. In this way fuselage similarity between models and large planes is insured. With too little cross section, the model appears too slim and bears little resemblance to full-size planes.

To find if your model qualifies under this rule, merely multiply the length by itself and divide by 100. Suppose the length is 30 inches. Then 30x30 equals 900. Divided by 100, the answer is 9 square inches. This is the minimum required area. For this model to qualify, the fuselage would have to be at least 3" wide by 3" deep, or have any two other dimensions which equal 9 when multiplied.

## 1937 WAKEFIELD RULES

*Question: What are the rules and requirements of a Wakefield Trophy entry? C. R., St. Augustine, Fla.*

Answer: The new Wakefield rules governing the 1937 contest are: wing area of 190 to 210 square inches (and this includes the center part of the wing which fits on top the fuselage), minimum weight of complete model 8 ounces, and the maximum cross-section area of the fuselage equal to $\frac{(\text{over-all length})^2}{100}$. The last differs from the American ruling, inasmuch as the length of the fuselage only is considered in this country instead of the over-all length.

## DROPPING BOMBS

*Question: How can model bombs be fastened on a model plane so they fall off when the model noses down? E. K., Plattsburg, N. Y.*

Answer: Bombs can be slipped on a straight piece of wire cemented to the bottom of the fuselage. The wire should be bent at such an angle that the bombs will slide free just as soon as the model stops climbing and assumes a level attitude. It will probably be necessary to keep the wire well greased so that even the slightest change in flying attitude will send the bombs on their downward trip. At the best, however, this method is rather uncertain, as it is difficult to regulate the time for dropping the bombs. If the model falters during its initial climb, the bombs will drop before the maximum altitude is reached.

# Constant-Speed Prop

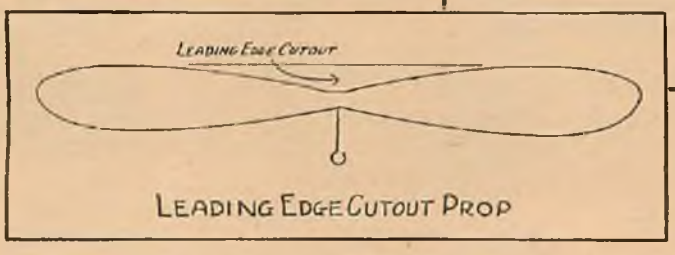
*Step up duration and get full thrust value from every rubber turn with this clever device.*

by Lawrence N. Smithline

AT the indoor convention held at the 1934 national contest at Akron it was agreed by all that the greatest single advance in increasing duration would come through better use of rubber in a more efficient propeller set-up. It was decided it would be best to have a propeller of high pitch at the start (when there is maximum torque) and decreased pitch as the torque diminished, so that the last winds would be utilized. Obviously this would be the most efficient system for a particular size of rubber, as rubber torque is not constant but depends on the number of winds, how much it is stretched, and several other factors.

Now that you have started to think about controlling prop pitch, you may get the idea that it would be better to decrease the pitch at the start and then increase it as the torque decreases. This is fallacious. A plane of a definite size needs a certain velocity to keep it aloft. This velocity is dependent directly on the thrust, and the thrust on the size of the rubber, all things being equal. If you do not concede this fact, try to fly a Class C tractor with an R.O.G. propeller. It just can't be done successfully.

With a little thought, many pitch-control devices can be designed, but some can be eliminated for one or more of the following reasons. It may be too heavy, too clumsy, inefficient, unreliable, or require too much skill to build. Two ideas remain, both of which are illustrated in the accompanying drawings.

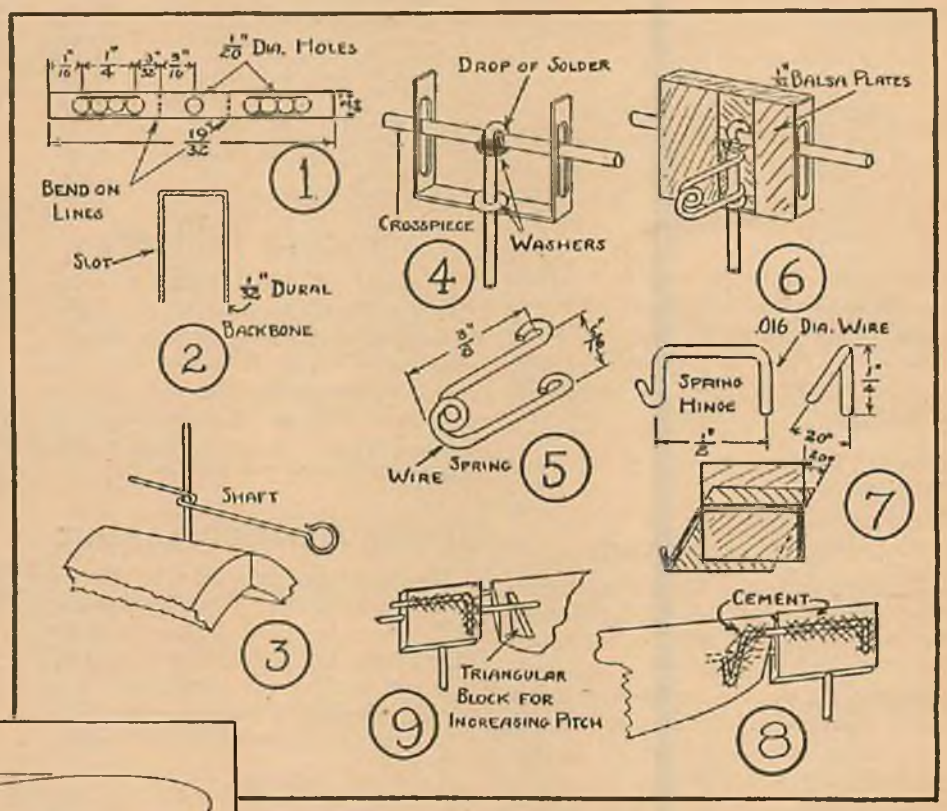



LEADING EDGE CUTOUT PROP

One is the leading-edge cutout prop, which has three advantages. It is light, being no heavier than the ordinary propeller. It does not require extraordinary skill to make. It takes no more time to construct than the ordinary propeller. Its chief disadvantage is the fact that its range of pitch change is very limited.

The second method, which will be described in detail, fulfills all the requirements. It is light, weighing about .007 ounces, can be easily made, and has a wide variation in pitch angle.

The method of operation of the leading edge cutout is simple. At full power the blades rotate faster than ordinarily. You know, of course, that the blade is an airfoil, and an airfoil is generally unstable—that is, if it is displaced positively, it tends to stall. This tendency increases as the square of the speed. By cutting away the leading edge at the hub, the point of support of the blades is moved back, the restraining moment to the stall is weaker, and the pitch is increased. As the rubber tension is decreased, the blades move more slowly, the tendency of the blades to stall is decreased, and the blade angle becomes smaller.




The operation of the second method, involving a mechanical device, is also simple. When the rubber is wound up, it has a certain tension. This tension pulls back on the shaft, which pulls a cross piece down a slot (see sketch #4, etc.) and forces the bottom of the blades out. Thus the pitch at the start is increased. As the propeller unwinds, the rubber tension is decreased. This lessens the tension on a spring which forces the cross piece outward along the slot. As the cross piece slides out, the pitch of the propeller is decreased and it becomes more efficient, giving a maximum of thrust at all times. *(Turn to page 94)*

*Flight records and contestants in competitions.*

# Model Matters

*Club notes and news of model organizations.*

(In contest tabulations, results are to be read as minutes (to left of colon), seconds, and fractions.)

## Chicago Aeronuts

Three new indoor helicopter official N. A. A. records were chalked up by Aeronuts of Chicago in their last contest. Here they are:

| | | |
|---|---|---|
| *Junior:* | Alex Nekimken | 2:07 |
| *Senior:* | Dean Decker | 1:49.8 |
| *Open:* | Carl Goldberg | 2:46.2 |

Through its new secretary, Richard Obarski, of 1733 E. 86th St., the club announces that the above results bring the total of indoor records for which members are responsible up to fifteen.

New club officers elected for 1937 are as follows: Carl Goldberg, president; Joseph Matulis, vice president; Richard Obarski, secretary; Marvin Setzke, treasurer, and Tom Cunningham, bulletin editor.

To promote general interest and competition among members, the Aeronuts have introduced a system of points given for placing in contests, attendance at meetings, experimentation, and so forth. Standings for 1936: Richard Obarski, 86½; Wallace Simmers, 73; Charles Belsky, 60; Alex Nekimken, 57, and Carl Goldberg, 56¾.

Aeronuts made almost a complete sweep of the Junior Birdmen's Chicago wing indoor championship meet, taking thirteen out of the fifteen possible places. Wallace Simmers is the local champ by virtue of two firsts, and the following received medals: Belsky, Swort, Obarski, Turner, Klesman, Kubilis, Setzke, and Blatnik.

## Junior Birdmen

Before about a thousand spectators in the army's Brooks Field balloon hangar at San Antonio, Texas, on Dec. 28, 16-year-old Lynn Radcliffe of Syracuse became the Junior Birdmen's new indoor champion. Two firsts, in the stick-model and cabin-model events, gave him a winning total of 200 points. Robert Amos of San Francisco finished second with 135 points for second place in the stick event, third in the glider, and fifth in the cabin. Third came Wallace Simmers of Chicago with 110 points for first in the glider event and fifth in the stick. The results:

### Glider Event

| | | |
|---|---|---|
| 1. | Wallace Simmers, Chicago | :53.8 |
| 2. | Andrew Petersen, Los Angeles | :53.4 |
| 3. | Robert Amos, San Francisco | :44.4 |
| 4. | Joe Tomsej, Detroit | :42 |
| 5. | William Pfeil, San Antonio | :41.8 |
| 6. | Kenneth Lane, Milwaukee | :39 |
| 7. | John Ginnetti, Washington | :38.6 |
| 8. | Clement Turansky, Pittsburgh | :37.6 |
| 9. | Wilbur F. Tyler, Boston | :37 |
| 10. | James P. Lovett, Atlanta | :36.6 |
| 11. | Warren Boardman, Albany | :35 |
| 12. | Lester Rosenblatt, New York | :34.8 |
| 13. | William H. Holman, Baltimore | :34.2 |
| 14. | Lynn Radcliffe, Syracuse | :30.5 |
| 15. | Fred Hollingsworth, Seattle | :28 |
| 16. | William Palensky, Omaha | :26 |
| 17. | Harold DeBolt, Rochester | :20 |

### Stick Event

| | | |
|---|---|---|
| 1. | Lynn Radcliffe, Syracuse | 16:21.2 |
| 2. | Robert Amos, San Francisco | 16:15.6 |
| 3. | John Ginnetti, Washington | 14:46.6 |
| 4. | Wilbur F. Tyler, Boston | 14:28.4 |
| 5. | Wallace Simmers, Chicago | 14:19.6 |
| 6. | Andrew Petersen, Los Angeles | 12:36.8 |
| 7. | Fred Hollingsworth, Seattle | 12:10 |
| 8. | Joe Tomsej, Detroit | 12:07 |
| 9. | Harold DeBolt, Rochester | 12:04 |
| 10. | Clement Turansky, Pittsburgh | 11:45 |
| 11. | Lester Rosenblatt, New York | 11:30.3 |
| 12. | William Pfeil, San Antonio | 10:29.2 |
| 13. | Kenneth Lane, Milwaukee | 9:00 |
| 14. | William H. Holman, Baltimore | 8:26.2 |
| 15. | Warren Boardman, Albany | 4:58 |
| 16. | James P. Lovett, Atlanta | :06.8 |
| 17. | William Palensky, Omaha | no flight |

### Cabin Event

| | | |
|---|---|---|
| 1. | Lynn Radcliffe, Syracuse | 15:20.2 |
| 2. | William Pfeil, San Antonio | 14:52.4 |
| 3. | Joe Tomsej, Detroit | 14:27.8 |
| 4. | John Ginnetti, Washington | 13:46.8 |
| 5. | Robert Amos, San Francisco | 13:31 |
| 6. | Wilbur F. Tyler, Boston | 12:44 |
| 7. | Harold DeBolt, Rochester | 11:38 |
| 8. | Andrew Petersen, Los Angeles | 11:25 |
| 9. | Fred Hollingsworth, Seattle | 11:13.8 |
| 10. | Kenneth Lane, Milwaukee | 10:38 |
| 11. | Clement Turansky, Pittsburgh | 6:49 |
| 12. | Lester Rosenblatt, New York | 6:20 |
| 13. | Warren Boardman, Albany | 4:50.2 |
| 14. | Wallace Simmers, Chicago | 3:44.6 |
| 15. | William H. Holman, Baltimore | 3:36 |
| 16. | James P. Lovett, Atlanta | :21.4 |
| 17. | William Palensky, Omaha | no flight |

## Syracuse Officers

A recent election of the Syracuse (N. Y.) Model Airplane Club resulted in the following line-up of new officers: president, Charles Birdseye; first vice president, Jean Chadwick; second vice president, William Rogers; secretary, Gordon Wheler; treasurer, Robert Dillman; club advisor, Ira Fralick.

## Junior Aviation League

The monthly meet of the Boston J. A. L., held Dec. 5 in the Armory, produced four new Boston records. Three, listed in the following contest results, are marked with an asterisk. Unlisted is Sampson's junior record flight of :33 with a class A glider. Summary:

### Gliders

| | | |
|---|---|---|
| 1. | Tyler, class A (senior) | *:35.8 |
| 2. | Sampson, class B (junior) | *:33.8 |
| 3. | Capo, class B | :32.8 |
| 4. | Shea, class A | :27.8 |
| 5. | Golden, class B | tied :27 |
| | Gordon Cain, class B | tied :27 |

### Stick H. L.

| | | |
|---|---|---|
| 1. | Capo, class B | 12:23.8 |
| 2. | Golden, class B | 10:07 |
| 3. | Tyler, class C | 9:43.2 |
| 4. | Sulkin, class C | 9:17 |
| 5. | Cain, class B | 8:25 |

### Stick R. O. G.

| | | |
|---|---|---|
| 1. | Phillips, class B (senior) | *12:26.6 |
| 2. | Capo, class B | 8:26 |
| 3. | Shea, class B | 8:18 |
| 4. | Tyler, class B | 8:05.2 |
| 5. | Pappas, class B | 6:39 |

### Flying Scale

| | | |
|---|---|---|
| 1. | MacLean (Rearwin) | :47 |
| 2. | Avola (Monocoupe) | :36.8 |
| 3. | Hannon (Taylor Cub) | :34.2 |
| 4. | Sampson (Monocoupe) | :31 |
| 5. | Robinson (Dewoitine) | :22 |

In a helicopter event Sampson did 1:24, and E. Whitten's ornithopter did :04.

Standings under the club's point system are as follows:

| | | | |
|---|---|---|---|
| Capo | 7755 | Pappas | 3313 |
| Phillips | 5451 | Durup | 3202 |
| Tyler | 4953 | Shea | 2004 |
| Sulkin | 3915 | Brown | 1876 |
| Sampson | 3473 | Sherman | 1725 |

Wilbur Tyler, of Everett, Mass., is going like a house afire, having reached third place after starting in October at zero. Sulkin has also been gaining.

The J.A.L. was temporarily without a director following the resignation of Mr. G. Bancroft Hall, whose year and a half of service, including the leading of a group to the 1936 national meet, helped the club to new achievements.

## Keystone Club

From Allentown, Pa., comes the report of an indoor meet of the Flying Keystone Model Airplane Club held Dec. 19. This was the third meet of the year for this modelers' organization, which is now about two and a half years old. It is sponsored by Ernest Schaffhauser, of 1520 Liberty St.

Indoor flying is done in the local high-school gym, which has a 28-foot ceiling. The following contest results will be of interest for comparison by modelers elsewhere whose flying is limited by similar altitude:

### R. O. G.

| | | |
|---|---|---|
| 1. | George Micott | 3:18 |
| 2. | Russell Fahringer | 3:02 |
| 3. | Martin Schultz, Jr. | 1:00 |
| 4. | Sterling Schaffhauser | :58 |

### Stick

| | | |
|---|---|---|
| 1. | Russell Fahringer (tractor) | 5:42 |
| 2. | George Micott (tractor) | 1:08 |
| 3. | Sterling Schaffhauser (pusher) | :30 |
| 4. | Richard Waidelich (tractor) | :20 |

### Cabin

| | | |
|---|---|---|
| 1. | George Micott | 3:07 |
| 2. | Russell Fahringer | :18 |

An exhibition scale-model contest was held Dec. 1 with the following scores:

| | | |
|---|---|---|
| 1. | Charles Wieder (Ryan NYP "Spirit of St. Louis") | 87 |
| 2. | Richard Metzger (S. E. 5) | tied 75 |
| | Robert Metzger (Boeing F4B-4) | tied 75 |
| 3. | Robert Metzger (Fokker D-VII) | 64 |
| 4. | Richard Waidelich (Waco WHD) | 51 |
| 5. | Richard Waidelich (Curtis A-12) | 31 |

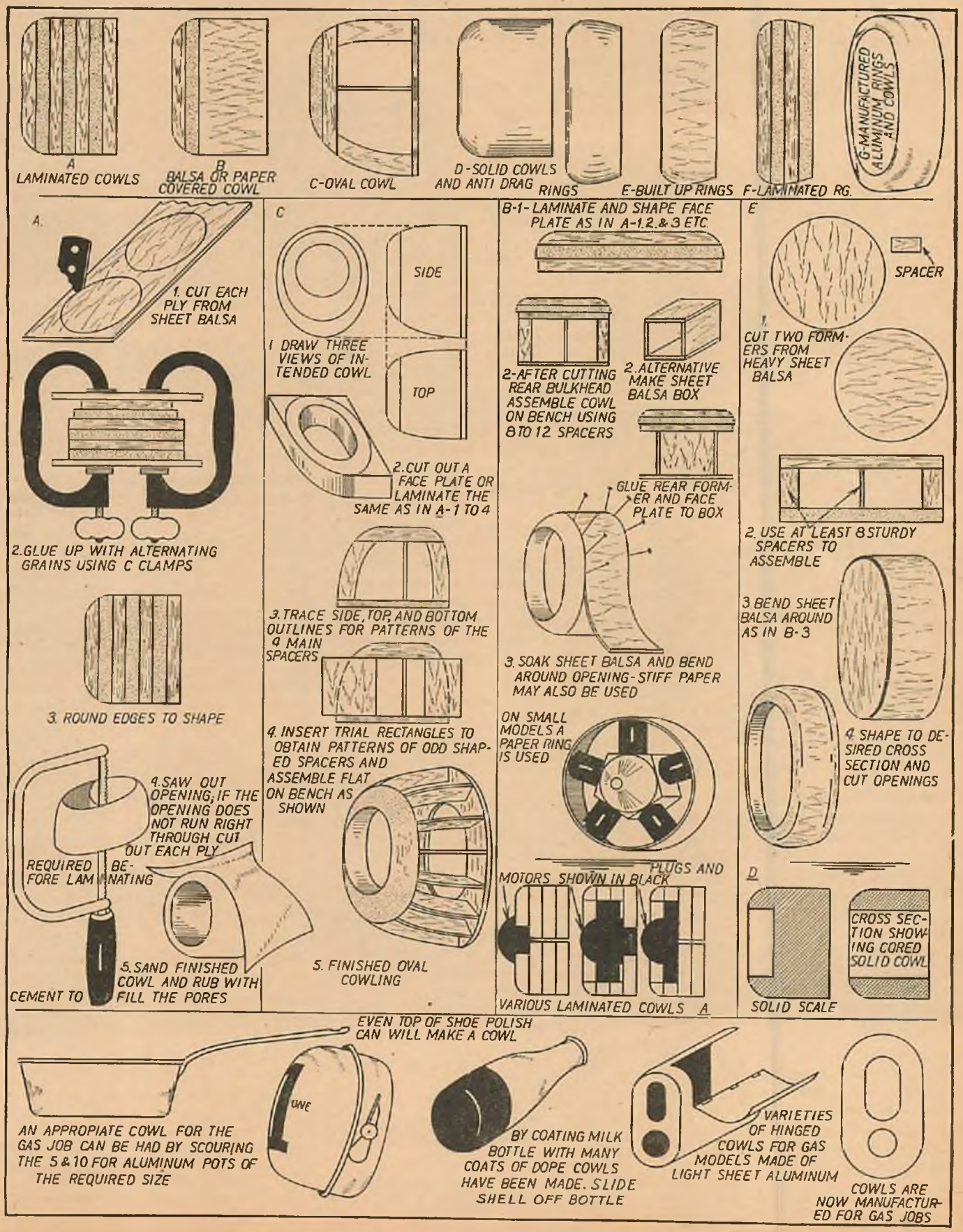
## Tulsa Election

Model Aeronautical Engineers of Tulsa, Okla., announce the result of their semi-annual election: president, William Adams; vice president, Alvie Dague; secretary, Vernon Sears; treasurer, Roy Wriston.

# Builder's Guide

## *Cowls*

by William Winter



# THE PURPLE FEZ

*(Continued from page 14)*

Sandy lowered his handkerchief. "You—you mean I can go to Florida? Alphonso, too?" he asked incredulously.

"That's the size of it," Bill said. "You'd better start getting ready. You'll leave in the Eaglet to-morrow. Now listen: That movie stuff is all right—but I'm sending you down there to lap up the sun and get rid of that cold. So you're going to spend a lot of time on the beach. Get me?"

"Yeah. *Kaaa-chooooo!* Gosh, that's swell of you." The boy hesitated, his eyes going to the battered suitcase. Then he said, "Are you going into New York this afternoon, Bill?"

"Maybe. Why?"

Sandy grasped the suitcase by its rope handle and held it up. "Look at this thing. It's Alphonso's personal overnight bag. I keep his clothes in it. And—well, golly it's a wreck, Bill. Alphonso chewed off the handle and I have to use rope. I've wanted to buy him a new one, but I spent all my dough on those dress clothes. *Kaaa-chooooo!* So, when you're in New York, will you get me a new one? Gosh, you wouldn't want Alphonso to go down South with this old wreck. It'd be mort—mort—*Kaaa-chooooo*—mortifying."

Bill said, "I could never look my best friend in the eye again. O. K. If I go to town I'll buy a new bag. Now,"—he gestured to the swaying monkey—"get him out of here. He's making me seasick."

"Sure," Sandy said. He snapped his fingers suddenly. "Gosh, I almost forgot. A telegram came for you. I was coming here, so they gave——"

Bill lunged to his feet, knocking his chair back. "A telegram!" he said violently. "Give it to me!"

Sandy shot him a frightened look, then dug into a pocket.

Shorty said, "Maybe——"

"Maybe," Bill said. He snatched the yellow envelope from the boy's extended hand, ripped the flap open and straightened out the telegram.

He read the message in one swift glance. It was brief.

THE TIME HAS COME. SMITH.

Bill crumpled the wire in his hand and whirled around to Shorty. "Get the gang here—pronto. I'll be right back."

He left the room and hurriedly descended to his secret study below. There, he opened the safe and took out an envelope, heavily sealed with wax. His tanned face was impassive as he tore the envelope open and extracted a single sheet of paper. Typewritten on the sheet was:

Leave immediately for New York City accompanied by two guards. Effect adequate disguise. Proceed to Café Royale on Christopher Street, Greenwich Village. Take last table on right in rear. When waiter comes, say: "Night is approaching. We must hurry." Thereafter obey him. Burn this upon reading.

By the time Bill had destroyed the letter and returned to the office, four of the pilots of his famous squadron were seated in the room—Bev Bates, Cy Hawkins, "Red" Gleason, and Shorty. Sandy and Alphonso had disappeared.

Bill took his place behind the desk.

"For the last few weeks you've all wondered why I've been sticking close to the field and keeping the Lancer primed for action. Now I can tell you." His words were clipped. "Three weeks ago a client posted forty thousand dollars with Paul Ross, my lawyer, to retain me for five weeks. This client wanted to remain unnamed—and still has, for that matter. I agreed to the proposition when Ross absolutely guaranteed the guy. All I knew was that I might have to make a long-distance flight at any time. If I did, I'd get forty thousand more.

"I was given a sealed envelope containing instructions. I was to open it only upon the receipt of a certain telegram. That telegram's just come. I've read the instructions. I'm leaving for New York immediately. Shorty and Red will go along as bodyguards. Bev, you and Cy stand by your ships at the field. Shorty has orders for you. Now get going!"

## III—THE CLIENT

THE CAFE ROYALE was a small, dingy restaurant in the basement of an old brownstone house on Christopher Street. It was deserted, save for two customers, when Bill, arrayed in greasy, worn clothes and a cloth cap, entered. Shorty and Red, similarly attired, followed him.

There was only one waiter in evidence. He eyed the three airmen sullenly as they walked to the rear of the café and sat down at the table the instructions had designated.

Shorty muttered, "A rat hole."

"Pipe down," Bill said cautiously. "Now get this—if I'm not back in two hours, come looking."

Red scowled. "Two hours! Say, you could be killed and——"

The waiter sauntered over and dropped a faded menu on the soiled tablecloth. He was pinch-faced and his skin was swarthy.

Bill looked up, said in a half whisper, "Night is approaching. We must hurry."

The man seemed to stiffen. His small eyes darted over the three men. Then he bowed and said out of the corner of his mouth, "The two stay. You follow."

Bill quietly obeyed. The waiter preceded him through a doorway in the rear wall, down a narrow passage and up a flight of metal steps. There was no conversation.

At the head of the stairs, the waiter stopped in front of a heavy door and pressed a concealed button. He whispered, "When the door opens, go inside." The man turned and vanished noiselessly down the steps.

Bill waited, his nerves on edge, his hand on the butt of his automatic. Then, without a sound, he saw the door glide into a recess in the wall, leaving an aperture of blackness.

He stepped cautiously through the opening, every sense alert, his gun ready.

A soft, warm light began to well up, grew stronger, and Bill saw that he was in a small room furnished in oriental splendor.

A man was seated, cross-legged, on a hassock across the room. Slowly, he arose and walked toward Bill. He was tall, very thin and wore immaculate morning clothes. He was unmistakably a Turk.

He said, "I am gratified that you have so quickly come, Mr. Barnes. I am he who negotiated through your attorney for your valuable services. You can put away your gun, effendi. You do not need it now. But later—yes."

Bill realized that he was still holding the automatic, aimed directly at the man. "Sorry." He grinned and stuck the gun in his pocket. "Mr Ross didn't tell me your name, sir."

The man shrugged. "Intentionally. I am known as Assaf Riza, the rug merchant. That, however, is an assumed name—— I have asked you to come quickly here, effendi. I most desperately need your help. Are you prepared to leave on an ocean flight immediately?"

Bill inspected the Turk carefully and then said slowly, "My machine is ready."

"Good. Please sit down here. There is much to tell you." When Bill was seated on a low divan, Riza continued, "It is most important that I depart this country quickly and secretly. My enemies are closing in. The very minutes are precious. At dawn to-morrow I wish to leave for Angora, Turkey."

Bill's face remained impassive. "Very well—if the weather is right."

"I pray to Allah that it is." Riza reached behind him and picked up a folded newspaper. He handed it to Bill.

It was that morning's edition of the New York *Star* and was folded back to the wire-photo section. The Turk

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pointed to a picture. "You perhaps have already seen this photograph, effendi?"

It was the picture of the crash of the Mystery Ace at the Miami Air Maneuvers. Bill said, "Why, yes. I saw it this morning."

Riza's face softened. "The Mystery Ace was my brother."

Bill started. "I'm sorry. He—he was a good flier."

"He was a good brother, too, effendi. He must have known that he was going to die. For he sent me a warning. That which he drew in the sky with his smoke was a fez. It meant, effendi, that the Society of the Purple Fez had at last found him. It meant that the society may soon find me. That is why I must flee."

"The Society of the Purple Fez?"

"It is but natural that you should know nothing about this organization. But you will. Please listen——

## IV—ESCAPE

"I MUST take you back to Turkey and the days of the World War, effendi, and to a man named Aziz Pasha," the Turk said. "He had been trained in Germany as a soldier and a pilot, this Aziz, and held high command in my country's army. In 1916, he organized a Turkish air unit. My brother and I were pilots and were asked to join. We did so. The squadron became famous on the Eastern Front."

Bill said, "Yes. I remember reading about that outfit. The insignia was a purple fez."

"A purple fez, effendi—yes. And we were proud of it. It stood for integrity and courage—for sultan and for country. We fought and bled and died for that symbol. We realized not that it would become the bloody mark of the assassin.

"As you know, the fortunes of war went against my country. The government capitulated to the British. But not Aziz Pasha; not the Purple Fez. Our squadron retreated to the interior and never surrendered. And thereafter, instead of having peace, my country became torn by internal strife, with two factions struggling for control. One was led by the dictator. The other by Aziz Pasha. We of the Purple Fez were still loyal to him, for he vowed that he was fighting for the welfare of Turkey and the sultan.

"But he lied. All he wanted was power and absolute control—and he cared not how he got it. By looting and confiscation, he began to accumulate a great fortune. And to his side and into membership in the exclusive Society of the Purple Fez, flocked a villainous army of murderers and thieves.

"But Aziz and his force could not match the strength of the dictator. With certain defeat confronting him, Aziz issued orders for the dictator to be assassinated. My brother and I were chosen to do the work.

"Our faith in our leader had already been badly shaken. This move decided us. We held a long council together. There was but one course to take. And, even though we knew we were signing our own death warrants, we took it. Instead of killing the dictator—we warned him, divulged the entire plot.

"Aziz was instantly arrested and banished for life to Fuada Island, the Turkish penal colony off the coast of Venezuela in South America. Many of his followers met the same fate. By official decree, the Society of the Purple Fez was disbanded under penalty of death.

Alphonso.

"But the loyal members of the society soon began to meet surreptitiously. Aziz Pasha had sworn vengeance upon my brother and me, and his followers strove to carry out his orders. From then on our lives were constantly menaced. Time and time again, we barely escaped. And finally, we were forced to flee to this country. We changed our names, our appearances. We lived apart, communicating only on the rarest of occasions. My brother continued to fly. I became a rug merchant.

"A year or two passed peacefully. Then word came that Aziz Pasha had escaped from Fuada Island and had vanished. Fear for our safety heightened, for we knew that Aziz would never give up his search. Our only hope lay in finding him before he found us.

"This month our work reached its climax. We not only discovered where Aziz was, but we learned what he was planning to do.

"Our information is of such vital nature that it has to be placed in the hands of the dictator himself. We had resolved to fly as soon as possible to Angora. My brother had begun secretly preparing a powerful airplane. It was to be completed within the next ten days. His performance at the Miami Air Maneuvers was to be his last. It was.

"As a guarantee that nothing should stop the information reaching the dictator, I entered into negotiations with you through your lawyer, effendi. I am grateful that I took such precautions.

"To-morrow, at daybreak, we leave. And with us will go the vital documents that will enable the dictator to block Aziz's murderous scheme. The very peace of the world—the fate of my country—is contained in those documents.

"The Society of the Purple Fez has killed my brother. They may find and kill me. Therefore, when you leave this room to return to your field, you will take an attaché case with you. And in that attaché case will be the all-important documents. They will be safer with you than with me.

"To-morrow morning at seven o'clock you will bring the attaché case in your airplane and land on the fairway of the seventh hole of the Briars Golf Club. Mr. Ross informed me that you would be familiar with the location."

"I am," Bill said.

"I will be waiting there in a black limousine. I will board your plane and we will leave immediately for Turkey. But, if my car is not there at the appointed time, and if I am not seated in it, you will know that something has gone wrong—that perhaps the Purple Fez has found me. If that be the case, do not land! Rather, head straight for Angora and fly fast. And when you get there, give the attaché case to no one but the dictator."

Riza leaned back and wearily closed his eyes. "That is the plan, effendi. Before you go I will pay you forty thousand dollars—making eighty in all. And now that you know the details, and the dangers, it is only right that you should have a chance not to accept my proposition. If you should do so, I can only trust that you will never repeat what I have said."

Bill said quietly, "I gave my word that I'd see the job through."

Riza looked at him for a long minute. "Thank you," he said. He arose from the hassock and retreated to the back of the room. When he returned he was carrying a tan-colored attaché case of soft leather. The case was well filled and its sides bulged. In his other hand, the Turk held a package wrapped in brown paper.

He handed the package to Bill and said, "Here is the money. And this"—he indicated the attaché case—"this you must guard with your very life.

"You understand your instructions perfectly, effendi?" Riza asked.

"Perfectly," Bill said.

"May Allah protect you."

Safe and swift the return journey to the Long Island field turned out to be.

## V—PREPARATIONS

AS soon as Bill had debarked from the car he went straight to his office, carry-

ing the tan attaché case and the bundle of money.

Sandy saw him and came running. "Golly, you got it for me," the boy said excitedly.

Bill said, "Got what?"

"The new bag for Alphonso, of course. *Kaaa-choooo!*" Sandy sneezed into his handkerchief and pointed to the tan attaché case.

A tired smile twisted Bill's lips. "Sorry, peewee. This case is part of the job I'm on. I clean forgot about buying a new bag for Alphonso."

"Gosh!" Sandy said, and his freckled face mirrored his disappointment.

Bill descended to his secret study and stored the attaché case and the money inside the strong safe. Then he telephoned Martin, the head mechanic, and ordered the Lancer groomed for flight.

"I'll take off at six thirty to-morrow morning," Bill said, "if the weather reports are good."

The weather reports were more than favorable when Bill blasted the heavily loaded Lancer down a lighted runway and into the air at precisely six thirty the next morning.

By ten minutes to seven, dawn had definitely arrived and Bill could now discern the rolling country of Connecticut below. He had come on a straight line from the field, knowing the route by heart.

But the nearer Bill came to the meeting place, the greater the nervous suspense grew.

The Lancer was now descending in a wide, circling course, with Bill crowded to the side of the cockpit cabin, his blue eyes watchful.

Bill recognized landmarks. He was very near the Briars Golf Club course and instinctively his free hand reached out to touch the soft leather of the attaché case that lay beside him. He could feel the bulge of the papers that packed its locked interior and to his ears once again came the whispery voice of Assaf Riza, "Verily, the fate of nations, of thousands of lives, rests upon you."

Bill thought grimly, "I only hope that guy's waiting for me. The set-up doesn't sound healthy."

But five minutes later, as the Lancer swooped low over the tree-bordered seventh fairway, his fears were lulled—for there, parked to one side of the stretch of green turf, was the black shape of a limousine.

Bill headed the amphibian into the wind and landed far down the fairway. Slowly he taxied the machine across the ground in the direction of the automobile while he jammed binoculars to his eyes. He focused them, and the powerful lens brought the car leaping closer, clearer.

The pilot's magnified gaze instantly centered on the man's face. In the next second, with a surge of relief, he knew that it was Assaf Riza.

He lowered the glasses, opened the throttle and taxied the Lancer rapidly now toward the car and the awaiting Turk. But Assaf Riza didn't wait. The Turk broke into a run and headed toward the plane, his arms gesticulating wildly.

When the Lancer was within two hundred yards of the man the Turk suddenly stumbled. He fell to one knee, staggered up again, lunged into a mad sprint, then pitched head foremost to the ground and lay still.

Bill closed the throttle, jammed on the brakes. His right hand streaked to his automatic, jerked it out.

Standing up in the cockpit, he shot one wary glance over the quiet fairway and the thick brush that bordered it, then slung a leg over the cockpit coaming. He hesitated, reached back and seized the handle of the attaché case in his left hand and jumped to the ground.

Frantically Bill dropped down beside Riza. The man was lying on his side, his hands pawing drunkenly at his face. Bill said, "Riza—it's Bill Barnes. What's wrong? Quick!"

The Turk's eyes were open; they held a strange light. The man said in a whisper, his lips barely moving. "I can't see—I've gone blind. I'm dying. They've got me—the Purple Fez—poison. Go, Barnes—go quickly! Take the case to Turkey—— Leave me——"

A horrible convulsion seized the man. He gasped, tried to speak, then his body went limp.

Bill felt for the man's pulse. There was no movement. Assaf Riza was dead!

Then, without warning, came the crashing report of a fired gun. An object *zinged* past Bill's head. Startled, he looked up and caught a flash of flame in the bushes beyond the limousine. He leaped to his feet, his automatic leveled. He tugged the trigger. The weapon roared once, twice.

Bill had a blurred impression of two shadowy figures charging out from the screen of foliage. Guns were in their hands. They fired.

Something crashed across Bill's head. He was hurled backward, to fall to the ground with stunning force. Vaguely he knew that he had been shot. He tried to get up, tried to lift his automatic. But all strength seemed to have been drained from him.

Pain throbbed through his head. As if in a dream, he heard running footsteps, felt the attaché case ripped from his powerless fingers.

Again Bill struggled to get up. He had to stop them! They were escaping with the attaché case. One of them was taking it away in a plane!

But consciousness was rapidly slipping from Bill. He tried to move his arms. And then he knew no more.

## VI—FIGHT

HOURS seemed to have passed when Bill opened his eyes. His head was aching. He raised a hand to his face. It came way, stained and dripping with blood.

The sight shocked him. He sat up and immediately the world began rocking crazily. He felt cold and sick, and he quickly closed his eyes.

The landscape had settled into place when he opened them again. He saw the Lancer, standing where he had left it. But the limousine and Riza's body had vanished. And worse still—so had the two strange men with the attaché case.

A familiar, vibrating roar was filling the air. Bill recognized it immediately, shot a quick look down the fairway and gasped. A biplane was angling up into the sky far down beyond the distant seventh green. And not only that—below it, racing along a narrow road toward the main highway, was the long, black shape of Riza's limousine.

Surprise sent Bill reeling to his feet. The enemy! They were just making their get-away. Then he must have been unconscious but minutes.

Bill turned. He started for the Lancer. He tried to run. He reached the Lancer's silvered fuselage, dizzy and weak, and leaned against it for support.

He heard the roar of the biplane dwindling to a drone. He saw the ship diminishing into the south. It would soon vanish. Agonized, Bill crawled up to the cockpit and half fell inside.

He worked the starter. As the engines boomed into life he leaned back against the seat and caught a glimpse of himself in the rear-view mirror. One side of his face was dyed solid crimson by the blood that had poured down from a gash in his head just above his ear.

He released the brakes, swung the big amphibian around to head into the wind and rammed the throttle open. Down that frost-hardened turf the sleek silver Juggernaut hammered, racing faster and faster.

Then the stick came back. The Lancer was off the ground and rocketing into the lightening skies.

The amphibian came around on a wing tip, leveled off and, with the gun sights framing the now far-away biplane, the mad race began.

Bill sat braced in the cockpit, binoculars at his eyes. He caught and held the enemy biplane in the magnified circles.

It was a single-seater, streamlined and fast. He could see the helmeted head of her pilot. The man turned once and looked back.

Dead south the two ships raced with the silver fury screaming nearer and nearer. Bill's fingers were already in position over the control column's firing trips, ready and waiting.

It was only minutes now before his terrific speed would enable him to reach the other plane. Through the glasses he could now see every detail of the biplane, could see the swarthy face of the pilot. And the pilot was holding up the brief case, had ripped open the flap. He was taking a mass of folded white papers from inside.

And now—now he was savagely tearing the papers into shreds—into confettilike pieces and throwing the scraps overboard!

BILL'S HAND hit the throttle, only to find it already in the last notch. The man was destroying the papers—the papers that had been in the attaché case—the papers that Riza had paid him to deliver to Turkey! Tiny white fragments were being scattered to the winds. They could never be recovered!

Blind rage came to Bill. He threw the binoculars to the floor. His eyes went to the gun sights.

The biplane was almost within range when she reared straight up and over in a quick Immelmann. In the next second the ship was heading back for the Lancer. Jets of flame came from her stationary guns.

Bill threw the stick, kicked the rudder. The Lancer skidded wildly, missing the enemy's leaden torrent by a yard.

The biplane's speed shot her past. Bill blasted the Lancer around in a lightninglike maneuver and raced after. Then, like a striking hawk, he was on the biplane's tail, in range. His fingers clamped down on the firing trips. And his fixed machine guns broke into their deadly chatter.

Twin, smoky streams drilled into the enemy's empennage, along the fuselage. The biplane dived. And Bill raked her belly from rudder to spinner cap.

He saw her pilot throw up an arm as if in surrender. Wisps of smoke began to trickle back from the engine. Bill fired another burst, then swung the Lancer away. Forgotten was his own wound, his own weakness. He watched the biplane narrowly, alert for the first sign of trickery.

The biplane was heading down, her wings wabbling. The smoke from her engine had diminished, but the ship was definitely disabled. Her propeller slowed and stopped. The angle of descent increased until the plane was in a headlong plunge.

Bill followed and critically inspected the rapidly approaching earth. They were over level country and adequate landing areas were on every side.

The enemy plane was holding to its wild dive as if completely out of control. Bill watched anxiously. With the papers apparently completely destroyed, his only hope lay in capturing the pilot and finding out what he knew. But now it seemed as if pilot and plane were heading for destruction.

Nearer and nearer to the earth the biplane plummeted. And then, when it was within two hundred feet of the ground, her pilot abruptly pulled out of the dive, stalled the ship to lose speed, and then went fish-tailing in for a landing on the grassy slope of a large meadow.

Bill saw through the ruse immediately. The enemy was planning to set his ship down and escape on foot.

The Lancer's throttle was jerked closed. The undercarriage dropped down. And Bill, throwing caution to the wind, went in for a fast landing.

He felt the wheels contact the ground and rumble across it. He put pressure on the brakes.

The enemy ship had already landed and was now running rapidly across the grass—straight for a weed-covered ditch.

Bill shouted a warning. The biplane's pilot must have seen the danger at the same moment. He tried to swing his speeding plane around. But he was too late.

The left wheel sank out of sight. The biplane lunged, whipped half around. Her nose rammed into the earth. The lower left wing crumpled. The fuselage shot skyward and, with a thunderous crash, the machine came to a shuddering stop.

Instantly flames geysered up from the half-buried engine.

Bill slung himself from the Lancer and dropped to the ground. He ran to the wreckage.

The enemy pilot was lying over the cockpit coaming. His eyes were closed and an irregular gash showed in his forehead where he had hit the instrument board.

The flames were welling up. Fire licked along the fuselage and into the single cockpit. And with it came sooty smoke.

Bill shielded his face, plunged through smoke and climbed up the canted fuselage. The enemy pilot's safety belt was already unfastened. Bill seized the man's arms, jerked him clear of the cockpit and quickly pulled him to a safe distance from the wreckage.

Then, without pausing, Bill raced back to the burning biplane. The attaché case was still somewhere inside the cockpit. It had to be found. Perhaps the enemy pilot had failed to destroy all the papers—perhaps some of the documents still remained in the case.

The fire had increased tenfold and the heat was blistering. Smoke swirled in Bill's face as he climbed up the fuselage. The fumes choked him. He again reached the cockpit, tried to see inside. The floor was now a mass of crackling flames. But he had a glimpse of the case, caught between the rudder pedals. He reached inside, seized the leather handle and jerked the case free.

Flames swirled up in his face. He half fell, half jumped to the ground. His clothes were singed and blackened as he stumbled away, his eyes blurred by the acrid smoke. He was not a moment too soon. For scarcely had he quitted the wreckage than the whole crumpled biplane became a roaring bonfire.

But Bill scarcely saw it. He held the attaché case up and inspected it. The fire had practically demolished it. The tan leather was charred and blistered. Only the handle and one end of the case had escaped the fury of the flames.

The flap had been cut free of its lock. Bill held it back and looked inside. The interior had been completely gutted by fire—and there were no papers within.

Bill stared at the charred case for a long minute. Assaf Riza had trusted him, had paid him well to do a job—and he had failed, scarcely before his work had begun.

It was then that the airman's gaze shifted to the figure of the enemy pilot. The man was still unconscious from the severe head blow he had received.

Ten minutes later the limp body of the captive was securely bound in the rear seat of the Lancer's cabin and the amphibian was again in the air. And as Bill guided the streaking ship high across the blue heavens toward his Long Island field, he looked in the rear-view mirror and studied the reflection of the enemy's face.

## VII—THE ISLAND

THE MAN was a Turkish murderer and had come from the island of Fuada far to the south off the coast of Venezuela.

Fuada and its tiny neighbor, Calabar Island, belonged to Turkey.

Twice world attention had been briefly focused on the Turkish penal colony. Once, early in the century, when a disastrous plague had decimated its convict population; then again in 1925, when it was reported that Aziz Pasha, the infamous leader of the Society of the Purple Fez, had successfully escaped to the mainland and vanished.

But, contrary to public belief and official statements, that master criminal, Aziz Pasha, had not escaped from Fuada.

He was now seated in a room of one of the prison buildings. He was dressed, not in convict clothes, but in rich silks and brocades. And on his head he wore a purple fez.

He sat cross-legged on a pile of cush-

ions, an evil, Buddhalike creature, his short body heavy with fat. The oily skin of his fleshy face was swarthy and pock-marked. A long mustache drooped from below a bulbous nose.

He gripped a microphone in one hand and snarled into it, "Contact Number Six!"

A frightened voice replied from a hidden amplifier, "I am still trying, master. But Number Six fails to answer."

"Try again! Get him!"

The door of the room opened and Dr. Kara, the prison physician, came inside. He was tall and emaciated and wore grimy tropical whites. A stubble of bluish beard covered his jowls and the muscles of his cadaverous face twitched spasmodically. His eyes were red-rimmed and unnaturally bright. He bowed low with an exaggerated gesture and said, "Your humble servant comes, Pasha. Has anything undue happened?"

Aziz Pasha's agate eyes glared at him from under heavy black eyebrows. "It took you a long time. I have good tidings and bad. The last of those traitorous brothers is dead. Number Six has taken the attaché case from the American, Barnes, and has fled in his plane, thinking Barnes lay dying. But now, Kara, Barnes is in his own plane pursuing. I ordered Number Six to destroy the papers. He has done so, reporting them as blank sheets. Barnes is overtaking him. There has been a fight. Number Six has reported that his plane is damaged, that he is about to land and flee afoot. Nothing has been heard from him since."

Dr. Kara sank down on a divan across the room and shrugged his thin shoulders. "Barnes has probably killed him, Pasha."

"May Allah have so willed. But I fear that Barnes has taken him alive. Therein is the danger. How much longer is Number Six scheduled to live? Quick—look up your records!"

Kara took a small notebook from a pocket and opened it. He moved a shaking finger down a typewritten list of numbers. Then he said, "Number Six's time is almost up. Without the Z injection he will die within the next hour or two."

Aziz scowled. "Too long! If he has been captured, there will be time for him to talk."

"He will not do much talking, Pasha, even though captured," the doctor said. "For the frenzy will soon be upon him. It is after his death that the danger may come. If Barnes suspects poisoning, he may order an autopsy performed. The result might be—well, unpleasant, Pasha."

"I realize that all too well, Kara." Aziz Pasha turned and spoke sharply again into the microphone. "What of Number Six?"

"Still no answer, master," came the voice of the radio operator. "I am trying to contact him."

Aziz Pasha slammed the microphone down on a coffee table at his side and glowered across the room.

Kara rubbed his twitching face and said, "Your thirst for vengeance may be our undoing. You have killed your two betrayers, but in so doing you have aroused the enmity of this airman, Barnes. He is dangerous, Pasha, too dangerous.

"I counseled against such procedure, but you regarded me not. It is dangerous to wait any longer. Our forces stand ready to descend upon Turkey. Your agents in the Moslem countries have sown the seeds of unrest. They now but await your command to foment wholesale revolt."

The small eyes of Aziz glowed. "I need not your advice, Kara."

The doctor said vehemently, "You wait so that you may have personal vengeance. You wait so that you may loot the American gold train. You wait—while new forces rise against you. You are a fool!"

Aziz's fat fists clenched. "Watch your tongue, Kara. You take too much of the drug. Remember, I am in command. I do what I please. I will give the word—but only when we have acquired the five million dollars' worth of gold bullion. I have my plans perfected. The money is necessary. I know what I am doing. And in the future, doctor, be very careful of your conduct. Remember, you are no longer essential to me."

A spasm of twitching contorted Kara's gaunt face. "Not essential? Where would you be now except for me? In a prison cell on this very island. And I, too, must caution you to take care, Pasha. I have foreseen treachery on your part and have prepared for it. I have written a full confession and put it into trustworthy hands in Turkey with the instructions that, if anything should happen to me, it is to be placed in government hands."

The doctor's eyes were burning. "I have revealed the whole story, Pasha. How you came to Fuada a prisoner, and by murder and bribery gained control of the prison. How you forced me to divulge the secrets of the deadly Calabar poison and the Z injection that counteracts it. How you have used these drugs on the prisoners and enslaved them by threat of death.

"I have written at length, Pasha. I have revealed that the supposedly uninhabited Calabar Island is the headquarters of the Purple Fez, where you keep your squadron of fast airplanes and your submarine. I have told of the robberies you committed in South America and of the gold-carrying ship which you looted and torpedoed with all aboard.

"I have told about the great fortune you have hidden on Calabar Island. And, Pasha, I have revealed every detail of your plan to overthrow the dictator and unite the Moslem world under your leadership——

"Not essential to you, Pasha? Think well before you act violently with me."

Aziz Pasha leaned back against the cushions, his fat face an impassive mask. Then he said, with deceptive softness, "I but jest, Kara. You and I must remain allies—or else we will swing from the same rope. You have been of inestimable help to me—and your reward will be great. When I am established ruler, you will be made my second in command."

Kara smiled thinly. "Perhaps."

"And remember this, doctor. I may have wreaked personal vengeance upon my two betrayers—but in so doing the incriminating documents which they sought to take to the dictator were destroyed."

"You are not even sure of that," Kara said. "Number Six reported the papers to be blank."

"Invisible ink does not show until properly treated, doctor."

"True. Perhaps invisible ink was used. But also, perhaps those papers were put there as a ruse—and that the real documents are elsewhere."

Aziz closed his eyes. For a long minute he was silent, then he said quietly, "Perhaps—perhaps. It might be well to make sure. Two brothers, Bill Barnes, and his lawyer, Paul Ross, were the only persons concerned with the papers. Two of the four are dead. Two still live. Yes—we must make very sure."

A slow smile came to Aziz's thick lips. "There will be no more danger when Paul Ross and Bill Barnes lie dead."

## VIII—THE PRISONER

IT LACKED a few minutes of eight a. m. when Bill Barnes was again seated in his office in the administration building. Shorty, Cy and Sandy were there, also.

Bill had landed the Lancer at the home field fifteen minutes before and the unconscious prisoner had been taken to the airport hospital. The doctor had treated Bill's gunshot wound, which, fortunately, had proved to be slight. A heavy bandage now encircled the pilot's head.

"That's what happened, fellas," Bill said as he finished, giving a clipped account of the events that had just transpired. "I saw him take the papers out of the case and tear them to shreds." His broad shoulders slumped. "What a sap I turned out to be!"

"But, hell, Bill," Shorty said, "you got that mug a prisoner. He should know plenty. Maybe he'll talk when he comes to."

"He'll talk, all right," Bill said coldly. "The doc says he's got a slight concussion. He'll recover consciousness soon. He'll talk—or else. But he may not be able to tell us much."

"And there was nothing in the attaché case when you found it?" Cy asked.

Bill gestured to the wastebasket, where he had thrown the charred remains of the case. "There it is. Empty."

Sandy left his chair and walked over to the basket. He was carrying Alphonso's battered suitcase by its improvised rope handle. The boy looked down at the fire-ruined attaché case. "Golly," he said plaintively. "*Kaaa-chooooo!* What a swell bag it was, too. Just the thing for Alphonso—— *Kaaa-chooooo!*"

Bill said irritably, "I thought I told you to start for Florida."

Sandy blew his nose. "The Eaglet's being checked over now, Bill. *Kaaa-chooooo!*"

Shorty said suddenly, "Hey! Paul Ross might know something, Bill. Isn't he the guy Riza was dealing through?"

Bill nodded. "I thought of that. But every break's against me, looks like. I phoned Ross' office soon as I got in here. He isn't there. He's up at his hunting lodge in the Adirondacks. His secretary told me she'd been trying to get him on the phone earlier, but couldn't. There was a heavy snowstorm up north last night. All the wires are down. Isn't that swell?" He shook his head grimly. "I'm going to fly up there to see him. But before I go, I want to hear what that prisoner has to say."

Cy said, "Isn't there something we can do, Bill?"

"No." Bill looked sharply at Cy. "Shorty gave you and Bev your orders?"

"Yes."

"O. K. Your job is to guard that gold train—no matter what happens here." Bill leaned back in his chair. "Now you guys clear out. I want to do a little thinking."

Shorty said "Sure," and, motioning to Cy and Sandy, started for the door.

Sandy lingered behind as the other two left. His eyes went again to the mutilated attaché case in the wastebasket. He said, "Say, Bill——"

The sharp rasp of the telephone bell cut him short. Bill jammed the receiver to his ear. "Bill Barnes."

It was the field doctor talking. He was excited. He said, "Bill! Your man's conscious, but he's gone wild. We've got him strapped down. Get over here—fast!"

"Right!" Bill slammed down the re-

ceiver on its hook, came to his feet with a lunge.

Sandy started talking rapidly. "Wait a sec, Bill. Listen: The handle on that burned case is still good. I could use it in place of this rope on Alphonso's bag. How about it? Could I have it?"

Bill was racing toward the door, the boy dancing in front of him. Bill said furiously, "Sure—sure—— Only get out of my way, will you!"

Angrily he brushed Sandy aside, bolted out through the doorway and down the hall. He heard Sandy shout after him, "Thanks. If I don't see you before I leave—*kaaa-choooo!*—good-by." But Bill didn't answer.

The airport doctor was standing in a gleaming, white corridor. He saw Bill and beckoned frantically. When the airman came up he said, "He's gone stark, raving mad."

Bill went into a small room. The Turk he had captured was lying on his back on a raised hospital bed. The man was straining against the four stout straps that bound down his body. His eyes were blazing. A torrent of foreign words poured from his mouth.

The noise echoed and reëchoed in the room. The doctor stood beside Bill, his face worried. "I've taken tests. They're being examined in the lab now. He gives every indication of being under the influence of a drug."

Bill moved over to the bed. He spoke to the prisoner, at first coaxingly, then roughly. But the man gave no indication that he had even heard or seen Bill. His raving continued. He was fighting furiously to get free. Perspiration streamed down his lean, swarthy face.

The doctor said to Bill, "I'll give him a hypodermic. That should quiet him."

Bill nodded.

As the doctor hurriedly departed, Shorty came inside. "Good gravy!" he shouted at Bill to make himself heard. "You sure got him talking like you said. What's he raving about?"

Bill scowled. "You got me. Arabic. Of course, he wouldn't use English," he added bitterly.

The prisoner did, but only after twenty agonizing minutes had passed—minutes in which the administered hypodermic seemed to have had no effect. Then suddenly the man had collapsed, exhausted.

Bill repeated the question he had been vainly asking: "Do you understand English?"

The prisoner said weakly, "I understand—I understand——"

His eyes looked up, mirroring stark fear. Before Bill could speak, the Turk said, "Get me to the island—quick—— My time is almost up—I must have the Z injection. Take me to the island——"

Bill leaned over him. "What island? I'll take you. What island?"

The prisoner didn't seem to hear. "I'm going blind—— It is the end—— Get me to the island—quick—— The password is 'kismet.' Show the purple fez—take me—before it is too late—— The island——"

"Where is it? What island?" Bill asked frantically.

"I must have the Z injection—I must—I am going blind—blind—— Help! Oh, Allah—Allah——"

A tremor shook his body. Then he went still.

The doctor bent quickly over the bed. When he straightened up he said quietly, "This man is dead."

## IX—ALARM

BILL sat down in a chair as the doctor pulled the sheet over the dead man's face. The room grew strangely quiet.

Shorty said, his voice low, "If he'd only told us the name of the island. I'll bet that's where Aziz Pasha is."

Bill nodded dejectedly, then said to the doctor, "Did he have any personal effects?"

"Nothing—— Wait a minute, he did. This thing was folded in his pocket." The doctor took a roll of cloth from the bedside table.

But it was only after Bill had unfolded it that he saw what it was—a purple fez.

Shorty whistled. "Say, that's what he was talking about! You say, 'kismet,' then show that fez."

"But first you have to know *what* island to go to," Bill said gloomily. He rolled up the fez and stuck it in a pocket, then turned to the doctor. "What'd he die of, doc?"

The physician looked puzzled. "Narcotic poisoning of some sort. I can't define it further than that, although the man's symptoms and his look after death are vaguely familiar to me. It's probably a rare drug. I may have read about it somewhere." He headed for the door. "I'll check up on the lab tests."

But when the doctor came back the expression of puzzlement was still on his face. "It's got me stopped. He died from the effects of an administered drug—but what drug, I don't know. The Z injection he spoke of undoubtedly was something that would counteract the poison."

Bill looked up sharply. "Listen—Assaf Riza died just the way this guy did. Got terribly excited, then went blind."

"Probably the same drug," the doctor said.

"Exactly." Bill came to his feet, his face flushed. "This drug must be rare, or you'd recognize it, doc. If we can find out what it is, we might get a lead. Can you make further tests?"

"Yes. I can take the cadaver to the Huntington Hospital and perform an autopsy. Dr. Holmes there is an authority on narcotics. I could consult with him."

Bill said "Swell. Get going!"

Ten minutes later the field ambulance, carrying the corpse of the Turk, raced away down the desolate road toward the distant town of Huntington. The doctor rode beside the driver on the front seat.

Bill and Shorty watched them go.

"I hope that'll net something," Bill said. "We've got to work fast. I'm going to call Ross' office again. Maybe they've heard from him. If they haven't, I'll take off for his lodge right away. Tell Martin to get the Lancer on the line, will you? And have Charlie fix some chow. I'll have to eat before I go—— Say, did Sandy get off all right?"

"Left half an hour ago," Shorty said. He swung away. "I'll look after things."

Bill hurried to the administration building and put in a call for his lawyer's office. As he waited, his eyes went to the charred attaché case in the wastebasket and he noted absently that Sandy had evidently taken him at his word and removed the handle.

The voice of Ross' secretary came abruptly through the receiver. Her news was discouraging. She hadn't been able to contact her employer. The snow storm of the night before had wiped out all means of wire communication.

Bill hung up. As he was pulling on his winter flying clothes, there was a knock on the door. Tony Lamport came inside. He was carrying a heavily sealed envelope.

"Bill, this came for you ten minutes ago by special messenger."

Bill opened the envelope, saw that it was a communication relative to the gold shipment. He said, "Wait a sec, Tony," then sat down at the desk and spread out the single sheet inclosure. The message was in code. Bill deciphered it with a pencil.

He said to Tony, "Have Shorty meet me at the mess hall pronto."

"Right." The radio operator went out.

Before Bill followed he applied the flame of a burning match to the sheet of paper and waited until the fire had consumed every portion of it. Then he hurried to the mess hall.

Charlie, the chef, had a hastily prepared meal on the table by the time Bill was seated. The airman attacked it hungrily.

Shorty came in as he was downing a cup of coffee. "Everything's ready, Bill," he reported.

"Good. Now listen——" Bill's voice fell to a whisper. "There's been a last-minute change made in the gold-ship-

ment schedule. The train leaves tomorrow afternoon, Sunday, at four p. m., *not* to-night. Tell Bev and Cy."

"O. K. Wonder why the switch."

"Taking an extra precaution, likely." Bill stood up, reached for his helmet and started for the door. "Come on. I'm taking off right now."

But he didn't. He had barely started down the outside steps when he stopped, his eyes widening.

Coming toward him was the doctor, supported by one of the airport's guards. The doctor's face was bloody and he limped as he walked.

Shorty said, "For the love of——"

Bill took the remaining steps at one leap. "What's happened?"

The doctor gasped for breath. "About a mile down the road—we were passing an oil truck—the man at its wheel pulled a gun, shot the ambulance driver—killed him—— The ambulance smashed into the ditch. I was thrown free—knocked out—— When I came to, the oil truck was gone—*and so was the body of the Turk!*"

## X—SNOW

THAT WAS at nine a. m.

But it wasn't until one thirty that afternoon that Bill was able to take off on his flight to the Adirondacks. For four and a half maddening hours, he had been held at the field while the police had conducted a routine investigation into the murder of the ambulance driver.

The result had been negligible. The oil truck had been found half a mile down the road from the wrecked ambulance—but the attackers and the stolen body had vanished.

And now, his tanned face darkened with anger, Bill swung the Lancer on her plotted course and moved the throttle steadily wider. The only solution seemed to lie with Paul Ross. And the sooner he could talk to him the better.

The Lancer hurtled on across the blue sky, its bullet nose aimed due north. Bill watched the country sweep away below and saw it gradually become whiter the nearer he came to his objective. And the sight of the dazzling blanket of snow brought a new worry to him.

On previous visits to the lawyer's lodge, he had always landed his ship at a small airport that lay in the valley down the mountainside from Ross' place. But would the snow storm that had blocked all telephone communication now also block safe landing? Would the airport's runways be cleared?

They were. Bill saw that with relief as he circled the Lancer over the valley at three forty-five. Minutes before he had swooped close to Tennet Mountain and had caught a brief glimpse of Ross' solitary, tree-masked log cabin. And better still, he had seen a line of smoke coming from its chimney.

Bill closed the throttle, landed the amphibian down a snow-banked runway and taxied toward the two hangars and the small administration building.

As he swung down from the cockpit, a man came hurrying from the building. He called, "Mr. Barnes!"

Bill recognized him as the airport manager. He said, "Hello, Parker," and shook hands.

The man's grip was tight. "I heard your machine and looked out. And I said to myself, 'That's Mr. Barnes as sure as shootin'.' Couldn't mistake the Lancer. This is sure a pleasure. First time I've seen you for nearly a year."

Bill nodded. "A long time. Will you look after the crate? I'm going up to see Mr. Ross. He's up there all right, isn't he?"

"Sure is. Only yesterday he made the run down from his place to here on skis. You can make it straight from his front porch to here now. But I guess you'll be tryin' that yourself."

"I'm afraid not," Bill said. "Wish I could get in some skiing, but it's business this time." He looked up at the snow-packed mountainside. "Is the road to the lodge cleared?"

"Reckon not." The manager chuckled. "You'll be lucky if you can find the road. Heap of snow came down last night. Afraid you'll have to make it up there afoot, Mr. Barnes. It'll be tough going."

It was tough going. Bill realized that after half an hour of floundering through knee-deep snow. And it grew tougher as he struggled on, following the winding course of the buried road. His progress was slow. Time and again, he was forced to stop and rest. But an anxious glance at his wrist watch always sent him on again.

Time was flying. Already the sun was dropping below the mountainous horizon. And it had disappeared entirely when Bill, looking up the tree-packed slope ahead, caught a glimpse of the lodge. Smoke was coming not only from its chimney but from the chauffeur's quarters in the garage at the rear.

A glow of light came from one of the windows. Bill cupped his hands and yelled, "Hey, Ross!"

But no one answered. No one appeared.

Bill frowned and plodded on to the log building. The place was almost buried with snow. The veranda was piled high. Bill went up the steps and crossed to the lighted window. He rubbed the glass clear and looked inside.

The glowing embers of a wood fire lay on the hearth of the open fireplace. And in front of it, stretched out on a couch was Paul Ross.

Bill hammered on the window. "Ross! Let me in!"

He saw the lawyer make a feeble motion with a hand, but he didn't get up. Alarmed, Bill hurried to the door. It was unlocked and swung inward under his pressure. He banged it closed behind him and ran across the room. "Ross! Anything wrong? Ross—it's Bill!"

The man was lying on his back. He moved a hand across his eyes and said weakly, "Bill? Thank God—I'm sick—I don't know what happened—I was waxing my skis—when I got delirious and—— Now I can hardly see—I'm going blind——"

*Blind!* The word exploded across Bill's brain.

The lawyer spoke again. "Bill—what are you doing here? I thought you were—flying to—Turkey——"

Bill said desperately, "Riza was killed. The papers were stolen from the attaché case and destroyed. Quick, tell me everything you know about Aziz Pasha."

Ross tried to get up. "The papers—were taken from inside—the case?"

"Yes."

"Have you—got the case—itself?"

"Yes. It's been badly burned."

Ross' voice was growing weaker. "The papers inside—were dummies—— The real documents—are—in the—handle——"

"The handle!" Bill almost shouted the word. "But Sandy's got it. He put it on his bag. He's gone to Fort Lauderdale, Florida!"

"Get the handle—take it—to Turkey—— Bill—I'm dying—I know—now—— I can't see—anything——"

His voice faded to nothing and he lay still.

Paul Ross was dead.

Bill's gaze whipped across the room. At the rear, below a window, was a long table. On it was a pair of skis and half hidden behind them—a telephone.

Bill made for the instrument, praying that service to the outside world had been resumed. If so, he'd call the field, have them radio Sandy to return north instantly!

As he ran, Bill caught a glimpse through the window of the moon-bathed garage. Smoke still trailed up from its chimney. But if the chauffeur was there, why hadn't Ross sought his aid by using the phone extension to the garage? It could be operated independent of the main line by the throw of a lever. Why hadn't the chauffeur come? Had he, also, been murdered?

The questions flicked across Bill's mind and went unanswered as he reached the telephone. He lifted the receiver and saw that the lever connecting the house-to-garage extension was in place. He started to throw it over in order to call the operator. Then—he froze!

The telephone hook hadn't moved upward when he'd lifted off the receiver.

Suddenly he realized why. A match had been wedged under the hook, so that, even with the receiver in position, the extension between the house and the garage had been constantly in operation!

*It meant that every word spoken in the lodge could have been heard in the garage!*

A murmur was coming from the receiver. Bill jammed it to his ear just in time to catch a man's voice saying, "Send it quickly. They await in the valley to receive it."

In that flashing second, the whole appalling situation became clear to Bill. Instead of Ross' chauffeur—agents of the Purple Fez must be in the garage. And the man who had just spoken must have been one of them.

Then, even as Bill's gaze stabbed through the window to the building behind the lodge, a brilliant ray of light came from the upper window of the garage. It blinked on and off with blurring rapidity.

Morse code!

Bill's trained eye read the rapidly sent message.

SANDERS HAS DOCUMENTS IN BAG HANDLE LANDING FORT LAUDERDALE. GET HIM.

## XI—DESCENT

THE ENEMY knew—knew everything! The information had been sent to confederates in the valley and would be relayed on. They were going after Sandy!

Frantically hoping that he might still be able to telephone to the outside, to the home field, Bill threw the lever, disconnecting the garage extension. But an instant of listening told him that the main line was dead.

That left only one course of action. He had to get to the Lancer, get to its radio, warn Sandy direct.

The enemy had heard him talking to Ross, had probably heard the click as the extension connection had been severed. They would be coming after him at any minute. He must hurry.

Bill dropped the receiver, half turned, and his eyes fell on the skis lying on the table. Instantly, he had a plan.

Bill grabbed up the long strips of polished hickory, dashed across the room, opened the door and rushed outside. Hastily, he laid the skis on the snow and jammed his boots into the toe irons. His fingers trembled as they jerked the straps of the bindings tight. In the next second the enemy agents might appear.

Bill stood up, took out his automatic. Holding the weapon ready, he pushed forward across the clearing. The skis glided smoothly on the hard snow surface. Under the brilliance of the full moon, he saw the place where the ski trail began. If he could only get to it, start down it before he was discovered.

But he had barely crossed half of the clearing when he heard a shout and caught a glimpse of two men running from behind the lodge.

A gun roared. Snow kicked up in front of Bill. Another shot followed, and another. The enemy was shooting with ill-aimed haste.

Bill twisted around, brought up his automatic and pulled the trigger. One of the men shrieked and plunged to the snow. The other was now kneeling, taking careful aim.

Bill crouched down on the skis. His speed was increasing. He was at the lip of the slope. As he went over it, he heard the blast of the enemy agent's gun. The bullet cut the air within a yard of him. Then he was tearing down a steep incline. Three shots followed him.

He jammed his gun in a pocket, crouched farther down on the wooden runners. His eyes were pin points of concentration as he watched the clearly remembered white trail ahead.

Far below he caught infrequent glimpses of the lights of the airport. They were growing brighter. His excitement mounted. The wind whistled past him as the mad, zigzagging plunge

The purple fez.

continued. Never for a second could he relax his concentration. Every turn, every new jump held danger. Every last bit of his experience and skill was needed.

He estimated that he was more than halfway down. And then, without warning, came swift disaster.

He was streaking through a heavily shadowed section of the trail. He failed to see a short jump until he was right at it. He was thrown off balance. The skis swerved away from the trail. The tip of the left one caught in an exposed root. The ski broke with a loud crack—and Bill was pitched headlong.

He landed with breath-taking force in a tangle of underbrush. The heavy blanket of snow broke the full impact of his fall. But he lay for a moment half stunned.

Then, the awful significance of what had happened whipped his senses alert. He groped for the harness straps, unfastened them, kicked the broken ski and its companion from his feet and staggered erect. He had to continue the rest of the way as best he could by foot.

Slipping, falling, sliding, Bill went down that steep slope, clinging to vines, to tree branches. Somehow he reached the bottom, his clothes torn, his face and hands scratched. The wild descent seemed to have taken hours. Actually, it had taken twenty minutes.

Bill saw the lights of the airport two hundred yards ahead. He ran. He reached the administration building and shouted. The office door opened and Parker, the manager, came outside.

Bill gasped, "Get the Lancer out—quick!"

Parker took one horrified look at the battered pilot, then without asking a question, turned and made for the hangars. Bill went after him.

As the door of one of the hangars was opened, Bill dived through. Lights sprang on and he saw the Lancer. He sprinted to it, swung himself up the fuselage and into the cockpit.

He snapped on a switch on the radio panel, jammed ear phones over his head, pulled the microphone to his mouth and shouted into it, "Calling Sandy Sanders . . . B. B. calling Sandy Sanders. . . . Urgent. . . . Please answer quickly. . . . Calling Sandy Sanders. . . . Urgent. . . ."

He stopped and listened. But no voice responded through the ear phones.

Parker had summoned a mechanic and between them they were rolling the Lancer outside the hangar.

Again Bill clipped his frantic call into the microphone. Then the ear phones crackled and he heard, not the voice of Sandy, but of Tony Lamport, the field radio operator. "Bill? Is that you, Bill?"

"Yes. I have to contact Sandy. It's life or death."

Tony's voice was clear. "I heard your signal and cut in. Sandy reported half an hour ago. He'd just landed at Fort Lauderdale."

"Where is he now?" Bill said frantically. "I have to get him!"

"He put the Eaglet in the hangar down there. Said he was heading for the movie studio. What's wrong anyway?"

"Get hold of him. Phone the movie studio. Do something. The documents are in the handle of Alphonso's bag. The Purple Fez knows. They're going after him. Contact him somehow. Warn him."

Tony said, "Right. Call you back."

Bill had the Diesels hammering smoothly and the Lancer poised at the end of the snow-cleared runway when he heard Tony's voice again.

The radio operator said, "He's left the airport. Hasn't arrived at the studio. I'm doing everything possible."

Bill's grip tightened on the microphone. Anguish was in his voice. "Keep trying. They'll kill him if they get to him. I'm taking off. I'm heading for Fort Lauderdale!"

## XII—THE CANAL

NIGHT was gliding into Fort Lauderdale skies when Sandy and Alphonso left the Eaglet in the new metal hangar at the Municipal Airport and walked toward the taxi stand.

The boy gripped the fire-scorched handle of Alphonso's small suitcase in his right hand. And in his left he carried his own club bag. The monkey was riding on his shoulder.

Sandy was grinning happily. "Alphonso, this is your great moment. *Kaaa-choooo!* The portals to cinema fame are awaiting your entry." The boy looked toward the single parked taxi. "Yon chariot awaits. *Kaaa-choooo!*"

As they approached the taxicab, Sandy heard the increasing roar of an engine and saw a man on a motor cycle streaking down the road to the airport. The boy watched eagerly as the machine came to a skidding stop near the taxi stand.

Sandy said, "Golly, I betcha they've sent a police escort for you, Alphonso, like all movie stars get."

But as he came nearer, the boy's eager expression turned to disgust. The man was dark-complexioned and wore soiled flying clothes and helmet—and was obviously not a policeman. He sat astride his machine, keeping it erect by his wide-spread legs.

The driver of the lone taxi was coming to meet them. He said, "Cab, kid?"

"Certainly," Sandy said. "*Kaaa-choooo!*"

The driver looked at Alphonso. "You wanna take the ape to the Miami zoo?"

Sandy showed his annoyance. "I am Mr. Sanders," he said loftily. "And this is Mr. Alphonso, the embryo motion-picture star. You will kindly transport us to the studios of Astonishing Pictures, Inc."

The man on the motor cycle looked over at them sharply and Sandy felt a glow of pride. That movie stuff always got them.

The taxi driver was saying, "Look, kid, the studio will be closed up for the night."

"Our coming has been announced by telegram," Sandy said. "They will be awaiting us. *Kaaa-choooo!*"

"O. K. You're the doctor." The driver took the bags from the boy and placed them on the floor of the rear seat. "That movie joint's miles west of here, damn near in the 'Glades."

Sandy climbed into the car and put Alphonso on the seat beside him.

The driver slipped behind the wheel and swung the car along the winding road down which the motor cyclist had come.

Thereafter, the dusk-shrouded landscape became more desolate with no houses visible in the wilderness of palmettos. The road was deserted save for a dilapidated automobile driven by a Negro. They passed it with a rush.

Sandy said, "Hey, driver, are you sure you're going in the right direction? *Kaaa-choooo!*"

The driver laughed. "Sure. I told you the joint was miles from anything."

The car jolted over a small concrete bridge that spanned a narrow hyacinth-choked canal. Sandy looked worried.

Alphonso scrambled up on the back of the seat. As Sandy turned to pull him down he glanced out the rear window—and started. For racing along the road behind them was the motor cyclist he had seen at the airport. The man was bending over the handlebars, coming fast.

The taxi driver had seen him, also, and swung the cab farther to the right to let him pass before they crossed another canal bridge. But as the motor cycle swung alongside, its speed slackened and the rider whipped out a revolver and yelled, "Stop!"

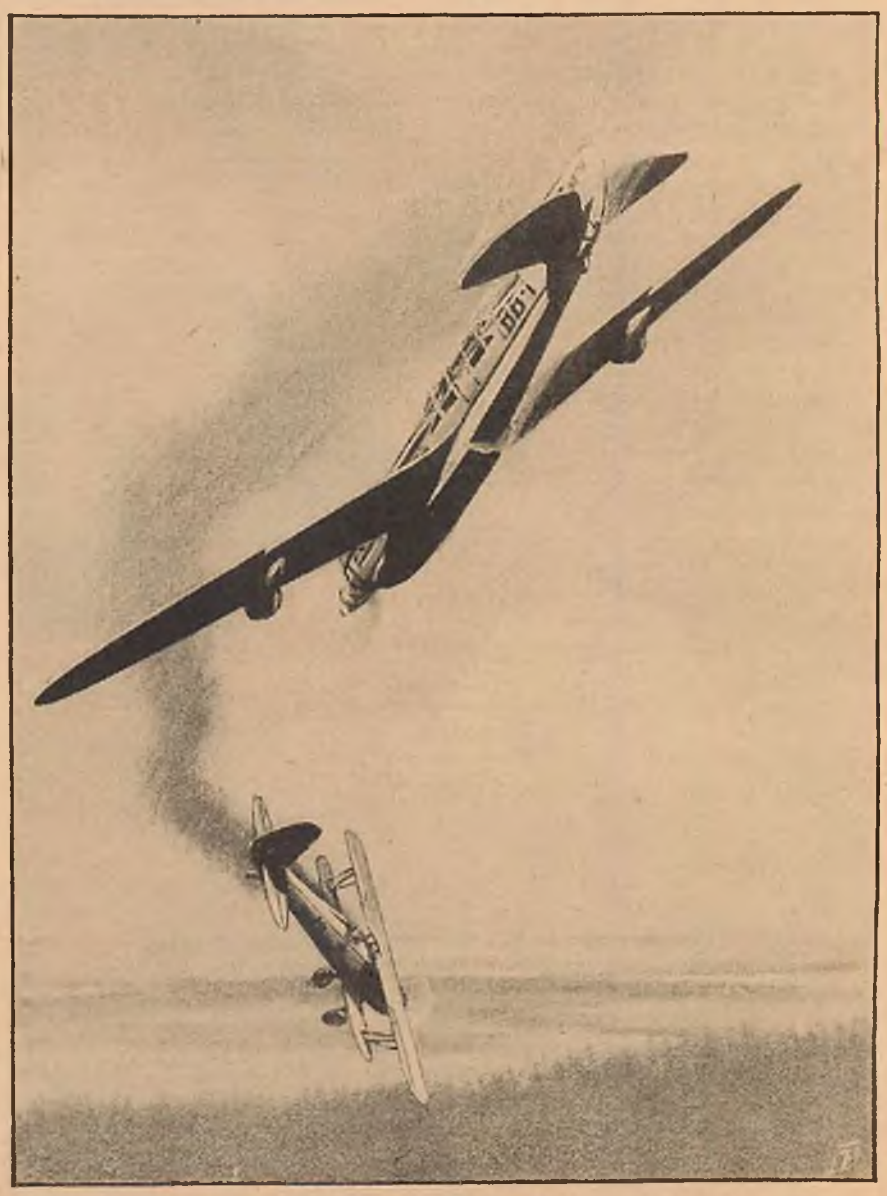
The taxi driver gave him one frightened look, bellowed, "Holdup!" and jammed his foot down on the accelerator.

The cab leaped forward.

Sandy sent a startled glance back. He saw the man on the motor cycle level his revolver and take careful aim. The boy shouted, "He's shooting!"

His words were drowned in the roar as the gun fired. The bullet smashed into the cab's left rear tire. The rubber blew out with a deafening bang.

And the taxi, within a yard of the



The biplane was apparently out of control, but Bill followed it down.

canal bridge, swerved violently, plunged off the road through a mass of undergrowth and came to a sudden stop, its engine half submerged in the weed-choked waters of the canal.

The impact had hurled Sandy to the floor; the monkey was on top of him.

Then the rear door was suddenly wrenched open. The gunman reached inside, seized Sandy's two bags and fled.

Sandy's senses cleared with a rush. The man was stealing Alphonso's clothes!

Enraged, the boy struggled to get to his feet. But by the time he had wormed through the open door, the gunman was astride his motor cycle and was racing away.

Sandy yelled at him, plunged through the undergrowth toward the road. Before he reached it, he saw an automobile pull to a stop a few yards away.

A Negro was at the wheel of the dilapidated sedan and instantly Sandy recognized it as the car they had passed but minutes before.

The Negro left the motor running and stepped cautiously from the car, the whites of his eyes showing in fright. "What—what's y'all doin' down there, boss?" His voice quavered.

Sandy scrambled up on the road. "Robbery!" He pointed to the now-distant motor cyclist. "I got to catch him. Gimme your car!"

The Negro was terrified. "No suh, boss. I'se got to pick beans to-morrow. I needs——"

But Sandy scarcely heard. The sight of the fleeing thief shot bitter anger through him. He brushed past the Negro and leaped into the car.

As he threw in the gear, Alphonso suddenly appeared at the roadside and with a leap landed on the seat beside him.

## XIII—MISHAP

FAR TO THE NORTH, as the Lancer screamed through icy, black skies, Bill waited in agony for news of the boy.

The amphibian's wheels had flicked off the snowy runway of the Adirondacks airport at five minutes after seven o'clock. And now, with every succeeding minute an eternity, Bill held the Lancer due south and listened for Tony's next report.

The lights of Albany were glimmering in the black void when the report came. It was simply, "Nothing new, Bill."

Then again, fifteen minutes later, with the Catskills passed and Poughkeepsie showing under the Lancer's right wing, "Still trying, Bill. But—nothing."

Nothing as New York State whipped away unseen. Nothing, as the Lancer shrilled across New Jersey and into Pennsylvania.

Then, with Philadelphia an artificial sunrise ahead, Bill's ear phones crackled again. And again it was Tony. But now his voice was excited. He said, "The driver of Sandy's taxi's been found. Reports they were attacked near the Everglades. Taxi cracked up. Sandy's bags stolen. Attacker got away on motor cycle. Sandy commandeered a car and followed. He hasn't come back. He hasn't been found."

Bill's grip tightened on the control column. He said, despairingly, "Have them search for the car. Have the taxi driver meet me at the Fort Lauderdale airport. I'll be there before midnight, if my luck holds."

His luck held and saw him cleave the inky skies of Maryland, of Virginia, of North Carolina, of South Carolina. And then, with the Lancer pelting within a hundred miles of Savannah, Georgia, abruptly, his luck deserted him.

It was nine forty-five when Bill first noticed the fluttering of the tachometer needle and the slight catch in the Diesels' smooth flow of power. Within five minutes the instrument showed an increased loss of revolutions and the entire ship was vibrating.

Bill leaned forward in the cockpit. One of the cylinders was skipping, firing weakly and sometimes not at all.

The situation grew worse. The pick-up in vibration and loss of power became alarming.

Bill inspected his maps, saw that Savannah lay straight ahead. He reduced the throttle and radioed Tony. When contact was made, he said, "Engine's gone bad. Sounds like trouble in fuel pump. Landing at Savannah airport. Report later. Anything on Sandy?"

"Same as before."

Half an hour later, with the Lancer resting in a hangar at the Savannah airport, Bill spoke again to his field. "Bad news, Tony. The Lancer's out. Wall of one of the cylinder's been badly scored. Have to be smoothed. New piston fitted. Major repair job. They can't handle it here. Get me Martin."

When the head mechanic came to the radio, Bill tersely explained the situation. Then, "Repairs must be made as fast as possible. Bring two of your men here in the transport. . . . Switch me back to Tony."

After a minute Tony said, "Shoot, Bill."

Bill's words were crisp. "Martin and men to proceed here in transport. Order gunners and full crew aboard, in case of trouble. Shorty and Red to fly Snorters as escort." Utter despair crept into his voice. "I'm leaving the Lancer here. Going to Fort Lauderdale by air liner. She's due here in an hour. It's the only thing to do."

And then, as if he hadn't had enough, his plans received another setback. For at eleven o'clock when the Miami-bound Douglas landed and Bill boarded her, the chief pilot refused to make a stop at Fort Lauderdale.

"I wish I could, Mr. Barnes," he said miserably. "You know that. But orders are orders. I'll have to take you to Miami. I'll radio to have a private ship and pilot waiting to fly you to Lauderdale. It won't take long. It's only twenty-five miles."

There was nothing for Bill to do but consent.

## XIV—THE SEARCH

IT WAS six o'clock Sunday morning when Bill hastily changed from the transport to a private ship at the Miami airport and took off for Fort Lauderdale.

The twenty-five miles through the dawn-streaked skies were quickly covered. As they landed and headed down a lighted runway toward the hangar at the end of the field, Bill saw a car speeding toward them. He said to the pilot, "Hold it a minute."

The plane was braked to a stop and Bill narrowly inspected the oncoming car. He saw that it was a taxi. As it halted alongside, a policeman jumped out. He looked up and yelled, "Mr. Barnes?"

Bill had the cabin door open. He said, "Yes," and climbed down to the concrete. "What's wrong?"

The police officer came over. "Plenty. I've been watching every plane for you. Want to warn you. We grabbed a foreigner at the field here early this morning. He was armed and had a newspaper picture of you. We've got him down at the station. Looks like he was out to plug you. May be more of his breed loose. You'd better be careful."

Bill nodded grimly. "Anything new on Sanders?"

"Yes. The car he used was found empty northwest of town. About an hour ago."

"What!" Bill grasped the policeman's arm fiercely. "What about the kid?"

"No sign of him. We haven't had much chance to look around yet. Too dark." He gestured toward the taxi driver. "Mike, here, was driving Sanders when they were attacked. He's been waiting for you all night. He'll take you to where the car is, if you want to go."

Want to go! Bill hurriedly dismissed the plane and entered the taxi.

The taxicab raced away from the airport. Bill said, "The faster the better, Mike."

The driver nodded. "O. K. I sure hope nothin' happened to that kid. He was a funny one."

They had gone but two miles when the police officer they had left at the airport overtook them on his motor cycle. As both vehicles slowed, the officer shouted, "Just got broadcast from headquarters. That foreigner's escaped.

Shot his way out. Watch yourself, Mr. Barnes."

He swung his machine around and headed back.

The driver said, "Holy Moses!" and stepped on the gas.

Five miles farther on, the cab turned off the highway and swung along a narrow road that snaked through a matted wilderness. The driver said, "It's along here somewheres."

But another mile had been passed before they sighted the old sedan parked at the side of the road. The taxi pulled up behind it and Bill got out.

A quick inspection of the deserted car revealed nothing. Bill said to the cab driver, "I'm going to look around. You stay here."

A wall of solid greenery confronted Bill on either side as he headed up the curving road. Mangrove thickets grew out of the muck, interlacing the closely packed trees. And over all was a leafy blanket of vines and giant cobwebs of gray Spanish moss.

Bill passed around a bend of the road and then stopped, his gaze ranging over the tangle despairingly. Even armed with a machete a man couldn't penetrate far into that jungle. But where had Sandy gone?

The early-morning light had increased, and, just as the pilot was about to start back to the taxi, his attention was suddenly focused to the side of the road. He hurried over, bent down. Instantly excitement flared. The man who had attacked the cab and stolen Sandy's bags had ridden a motor cycle. And now, in that soft soil under Bill's very eyes, was the clear imprint of a single rubber tire!

The tire track led away from the road at a right angle, dipped down the mossy slope and disappeared into an almost solid mass of twisted vines.

Bill immediately tried to follow it. He extended his arms to push through the foliage and, with a start of surprise, he found that the thick vines parted like two huge curtains. Beyond, a narrow path led into the depths of the shadow-blackened wilderness.

With his automatic ready, Bill pushed through. And the vines swished closed behind him. Cautiously, he followed the path, his eyes searching for the imprinted tire trail. And then, twenty yards farther on, the marks of the motor cycle tires faded and disappeared in the spongy moss underfoot.

Bill stopped, leaned down. Then, without a second of warning, it happened. Something hit him squarely on the back of the neck.

He stumbled, fell to one knee. He twisted around, swung up his gun. He saw a small, hairy face, a pair of beady eyes looking over his shoulder. He gasped, "Alphonso!"

The monkey was dressed in his miniature flying suit. His small arms went tightly around Bill's neck and he whimpered.

Bill pulled him down, and stroked his sleek head. Alphonso here! Then Sandy couldn't be far away. But where?

The monkey squirmed away from Bill, jumped to the ground and scampered down the path. He stopped, looked back at Bill, then went on.

Bill whispered, "O. K. I'll follow."

Then, with the monkey ever in the lead, the pilot went along that gloom-shrouded, winding trail. Two hundred yards had been passed when Alphonso abruptly disappeared through a screen of greenery that choked the trail. Bill parted the foliage.

Straight ahead was a high, concrete wall overgrown with creepers and vines. And in the wall was a wrought-iron gate.

Alphonso had scampered up the wall and was poised at the top. Bill hurried to the gate and looked through the open grille work. Beyond, almost completely hidden by trees and shrubs, was a house. It was Mexican in design and seemed to be in the last stages of decay.

Suddenly from the direction of the road came the sound of a human voice raised in terror. The taxi driver's! He was shouting, "Mr. Barnes! Look out! The foreigner's coming!"

## XV—DEATH

BEFORE the echo of that warning shout had died, Bill heard a loud crackling of bushes. The foreigner who had escaped from the police! He was coming down the trail!

The noise was increasing. And now Bill could hear the man's labored breathing as he raced nearer.

Quickly, the pilot dodged off the trail and crouched behind a dense thicket, his automatic held ready. And no sooner had he concealed himself than a wild-eyed Turk came plunging into view. He was running furiously. His swarthy face was bleeding from thorn scratches. A torrent of words was streaming from his mouth, "The plane—the plane—— You have kept me too long—past my time—I must get to the island—Allah—Allah—— The Z injection——"

He raced straight for the gate in the wall, banged it open and disappeared inside.

Bill threw caution to the wind and followed. But by the time he had sprinted through the gate, the Turk was halfway across the grounds and making for the house.

Alphonso leaped from the wall to Bill's shoulder and clung there as the pilot raced on through.

With a furious spurt of speed, Bill reached the front of the house. The Turk had gone inside, could be heard pounding across the floor.

Bill went up rotted steps and into a large room, empty of furniture and grimy with the accumulated dirt of years. But the pilot scarcely saw it. The Turk had passed straight through, had gone out a door in the rear.

Bill reached that door, flung it open and found himself looking down upon a wide canal. He saw a boathouse. And floating at the end of a boom was a sleek, purple amphibian!

The Turk was running drunkenly down a wooden wharf that led from the house to the boat building. He stumbled and fell. His shouts of terror increased. He tried to crawl toward the airplane. Then, as the furious frenzy seemed to spend itself, he collapsed.

He was lying on his side, pawing at his eyes when Bill reached him. The pilot shook Alphonso from his shoulder and stooped down.

"Quick—I'll help you," Bill said. A hurried plan had formulated in his mind. "I'll take you to the island in your own plane. I'll get you the Z injection. But where's the island? Tell me!"

The man's eyes were blank. He said weakly, "No—it is too late. I am going blind. They left me—here to kill—the American, Barnes. He did not come. The police—they took me——"

Bill seized his shoulder and shook it. "Where's the boy—Sanders?"

"They took him—in another airplane—to the island. They will give him the drug. The Master of the Purple Fez ordered——" The man's voice faded away.

Again Bill shook him. "Where's the island? For Lord's sake, tell me!"

But the Turk didn't answer. He was dead.

Suddenly Bill heard his name being called and recognized the taxi driver's voice. He was evidently out somewhere in front of the house. Bill cupped his hands and shouted, "Come here. Back of the house. Everything's O. K."

By the time Mike had arrived, Bill had crawled over to the plane and slipped down into the rear cockpit. His experienced eye had gone over the instrument panel and the fittings. The amphibian was heavily powered and armed with two stationary machine guns. Her indicator showed the tanks full of fuel.

Mike stood on the wharf and said, "I tried to grab him. Couldn't. I was afraid he'd got you. He was acting crazylike——"

Bill worked the starter. He jazzed the booming engine, then throttled down. He called to the driver, "Help me get this ship out to the canal. I'm taking her to the airport. You notify the cops about what happened here."

Five minutes later, with Alphonso tied to the safety belt in the front cockpit,

the amphibian streaked down a long stretch of clear canal water and headed into the air.

Bill set her down on the Fort Lauderdale airport. As he stepped to the ground, the manager rushed over. "Your field's been calling," he said. "They're on the wire now."

Bill hurried to the office, seized the phone. Tony's voice sounded. "Bill! I've been trying to locate you. Everything O. K.?"

Bill gave him a clipped report of what had happened.

Tony said, "Listen: The doc's tracked down that drug. Here he is. Wants to talk to you."

The field doctor spoke quickly. "Yes. I've identified it. The drug's extracted from the Calabar plant. It's very rare. Only found on Fuada and Calabar Islands——"

Bill cut him short. "Fuada and Calabar Islands? Where are they?"

The doctor said, "Off the coast of Venezuela in the Caribbean. Fuada is the Turkish prison island, you know."

Bill's grip tightened on the receiver. "The Turkish——" He checked his words as sudden memory returned, but his thoughts went racing on. The Turkish prison island! Fuada! The island from which Aziz Pasha had escaped.

But had he? Could the headquarters of the Purple Fez be at Fuada? Mightn't——

Bill said into the mouthpiece, "Thanks, doc. Now put Tony on, fast!"

When the radio operator spoke, Bill said hurriedly, "When'll the Lancer be ready?"

"Repairs completed early to-night."

"O. K. Don't dare do much talking here. I've a plan. Orders to be sent in usual way."

He put down the receiver and without getting up from the desk he seized a telegram blank and wrote a message in code.

Deciphered it read:

> LANCER AND ALL SHIPS NOW AT SAVANNAH TO BE FLOWN TO LAUDERDALE SOON AS POSSIBLE. AM CONVINCED THAT SANDY IS HELD ON FUADA ISLAND. AM HEADING IN CAPTURED PURPLE FEZ PLANE IMMEDIATELY FOR FUADA. STAND BY AT FORT LAUDERDALE.
>
> BILL.

And at six o'clock that night, a thousand miles to the south, a purple amphibian streaked through sunset-dyed skies. And in its cockpit rode a grim-faced avenger, Bill Barnes.

## XVI—THE NIGHT

THE COLLECTION of all available charts and data on the south Caribbean, Fuada and Calabar Islands had delayed Bill's take-off from the Fort Lauderdale airport until noon. But once in the air, with the engine opened to its high cruising speed and a strong wind on his tail, he had come far and fast.

Aziz Pasha

And now, with the blackness of the night rapidly descending, the worries that had besieged him from the start crowded in closer. He was taking a wild, reckless gamble. How did he know that Sandy was on Fuada? And if he was, could Bill rescue him—or would they both die at the hands of the Purple Fez?

In the wild excitement that had attended the early hours of his flight, Bill had tried to forget the awful risks he was taking. And now, every passing minute brought the danger closer, closer.

He instinctively felt in his pocket for the purple fez that had been left by the Turkish prisoner who had died at the Long Island air field. The fez and the password "kismet"—that was all he had to help him.

Grimly, Bill forced his rigid concentration on the instruments. He had long since estimated that seven o'clock would see him in the vicinity of the island. And it was now six o'clock. In less than an hour——

The slightest error in navigation would defeat the whole plan. The islands were small and in the moonless, overcast night could be easily missed.

But as the hands of the chronometer stood at seven o'clock, he saw a glow of light ahead. The ship raced nearer and the lights grew brighter.

Bill leaned forward, his eyes staring. The charts and instruments indicated the plane was on a line for the islands. Then that light ahead must be either Fuada or Calabar!

A nerve at the base of Bill's throat began to throb. The amphibian roared nearer and the light became rectangular, larger.

Then Bill saw that it was a floodlighted field and that airplanes were taking off from it!

Airplanes!

Plane after plane was hurtling into the air. Bill could catch the gleam of their navigation lights now.

Quickly he swung the amphibian to the left and away. He looked back. The ships were gathering in the sky, into triads, heading north.

Now was the time to land. If any one should observe him, it would appear that one of the main body of ships was making a forced landing.

Yes. That was it. He threw the stick forward, closed the throttle. Lower and lower he glided toward the irregular blob of black that he knew was the island.

Far above, the planes were heading away. And more were taking off. Their thunder filled the night. Bill could now vaguely discern the rocky coast line dead ahead. He eased the plane down—down until the pontoons were lapping the water. The ship settled gently.

Bill stood up in the cockpit and searched the darkness that masked the shore. He took the purple fez from his pocket, placed his automatic inside of it. And, as the forward motion of the amphibian slowed, he climbed from the cockpit to the right pontoon. He crouched there, waiting.

Then, holding the fez-wrapped gun high in one hand, he slipped into the water. With the other hand he struck out for the shore.

The swim was short. Cautiously, he crawled up on the coral beach and lay still, straining his eyes and his ears. But nothing could be heard except the eternal hammering of engines.

Bill slowly got to his feet. And with his eyes on the reflection of the field lights, he started up the coral slope in that direction. He carried the gun still concealed under the fez and held it closely to him.

The grade was gradual and he hadn't gone more than ten yards when he struck a path. It led upward and Bill, as his eyes became more accustomed to the darkness, quickly followed it.

The night was hot and sticky and the exertion of his hurried climb brought perspiration to his body. The path ahead suddenly flattened off and Bill found himself gazing across a level stretch of ground. In the distance was the illuminated flying field. Silhouetted against the light were buildings.

And then he saw something else. Just five yards away a man had stepped out from behind a screen of bushes. He was holding a rifle. A sentinel.

He barked out a command in Arabic.

Bill's right hand swung the fez-concealed gun to cover the man. Discovery now would be fatal.

The sentry was coming at him. Again the Arabic command rang out.

Bill walked toward the sentry. He took a chance and muttered, "Kismet."

The man growled something and lowered his rifle.

Relieved, Bill started past him. But in that second a sudden beam of light swept over him as the sentry focused a flashlight.

Bill didn't wait. His left fist slashed out in a terrific jab. It landed on the man's jaw. The sentry was blasted back, smashed to the ground.

Bill bent over him. A quick examination revealed that the man was totally unconscious, that he had hit the back of his head against a projection of coral rock.

Stooping low, he went past the first building, his senses alert, his eyes ever watchful. The planes were leaving the field spasmodically now.

And during a lull in the roar of engines Bill heard a shrill sound come from within the building he had just passed.

*"Kaaachoooo!"*

He stopped instantly. Some one had sneezed. It had been a distinctive, high-pitched sound. Sandy!

Quickly Bill doubled back. He crept up to the single small window high in the side of the first house. Then, pressing his body against the frame side of the building, he stood on his tiptoes and took one hasty look through the window.

One look was sufficient. Sandy was inside!

Bill risked another look. There were other people in the room; he could hear them moving around, but the narrowness of the window restricted his vision.

The fat man was talking. Bill moved nearer and listened. "—we will be quite successful, young one. You see, the route to Fort Weston passes through the mountains and through Hunter's Tunnel. The train will be in three sections. The first and last sections merely carry guards. The center one has the gold. We will allow the first section to pass freely through the tunnel. But when the second enters, two things will happen: The far end of the tunnel will be blasted closed. Then a stream of poison gas will be released inside. It will kill every man aboard."

Bill reached the lip of the slope—went over it——

And then, with feverish speed, Bill stripped the dark cotton shirt from the man's body, hurriedly bound and gagged him. Then, seizing the flashlight, the pilot went on.

Five minutes later he was within a hundred yards of the flying field and the two buildings which bordered it. The nearest one was dark save for a light in one small window. But the building beyond was brightly illuminated and Bill saw men coming and going. The pilot started for it.

## XVII—THE EAVESDROPPER

IN THAT brief glimpse Bill had seen the boy tied to a chair, his back to the window. Seated in front of him was a fat man dressed in flying clothes. And on the fat man's head was a purple fez.

Bill stood rigid. Fort Weston! Hunter's Tunnel! A plan to rob the gold shipment! He heard Sandy say, "You won't get away with it, Aziz."

Aziz Pasha! The fat man was Aziz Pasha.

The man was talking again. "Verily, we will. I have arranged for every detail. The last section will be bombed

out of existence by my planes. And in the meantime, my transports will have landed at a designated place. My men, wearing gas masks, will enter the tunnel. The gold will be transferred to the transports. They will take off. They will fly to Apalachee Bay in the Gulf of Mexico and land. The bullion will be loaded aboard my submarine there."

Bill heard Sandy sneeze again.

Aziz laughed. "You will not suffer much longer from that cold, Sanders. I have planned to give you a certain cure—the Calabar drug. It can be given by injection or as a powder mixed in food. It is powerful, Sanders. The injection *you* will receive will be calculated to kill you in two hours, almost to the minute. I am quite sure of its effectiveness. I have used it continually on my men since I became master of Fuada, and this island of Calabar.

"Dr. Kara here has an antidote which he terms the Z injection. When my men are sent out on missions they are inoculated with the Calabar drug. If they do their work well and get back here in time, they receive the Z injection and they live. If they fail—they die. And sometimes it is more convenient that some should never return. Even if they have done their work well, they die—and their secrets die with them."

There was a silence. Then Aziz's soft voice came again, "I would have liked to have thanked the great Bill Barnes for his stupidity in losing the documents. But I now thank you, Sanders, for your kindness in delivering them to me. If those documents had ever reached the dictator, my plan would have been completely disrupted.

"But now, when my submarine conveys me to Turkish shores, the country will break out in revolt. The dictator will be overthrown. And at the same time revolution and bloodshed will sweep through all the Moslem countries. And I, Aziz Pasha, will be crowned Sultan of the united Moslem empire."

Then Sandy said defiantly, "You may kill me—but Bill will get you, if it's the last thing he does." The boy's voice broke.

And Aziz answered, "Your Bill has long since been looked after, young one. Yes, I will be quite successful. Before this night is over, Fuada and Calabar Islands will be completely evacuated. There are but two planes yet to leave the field: My personal one and another that will do rear-guard duty. And the remainder of my ground force will then embark on a vessel now in the harbor and leave for Turkey. Part of the great treasure that I have accumulated will go with them. The other part is aboard my submarine. And to it will be added the bullion from the gold shipment."

Bill heard knuckles thud on a door, heard hinges squeak. Some one spoke in Arabic. Aziz answered.

Then he said to Sandy, "My plane is now ready, Sanders. Dr. Kara and I must leave. My plane is faster, much faster than the others—but we must not tarry any longer if we are to catch up with the rest of the fleet. We cannot afford to miss the spectacle at five o'clock to-morrow morning at Hunter's Tunnel.

"Come, Kara. Give the hypodermic to Abdul. He will administer it to Sanders. We must hurry."

A chair scraped. Bill, aghast at what he'd heard, shot a quick look through that narrow window. He was just in time to see a tall emaciated-looking man step to Aziz's side. Then both men vanished from the pilot's line of vision.

Sandy was about to receive the Calabar injection! And Aziz and Dr. Kara were leaving! They had to be stopped. But first—Sandy!

Bill started around the building on the run. As he reached the corner, he saw Aziz and Dr. Kara hurrying across the lighted ground toward a biplane which was painted a pure white. Behind the white plane was one single pursuit ship. The last!

Bill brought up his automatic in the direction of the two criminals, then lowered it. No! He had to get to Sandy first!

He saw the entrance to the building, saw that only one man was standing by it. Hugging the wall, Bill approached him, his automatic gripped by the barrel. Then, like a panther, the pilot sprang. His right arm flashed up and down. The butt end of the gun crashed against the man's temple. He fell without a sound. Bill caught him and lowered him to the ground.

Bill turned, lowered his shoulder and threw himself at the closed door of the building. The door crashed open. He plunged inside.

He saw three men—and Sandy! One man was bending over radio equipment; another was standing near him; the third was holding a shiny hypodermic needle poised above Sandy's arm.

Bill pulled the trigger. His automatic blasted. The man with the hypodermic needle started to turn as a bullet slashed into his head. He pitched forward. The needle dropped from his fingers.

Bill swung his flaming gun in a blurred arc. The stream of bullets cut down the radio man as he wheeled, a gun in his hand.

But the third man was now shooting. A bullet whistled past Bill. The man shouted, fired again. But even as the muzzle of his gun belched flame, he staggered and fell, a slug from Bill's gun slashing into his throat.

Then Bill was beside Sandy. He had heard the kid's gasp of astonishment—and now Sandy was saying brokenly, "Bill—Bill—Bill!"

But the pilot was working quickly at the knotted ropes that bound the boy. He spoke rapidly, "Aziz and Kara are taking off. Just one plane left. We've got to get it. The one I came in hasn't enough fuel!"

The ropes loosened. Sandy struggled free. Bill said, "Grab one of those guns," and then darted across the room to the radio equipment. He picked up a chair. With a wild swing, he crashed it against the radio panel. The instruments splintered. Now no warning could be sent to the killer fleet ahead. He made sure that the radio was permanently disabled, then headed for the door.

Sandy had taken a gun from one of the fallen men.

Bill bellowed, "Come on," and plunged outside. He could hear the thunderous booming of engines.

Horrified, Bill saw the white ship pelting down across the field into a fast take-off.

And the purple ship, engine running, was poised at the end of a runway. Its pilot was walking toward it. Bill said, "Get to that plane, kid. Shoot and shoot to kill!"

Together they ran.

The enemy pilot had reached the side of the last ship, was leisurely pulling himself up the fuselage. Bill put greater speed into his pumping legs, tore ahead of Sandy. He brought up his gun, leveled it, pulled the trigger. Once, twice, the automatic barked.

The enemy pilot's hold loosened. He fell back to the ground.

Bill yelled at Sandy, "Hurry! Get into the rear seat."

The boy reached the plane. Bill swung himself into the front cockpit.

## XVIII—THE RACE

BILL'S EYES drilled through the blackness. Far ahead he detected three colored pin points. The white ship's navigation lights. Kara and Aziz Pasha!

Bill had the throttle wide open, the biplane headed after the other ship. But with his engine straining, he saw the other's navigation lights dim and vanish.

Then he remembered what Aziz had said—that his plane was much faster than the others.

Grimly then, Bill forced his wild thoughts into clear reasoning.

The gold train had left New York that afternoon at four o'clock, en route to Fort Weston and the nation's treasure vaults. Aziz Pasha had said it would reach Hunter's Tunnel in the Tennessee Mountains at five o'clock the next morning.

Five o'clock!

And in this slow plane Bill knew that he'd never get there in time. No! His only chance was to get to Fort Lauderdale where he had ordered his planes to be stationed. Get to the Lancer's radio! Bev and Cy were flying aerial patrol over the gold train. They had to be warned of the robbery. The train had to be stopped.

And then Aziz Pasha and his entire fleet had to be destroyed! That was Bill's job—the job he'd been paid money to do—the job that had caused blood to flow and men to die.

Fort Lauderdale! But would he ever get there in time?

He and Sandy had left the island at nine p. m. Bill estimated his speed and the result was dismaying. It would be after three o'clock the next morning before the twelve hundred intervening miles could be covered—after three before they could possibly reach the Lancer's radio! That would give him time to send out warning—if nothing happened.

And far ahead of him, hurtling through the blackness, was the killer fleet of the Purple Fez!

THE murderous squadron was still far ahead when Bill landed the biplane at the Fort Lauderdale airport at twenty minutes after three.

A tropical thunderstorm was raging. Rain was falling in torrents as Bill gunned his machine to the hangar and braked it to a stop.

He threw back the hatch overhead and, yelling to Sandy to get out his Eaglet, leaped to the ground. Dimly through the veil of rain he could see the shapes of planes at the side of the field—his planes!

And now, now his men were rushing from those planes, gathering around them. Bill saw Shorty, bellowed terse instructions for all ships to head to Hunter's Tunnel in the Tennessee Mountains, ended with, "Now into the air —quick!"

Then Bill saw the Lancer, ran to it. He vaulted up into the cockpit, jerked ear phones over his head, connected them and switched on the radio. He seized the microphone and rapped into it, "Calling Bev and Cy. . . . B. B. calling Bev and Cy. . . ."

But only crackling bursts of static came to his ears. He called again—and again. But the blasts of static were becoming almost deafening. And no answer could be heard.

Bill started the engines, and while they boomed out he put through his agonized call again. Then he heard a far-away voice, "Bev answering——" And then the voice was lost in the noisy static bombardment.

Bill's fingers dug into the microphone. "Bev! Bill calling. . . . Can you hear me?"

There was no answer.

Bill shot a look across the field. He saw that the transport was already in motion down the lighted runway, that Shorty's Snorter and Red's were in position. Martin and his men were pulling the Eaglet from the hangar and Sandy was climbing into the single cockpit.

Frantically now, Bill shouted into the microphone. "Bev. . . . Cy. . . . Answer quickly. . . . Urgent. . . ." He winced from the noise of the static. Then he went on, hoping, praying that his words could be heard. "Stop the gold train before it reaches Hunter's Tunnel! Purple Fez fleet racing to rob it. You hear me?"

Then again came a faint voice, "Bev answering. . . . Is—that—you—Bill? I can't—hear—the——" And then the voice was drowned out.

The transport was now clear of the field. Red's Snorter was racing down the runway and Shorty was following. Mechanics were wheeling the Lancer into position.

And while Bill vainly shouted, he saw the Eaglet take off. And then it was his time. He gunned the engines and followed.

And as the Lancer shrieked through the pelting rain, Bill continued his broadcast. But still no answer.

The planes of his fleet were now coming into formation around the Lancer. Bill laid his course dead on for Hunter's Tunnel and the Tennessee Mountains. Time was speeding by. Twenty minutes to four!

And at five o'clock the gold train would reach Hunter's Tunnel!

The static was growing even worse. Bill frantically sent out his broadcast.

And the Lancer at the head of the V formation raced northward.

Then it was four—and the hands of the chronometer were swinging on.

Four fifteen—— Still no answer from Cy or Bev.

Horrified, Bill kept up his shouting. "Calling Bev and Cy. . . . Answer —answer. . . . Holdup of gold train at Hunter's Tunnel. . . . Stop train. . . . Answer—answer. . . ."

Then, at four thirty, Bill heard a faint reply "Bev answering. Bill, I've been trying to get you—— What——"

Bill cut him short. "Stop the train before Hunter's Tunnel! Holdup! You hear me?"

"Yes. Please repeat."

Then Cy's voice came in, "Not clear, Bill."

Again the words were poured into the microphone. The two men acknowledged the message. Bill added, "Call out army planes from Fort Weston. Raiders over thirty in number—— Making for Hunter's Tunnel!"

Then, suddenly, Shorty's voice rang in Bill's phones. "Planes ahead! Look, Bill!"

Bill's eyes whipped up. The storm had long since been left behind but the sky was still starless. Then Bill saw the gleam of navigation lights, caught the vague shape of planes!

The enemy! They were overtaking the Purple Fez fleet!

He shouted into the microphone, "Calling all planes! Enemy sighted. Attack!"

One swift glance at his instruments, at his charts, showed that they were over the Tennessee Mountains, that they were almost at Hunter's Tunnel.

Bill's fingers slid down to the gun trips. Then he heard Bev's voice, "Bill! Train's been sidetracked! Army squadron taken off from Fort Weston. Have sighted enemy ships. Cy and I are attacking from this end!"

## XIX—COMBAT

THEN—the enemy fleet was overtaken and the fight was on.

Bill's force, spread out in battle formation, slashed across the sky from the south. Bev and Cy and the army squadron came in from the north and the west.

The enemy ships were caught by surprise, were bottled up. With guns flaming, Bill and his pilots and the army fliers attacked with savage fury.

Never before had Bill been in such a fight. The sky seemed full of ships, whirling, diving, climbing. Bill's fingers were forever on the firing trips, clamping them down. The yammering of his machine guns, the bellow of his cannon drowned out his hearing. Plane after plane of the enemy force went down to flaming destruction before his onslaught. But always as he fought he searched for a white plane.

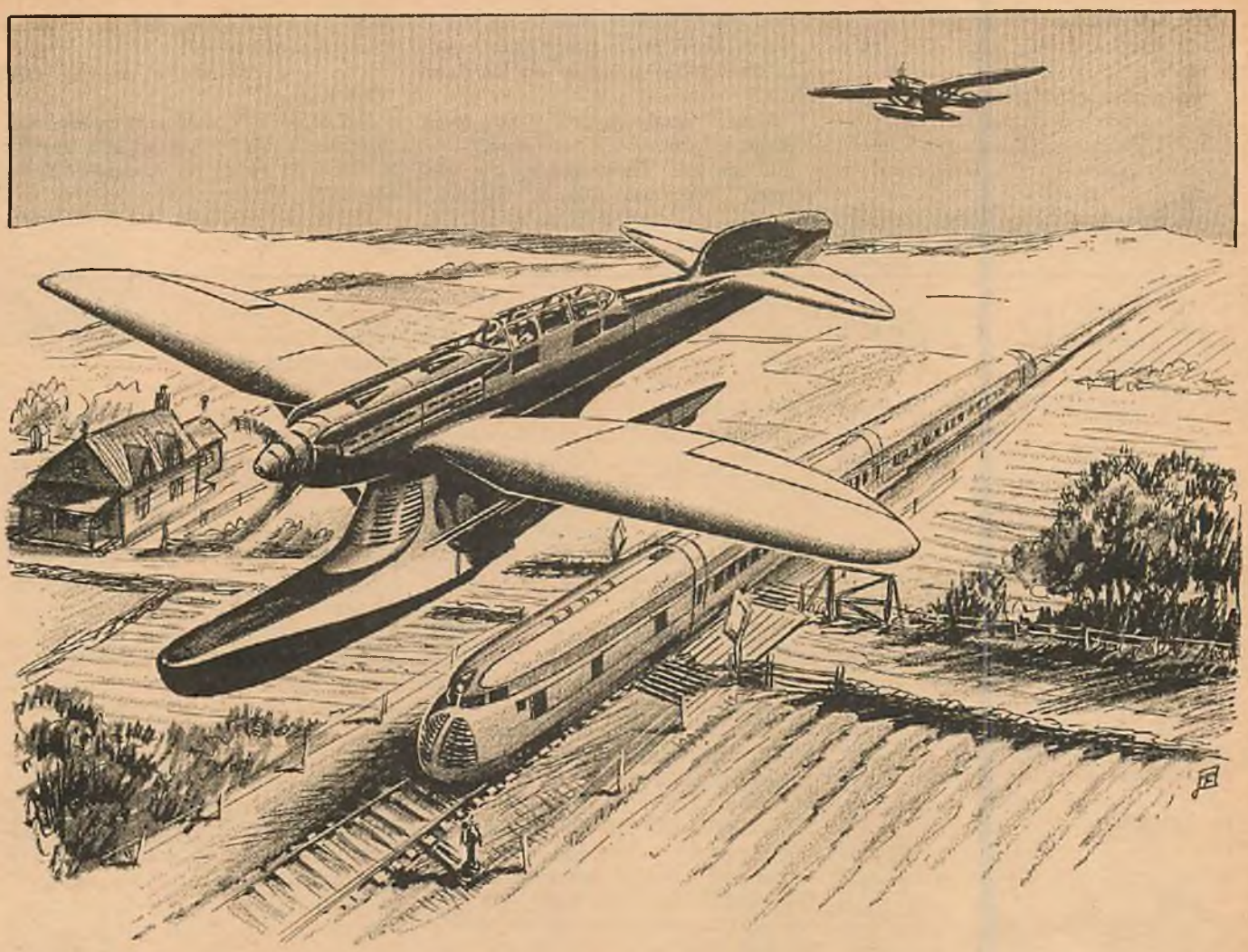
Then, with more than half their number blasted from the heavens, the remnant of the Purple Fez fleet fled wildly in all directions. But their attackers pursued.

Still the white ship carrying Dr. Kara and Aziz Pasha had not been seen. Bill zoomed steeply as a sudden thought struck him. Perhaps the two master criminals, when they had seen sure defeat facing their force, had pelted away —had headed for where the submarine waited in Apalachee Bay.

The thought became a conviction. Bill banked the Lancer to the south and jammed the throttle open.

His job was to get Aziz Pasha. The battle could now be left to Bill's men and the army pilots.

And as the mighty amphibian hurtled faster and faster into the south, Bill sent a hurried radio message to Shorty. Then he took out his maps, thumbed rapidly through them.



Watchful Snorters guarded the gold train.

Apalachee Bay—on the north coast of the Gulf of Mexico in Florida.

Night began to dim and still the Lancer hammered on. Dawn cast its bloom over the sky as the clock advanced.

Bill rode the cockpit in grim intensity. He searched the skies ahead. Perhaps he had come on a wild-goose chase. But he couldn't take a chance.

Out of Georgia and into the narrow strip of Florida he guided his thundering ship. He saw the waters of the Gulf of Mexico. Then, silhouetted against the clear, morning sky he saw an airplane.

Binoculars were whipped to his eyes, focused. A cry of triumph was wrenched from his lips. The ship was *painted pure* white.

And even as his magnified gaze rested upon it, he saw the plane angle down.

Frantically, he waited. The ship dropped out of sight below the sky line. It must be landing—landing where the submarine waited.

Three minutes later, the Lancer bulleted across the blue waters of Apalachee Bay. Bill threw the stick forward, reduced the throttle.

There—there on the water was the white plane. And beside it was a submarine. Two men had jumped from the plane, were now on the submarine's deck.

Bill's fingers again sought the firing trips. His eyes went down the gun sights. He saw the two men scramble up the conning tower and drop below.

Then he was within range. His guns fired. The top of the conning tower closed as the leaden hail spewed around the submarine.

He held his machine on its plummeting descent until he was almost at the submarine. He hauled back on the stick, at the last minute yanked the Lancer into the sky.

The submarine was submerging rapidly. Bill whirled back. His hand went to the bomb release. He made a snap decision of distance, jerked the bomb handles.

Cylindrical shapes pelted down from the belly of the Lancer. Bill looked back. Great geysers of water leaped up where the submarine had been. The white plane had vanished in the series of terrific explosions.

And all Bill could see of plane and submarine was a great, oily circle—a circle that was spreading wider and wider on the surface of the blue waters.

## XX—HOME

AT FIVE O'CLOCK on Sunday afternoon, Bill was seated at his desk in the administration building. He looked around at his pilots who were assembled before him. The only casualty of the morning's fight had been suffered by Cy. He had received a bullet wound and his shoulder was now heavily bandaged.

Bill said, "I want to thank you fellows for the way you came through. Your performance was tops. Directly after I landed, I cabled the Turkish government, telling them about everything. A few minutes ago I received an answer. The revolution will be stopped and an armed force has left for Fuada Island. Aziz Pasha's boat will be intercepted. His men will be captured and the treasure aboard——

Well, the Turkish government wishes us to have a goodly part of it as a reward."

Sandy was seated near the desk with Alphonso perched on his shoulder. He said, "I guess everything's O. K. now, Bill—— *Kaaachoooo!*" He sneezed violently.

Bill looked at him. "Yes," he said. "Everything's O. K. but *you*. I sent you down to Florida once to get rid of a cold. Now you're going again. But this time you're going by air liner and alone."

"Alone?" Sandy gasped. "You mean without Alphonso? *Kaaachoooo!*"

Bill nodded. He picked up the telephone. "Get me Atlantic Airlines." When he was connected, he said, "This is Bill Barnes. I want to reserve one passage to Miami on the night plane. What time does——"

The voice at the other end said, "One passage?"

But before Bill could answer, Alphonso threw back his little head and brought it forward with a violent—"*Kaaachoooo!*"

Bill sighed and said, "I beg your pardon. Make it two."

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# UP AND OVER!

*(Continued from page 30)*

machine guns on it, and all? Couldn't be done! No!"

A radio operator approached the camp superintendent with a message.

He whistled. He folded it neatly and put it in his pocket.

"Well, you'd better get one somewhere," he said. "This is from our agent in El Paso. He says Ruiz took delivery on a Laird speed job an hour ago, and hired a half-breed pilot to fly it. Paid five thousand down. They're headed this way now!"

"Wow!" broke out Dickinson. "It's a war! He'll put a gun on it and shoot all our ships out of the sky! For Pete's sake, clear me through to our main office at Miami with your radio! I've got to warn them to ground everything in Mexico until we've stopped that plane!"

"Paid five thousand down on it, you notice," the camp superintendent remarked coldly. "That was our money, Dickinson. It belonged to us. Ruiz stole it, and then used it to buy a ship to hijack all our future pay rolls. I think it's Blaney's turn. What's your scheme?"

"I still think I can do it," Blaney spoke. "And I don't need a ship with a machine gun, either. I can outfly him!"

"Boy, you're crazy!" growled the camp superintendent.

"Outfly a Laird with a seven-year-old mail plane?" Dickinson shouted. "Are you trying to commit suicide?"

But Blaney was already lifting his foot into the stirrup in the Stearman's side.

"I haven't time to hunt up a pursuit ship with synchronized guns," he pointed out. "That ship is in the air now! It's probably headed this way! We've got four other flights in the air now, on passenger schedules. Do you think we want those ships shot down, and their passengers robbed? I've got to find some way to stop that ship! I don't care if it's armed or not!"

The mechanic had the starter crank in the Wasp's socket, and the inertia starter was raising a whining voice. Dickinson leaned hard up against the fuselage, hanging fast to his hat and shouting in Blaney's ear as the Wasp caught and sent a blast of air backward along the ship.

"You can take mine!" he yelled. "My Lockheed!"

"It's too heavy!" roared Blaney. "Not enough ceiling! See you in Mexico City to-night!"

He gunned the Wasp and booted rudder. The Stearman bumped over the rutted field and struggled into the sky. The field was so high in the mountains that he was lucky to get off at all, and almost immediately he found himself in a bank of moist, cumulous cloud, headed blindly north.

Altitude! Blaney snuggled his short, heavy body comfortably in the Stearman's pit, took a deep lungful of icy air, and eased back the stick. She was heading for the sky, and Blaney, free of the restrictions and red tape of passenger flying, let out a yell of pure exuberance. Up—up—eighteen thousand on his altimeter, and still going. The range was far below, now, spread out brown and wrinkled beneath like a relief model. Nineteen thousand! Far enough. It had been two years since he had done any high-altitude work without oxygen, and he didn't want to run short of breath.

The old Stearman was clipping off the miles like a true veteran. Blaney was talking to himself. Not thinking aloud, but actually talking and shouting into the roaring blast of air, as high-altitude pilots did to keep their lungs full.

"Laird?" he yelled at nothing in particular. "Let's see. It's a race model they sell to wealthy sportsmen. Hits about two hundred top speed. Tricky as the devil to handle. Put a fixed Browning on it with a synchronizing gear, and you've got as sweet a pursuit ship as anything in the air corps. It's built to stunt. It all depends on who's flying it. Quelado? No; he's flying in Spain. Martinez? Maybe. Padilla? Probably. Ought to pick it up any minute now."

He idled the Wasp while he leaned far out to search the dim blue horizon. Slowly he let it gather speed again, while he waited there, circling just above those concealing cumulous clouds, watching through the wide rifts for a pair of tiny green wings. If it were headed straight back toward Ruiz' base, it would come along this course.

"Be careful!" he warned himself. "It's probably landed at Sierra Mojada and had some kind of a gun installed. Ruiz is probably aiming at the afternoon transport run. Carries a lot of bank-transfer shipments."

Suddenly he saw it, a few thousand feet below, headed southeast. Again Blaney's clear-blue eyes squinted into slits as he peered downward like an eagle, studying the ship. A tiny little biplane with a stubby lower wing, and a carefully streamlined N. A. C. A. ring cowling on its supercharged Wasp. The top wing hid the fuselage, denying Blaney a chance to see whether there was a gun mounted there or not.

He'd have to come down close to see that. If he did, he'd expose himself to a string of shots in the event there was a gun on it. But Blaney held his breath, pulled the Stearman up and over in a lazy loop, then whistled downward in a power dive aimed directly at the speeding ship below. The wires whined; then they wailed; then they screamed. The rising crescendo of the motor was music to Blaney's ears. Below, the Laird seemed to vault straight up in his face as he whistled down on it, motor full out. His eyes focused for a quick but searching look. Then he had swooped over it, pulled up in another loop, and almost driven the tiny ship nose first into the jagged peaks below.

Its pilot swung it broadside to its course, veered into a vertical bank and started up. The little Laird would catch the mail plane like a hawk overtaking a passenger pigeon, if Blaney didn't prevent it. The little Laird swooped away from the mountaintops; its pilot spotted Blaney and began climbing in a peculiar fish-tail stagger that meant only one thing. A gun! And synchronized, at that!

Its pilot was trying to catch Blaney in his ring sights, and kicking the rudder back and forth in an effort to aim. Blaney swung around, arched his stick from side to side of the cockpit, so that his Stearman came headlong toward the Laird in a baffling series of opposite banks. The pilot had the gun working now, and was spraying futile bullets all over the sky. But the Laird was twice as fast on the controls as the bigger, heavier Stearman, and the Mex pilot flying it knew his aerobatics.

He dodged beneath Blaney, jammed full throttle and came roaring up in an Immelmann. That was a signal as wide open as a barn door that Blaney had a fight on his hands. Many pilots can

stunt, but few can pull an Immelmann and come out in the right direction. This Mex pilot came roaring up in a half loop, hung there on his back for a fraction of a second, and then turned the little ship right-side up in a fast half roll that put him right on Blaney's tail and slightly above—the old instruction-book position for a killing in the air corps manuals.

Blaney's flesh was crawling in mortal fear. The Mex had him—had him centered in his sights and had grabbed his gun trip while he held his eyes hard up against the rubber eyepiece on the telescopic sighting tube. That was all that saved Blaney's life.

He swung the Stearman into a vertical bank and up in a climbing turn while the Mex was still pouring hot steel out of the gun in a straight line. The other pilot had to take his eye out of the sights, look around the sky and find his target, then kick the Laird into position again. Blaney had taken quick advantage of his chance to pull the Stearman up into a steep climb, and keep it climbing until he had gotten out of danger.

Right through a gray-white cloud bank and into the crisp, icy, rarified air above climbed the old mail ship. Relieved, breathing hard as the frozen air tortured his lungs, Blaney cast an eye over the ship to see what had happened. A bright, clean splinter was broken off the outer bay strut where some slug had creased it. Four or five holes in a neat line in the fabric below, but, luckily, none of them had shattered a wing rib. He was totally unarmed, and had a ship that was no match for the lightninglike capers of that little Laird, yet his confidence in his ability to do what he set out to do was unshaken.

"I can do it!" he shouted to himself. "The guy doesn't know much about that gun. And unless he does, it doesn't help him much!"

Down again through the clouds he sent the bullet-ridden ship, to see the Laird straightened out on its course and miles ahead. It was flying high over the ridge of snowy peaks, a bright dot against the harsh sky. Blaney knew he was in the pilot's blind spot if he stayed back far enough, so he trailed along and watched.

Presently the Laird banked around, headed downward and disappeared beyond a distant range. Climbing again, Blaney followed at a safe altitude. He raised his sticky goggles from his damp forehead, took a pair of binoculars from their rack inside the cockpit, and studied the saw-tooth peaks below. It seemed incredible that a man could land a fast ship where no field existed, but the Laird had gone somewhere. Presently he saw the ship in a long, narrow clearing down in the foothills. In his powerful glasses he could see a white canvas tent hangar staked out at one end, a tiny little wind sock on a pole behind it. There was a radio mast a little farther beyond, and, to Blaney's amazement, he could make out a regular settlement in those isolated hills—shacks, a picket line, a rocky mountain trail leading southwest. He smiled.


Ruiz had shaken a futile fist at the roaring sky.

It was the first round in the fight. With the discovery of Ruiz' hidden mountain camp, he had something tangible to work on. He replaced the binoculars and fumbled around inside his flying suit for his little miniature camera that he always carried with him. It took a picture about the size of an airmail stamp, but it had a lens as big as the picture itself. He opened a little door in the back of the camera and removed a round, amber-colored filter, which he fitted on the lens. Then he held the stick with his knee, while he leaned over the side and held the camera close against his eye.

"The sap!" he sneered. "Staking out a new white tent against a background like that. It sticks out in these mountains like a monument!"

The shutter snapped. Blaney headed for Valbuena Airport.

In the dark room that night, Dickinson was inclined to be skeptical until he saw the enlargement of Blaney's picture. They pinned it, dripping wet, on a cardboard backing and then studied the enlargement with reading glasses.

"There it is!" Blaney pointed out. "Back of the white tent, what do you find? A radio mast. What does that mean, my fine friend? It means that every two-way conversation over our system is being translated into bad Spanish and whispered in Señor Ruiz' fuzzy ear."

"That's where he got the idea of extending his operations into the air, I suppose," Dickinson commented bitterly. "Well, we can dope out a code of some kind until we settle this problem. Let's take a look at that field. How many ships can we get in there?"

"None of that, now," Blaney warned. "It's long, but narrow. It's a one-way field. If you've got a cross wind, the Stearman is the only thing you can land there. I hope you don't think you can come skyrocketing in there with a Douglas transport that lands at seventy."

"No, but we can pack four or five men in the freight compartment of the Stearman. We can hide 'em, take off again and bring back another load. In that way we can get enough men to do some good."

Blaney looked hard at his chief, trying not to say what he felt.

"I can forgive you," he muttered. "You've never had any experience fighting bandits. But forget about that bright idea. Let me do it."

"All right, but how?"

"I don't know—yet. Get the Stearman serviced. I'll try now."

As he zoomed upward into the starry night, Blaney's thoughts were a confused jumble of impressions. Knowing that the Laird was armed, and that its pilot was both expert and unafraid, Blaney knew the Caribbean Airways' whole future depended on destroying

that plane or putting it out of action at once. Yet the idea of landing an attacking party there was idiotic. It couldn't be done without discovery, and there is nothing more vulnerable to rifle fire than a landing airplane. Stealth—concealment, quick action by a lone airman. That was the only way.

He didn't know just what he would be able to accomplish when he got there. But he knew he had to try—he had to take a long chance.

Examining the enlarged picture with a small flashlight in the Stearman's cockpit, he took a bearing on the distant range of mountains looming black and jagged against a faint moon. It was foggy up there. The fog was closing down instead of lifting. It would make it harder, but the fog itself would give him a concealing cloak that might help. He knew those mountains the way the average citizen knew his front hall in the dark. He could fly directly to that hidden field without a ray of light to help him, as long as he could see the moon to act as a guide.

Hovering over the field, he idled the motor as much as he could and circled. Little pin points of yellow light were winking below, the lanterns of Ruiz' camp. Losing altitude gradually, he made out the flat, grayish outlines of the tent hangar. Banking away from the field, he sent the ship in a lazy glide around a figure eight, then came in at the extreme end of the field, with his motor cut completely out. Only a faint sighing in the taut cables interrupted the stillness as the Stearman floated down to a smooth landing, and stopped as Blaney dug his heels into the brake cups.

Rather than start the motor again to swing the ship around, he got out, lifted the tail and headed the ship toward the end of the field. Laboriously he pushed it by hand at a snail's pace until it was tight up against the rocky ledge on one side, half hidden from the camp by a sloping projection. Then he felt his way along the rock toward the camp.

As he approached he heard voices, drunken laughter, the clink of bottles falling off a table. Ruiz was celebrating something; Blaney didn't know what. But the whole camp was in an uproar, with no sentries posted, no guards watching, nothing being done to disturb Blaney's silent progress.

At the rear of the tent hangar he raised his eyes to the level of a dimly lighted room. A multitude of panels and dials told him the radio receiving set was switched off. No operator was in the room. Presently Ruiz himself, with two sleek-looking young Mexican youths, came in. They were arguing about the radio set, he gathered. One of them was the operator. He told Ruiz in rapid Spanish that suddenly all the Caribbean Airways' signals ceased. But the set was performing well.

Ruiz yelled that it was his fault, that he didn't know how to run a radio station. The Mexican yelled back that Ruiz was loco. Then he added *muy loco*—very crazy. Ruiz' fist closed about the heavy quirt he always carried. His arm lifted. Then he stopped.

"What's the difference?" he asked in an oily sneer. "To-morrow we shall hear plenty of calls. Distress calls. Eh, Padilla?"

"Many calls, señor. To me, and this new plane, those clumsy transports will be what the gringos call—how you say? —duck soup!"

"Ah!" Ruiz rubbed his dirty hands together. "All right, my son. Leave the radio set alone for to-night. Get some sleep. To-morrow you must be wide awake! Come, Padilla. You, too. *Buenas noches!*"

The young operator blew out the lantern and the three figures left the shack. A key turned in the lock. Padilla and the operator turned toward the quieter part of the camp—probably the barracks. Ruiz seemed to hesitate, and then, with a wild guffaw, started for the noise and laughter.

Blaney leaped from the edge of the radio shack and threw himself headlong at the astonished Ruiz' knees. Rolling in the dust, Ruiz shouting wild curses, Blaney grunting as he flung Ruiz over on his stomach, the uproar blanketed out the noise of the scuffle. Then Blaney had the bandit's quirt and stung the Mexican across the back with it. Ruiz yelled. But nobody heard him.

A quick search showed the bandit's holster empty. No six-shooter to fear, then! Blaney lugged Ruiz upright and knocked him sprawling with a smashing uppercut. And Ruiz, turning over and spinning to his feet like a mountain wild cat, launched himself at this ghostlike enemy with a wild rage that only desperate Mexicans can develop.

Ruiz was bigger, stronger, and twice as much in his element in a finish fight. To him there was only one objective in any sort of a fight: kill. *Kill!* But he had no gun; his whip was gone, and he was terrorized by the sudden attack. Blaney, cool and businesslike, went about the business of killing Ruiz with his bare hands, silently and efficiently. He ducked back as Ruiz flung out a booted foot to trip him, dodged again as that heavy boot swung upward for a disastrous kick into the stomach. Instead, Blaney danced around Ruiz' kicking feet and pinned the bandit's arms behind him with his own left arm. His right fist closed about Ruiz' greasy throat.

Blaney was breathing hard, panting like a wrestler, but, as his fingers sunk deeper into Ruiz' windpipe, he could feel the bandit's breath wheezing harder and harder—gurgling deep in his throat with utter exhaustion. With his last effort, Ruiz brought that spurred boot down like a vicious pile-driver on Blaney's foot. The airman yelled with pain, but hung on. Again Ruiz' boot crashed down on Blaney's instep. He lost his hold. Ruiz whirled, reached into his faded khaki shirt for a gleaming knife and dug it, with one flashing motion, straight at Blaney's heart.

But Blaney wasn't there. He had fallen flat on the ground to dodge it, and, with his two feet burning like fire, he lifted them up and brought Ruiz down upon him. Rolling over and over, kicking, swearing, biting, shouting foul curses, Ruiz was lashing out with the hysteria of a wild man. Blow after blow thumped into Blaney's face, chest and body. He clamped his eyes shut, ducked his head, and plowed in. Ruiz' clutching fingers were in his mouth, his eyes, scratching down his face, but Ruiz was down, on his back. With three swift, smashing lefts to the head, Blaney had put him there.

Gulping, sweating, Blaney crouched over the unconscious bandit. His lungs were fighting for breath in the high altitude of the field. Every bone ached. Every muscle seemed on fire. He knew it would be only a matter of minutes before Ruiz' absence was discovered and a search was started. He thought of the mail compartment in his Stearman. But that would mean dragging Ruiz there bodily, over a quarter of a mile of rugged grass.

There was no help for it. Grunting again, Blaney stooped and lifted the unconscious bandit to his shoulder. Draped over it like a rug on a clothesline, Blaney lugged Ruiz away from the camp toward the plane.

He didn't know, afterward, just how long it took him to make that trip. It was several hours, certainly. He would go a few yards, stop, prop his burden against the rocky wall, and rest. Then he'd listen. People were all over the camp now, with lanterns and flares, raising their voices and probing into the darkened field with powerful flashlights. But Blaney kept the unconscious bandit well hidden at such times. Then Ruiz would groan and regain consciousness, whereupon Blaney would stand him up against the rock and crack him again.

Finally, at dawn, he made it. The ship was silent, moist in the clammy fog, and cold. Fumbling with the catches, Blaney unfastened the mail compartment and dumped Ruiz inside. He locked it, fitted the crank in the starter, and began the hardest part of the whole adventure.

He knew that the moment that big Wasp caught, the whole party of Ruiz' mob would be running outside, straining their eyes in the dawn to see. They'd see the take-off, because the Stearman would go right over the camp in order to lift. Some of them might

fire at it. Then they'd get out their two-hundred-mile-an-hour Laird, with its murderous gun, and it would be all over but the shouting.

At any rate, Blaney headed the ship right toward the camp and gave it full gun. After a thousand-foot run, it started to lift, and just missed the wind sock at the extreme deep part of the field. It looked to Blaney as if a thousand men were there below him, their tiny, white faces upraised in astonishment, as the Stearman felt the cold mountain air on its thick wings. But somehow Blaney fought it over the threatening roof tops, and the veteran old crate clawed its way to the free air beyond.

Frenzied activity below showed him he was right—the tiny green wings of the Laird marched out backward from the white tent hangar. He'd have to run for it now—and burdened by the added weight of the furious bandit Ruiz, who had come to again and was pounding on the sides of the mail compartment like a monkey in a flying zoo.

Fog—rolling down into the gorges like a malignant ghost, worried him. It cut off all his bearings. All the mountaintops were concealed in this white covering, which slowly but surely was settling down more and more into the lower foothills. Blaney's heart skipped a beat as the big ship veered away from a threatening cliff ahead, and shot through a narrow gorge toward freedom.

But that freedom didn't come. Behind him came the blazing fury of the Laird, its gun stuttering a warning of avenging death. Ahead was a maze of mountain chasms, the two ships powerless to lift above because of the blind threat of instant death in the concealing fog.

Blaney searched for a familiar landmark, but found none. The two ships were playing hide and seek in the gorges, twisting and turning and flying back and forth, each seeking to cut off the other's path to the free, clear air of the lowlands. Panic began to clutch at Blaney's brain. He couldn't get out! Sheer cliffs thousands of feet high on all sides, the gorges getting narrower, the ship unable to climb out, and behind him came that swooping Laird, probing with lines of white-hot steel for the pilot's beating heart!

Blaney's trembling fingers clutched at the fastenings on his helmet, ripped it open. He pulled the goggles up on his forehead, and ran his hand over his face in desperation. Relentless as fate itself, the rocky cliffs set their stone faces stolidly against him. Solidly penned in, and the gorge narrowing ahead!

The very mountains themselves were helping Ruiz, Blaney yelled at himself. Nature—vindictive, harsh, cruel! He yanked the ship down sudden gorges that opened from the valley, twisted into narrow chasms hardly wide enough for the ship itself. He tried to climb—always that stubborn mist that concealed everything. Suicide; certain death to get up into that. And he couldn't turn. The gorge was too narrow. If he could have turned, the Laird was right behind, trying to get close enough for the finish burst from its hot gun.

Then the Fates took his life in their hands—suddenly. Swinging the Stearman into another deep gorge lined with parallel cliffs, Blaney's eyes bulged, and he flung up his arm as if to ward off a blow. The end of the trail! There, a scant thousand feet ahead, was a flat cliff, thousands of feet high, marching straight up into the fog. Into heaven, for all Blaney knew. He had to act! Behind him, the Laird swung into the same gorge, opened viciously with its synchronized gun, as it swooped up the gorge on its hated enemy. Bullets spat into the rock. Little bursts of dust showed all about him.

Blindly, Blaney acted purely by instinct. He remembered that other pilot's Immelmann the day before. Yanking the stick back and opening the roaring Wasp full out, he swung the Stearman up and over, whipped it upright in a fast half roll that brought him above the Laird and headed out.

The Laird, its pilot's eyes glued to that infernal eyepiece on the gun's sighting tube, didn't follow. Its pilot couldn't think quickly enough. There was a sickening crash, a wrenching of steel and fabric, a lurching drop. The wreckage fell down, over and over, down the gorge, until it finally came to a merciful rest in a clump of pines.

The Immelmann had thrown Blaney far enough into the fog to clear a jutting peak. Beyond, the vista of sloping lowlands and planted fields fell upon his eyes like a mirage. Free!

"HERE'S your man," he told the astonished Dickinson back at Valbuena. "And that Laird is up in the mountains, hanging on a tree, with the pilot underneath. Service on schedule again! What'll we do with Ruiz, here?"

"Let's announce on our radio that we've caught him," said Dickinson, "and drop in on that camp up there about the same time. Gosh, Blaney, would I like to see their expressions! That'll make a good picture for your collection!"

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# RUNAWAY

*(Continued from page 22)*

Sanders laughed, said, "Can you imagine any more secluded place than the basket of this crate at fifteen hundred feet?" and got out of the car and splashed off toward the east.

Brent, in the basket ready to take off—the cleanest and driest place he could find—looked out across the fields that lay flat and level as far as he could see. The crew removed the final sandbags from the mooring harness, and the winch operator tested his engine with a series of staccato, ear-splitting accelerations. In the silence that followed that final blast of the exhaust, Brent heard the high whine of an automobile coming at a dizzy speed from the direction of Tallorah, and looked up to find the reason for such driving on a road made slippery and dangerous by rain.

A low, black touring car, top down, was careening and swaying down the highway, with another car in swift pursuit perhaps a hundred yards behind it. Brent, watching it, asked, "Sergeant, has that guy gone crazy?"

"Probably a drunk, lieutenant."

For a moment there was no change in the spacing of the two machines; and then a quick *rat-ta-ta-ta-tat* of an automatic rifle cracked murderously across the steaming flats. The rearmost car swerved violently, plunged from the road and turned over in a spray of muddy water in the ditch. The lead car came on unchecked.

Sergeant Weems cried, "Oh-oh! That baby's been up to something, and he's out for blood!" and whirled down from his seat and started running toward the tent to get an army rifle.

But he had insufficient time for that. The car, brakes screaming, slithered to a stop almost beside the bedding ground, no more than fifty feet away. The man in the rear seat was standing upright now, and his gun was swung upon the crew there. He was snarling in a cold, ferocious voice, "Up with 'em! I'd just as soon bump off the crowd of you as bat an eye!"

Brent's impressions came in an interrupted flood that had no ordered sequence. He recognized Judith Gardner in the front seat of the car beside the driver, but he felt no surprise in seeing her. That seemed natural enough; and yet, somehow, he wished that Sanders could have been here to see her as he himself was seeing her: a blood streak across her forehead, and her pale, impassive face that held no fear in it, but rather a helpless, passionate defiance.

Things were moving quickly. The driver had the door open, was stepping down into the mud. In the rear seat the gunman was swinging his rifle back and forth, still telling them all to raise their hands.

At this command, a quick, pervading excitement swept Brent. He saw Sergeant Weems stop in his tracks and raise his arms. He heard a soldier holding to a handling line of the balloon cry plain-

tively: "Don't shoot! Don't shoot! We can't let go to raise our hands or this balloon will get away!"

The gunman laughed. It wasn't funny, but he laughed; and Brent could see that he was rushed for time, and that he was nervous. The gun seemed pointed everywhere at once, and it occurred to Brent that a jumpy forefinger might press the trigger accidentally at any time.

The driver's voice was harsh and nasal, cracking like a whip. "We just stuck up the bank back there. We're in for it. Got cut off on the west. We'll jump in that balloon and you cut it loose with us."

Brent, hands in the air, watched and heard all this from the vantage point of the basket, five feet higher than the ground. He saw the driver reach back and grip Judith Gardner by the elbow and either force or help her from the car. She had a moneybag in each hand, and the driver had one stuck in his belt. He had a pistol. Its snout was a yawning cavern to Brent's eyes even at this distance.

But for a moment he forgot the gun, thinking of the girl. She wasn't voluntarily involved in this, of course. She was a hostage to prevent gunfire from pursuing forces of the law. And she was, doubtless, in danger of her life. He wondered what would happen to her, going on a flight like this with these two cutthroats. No telling where the craft would land with this north wind.

He shouted, thinking to save her the harrowing experience, "You can take the balloon, of course. But remember, it hasn't any motive power. You can't go anywhere but up. You'd do better in a car. And don't forget—you're fooling with the Federal government when you make me cut it loose for you. This is United States army property."

The rifleman had come forward and was prodding Sergeant Weems before him. He was a squat, stocky man. His face had a two-day growth of black beard stubble on it, and his little eyes were ice-blue with a dangerous and impatient light.

He said in a quiet yet sibilant tone that carried to Brent's ears against the wind with a surprising force: "That's enough from you, shavetail! This wind'll blow us across the Mississippi, or *you'll* never see the sun go down. These low clouds will hide the direction we're drifting, won't they? Isn't this a real smart idea for a get-away?" He laughed mirthlessly. "Even have an army pilot to get us over there!"

Brent swallowed heavily. He was going, too, was he? Somehow he hadn't included that possibility in this scheme. There was no doubt about it in his mind that these two holdup men were killers, and that this gunman's threat was not an idle one. They wouldn't hesitate to shoot him and toss his body from the basket if it seemed expedient. He shuddered faintly, and the wind seemed chill. If he had to climb above the clouds, he didn't know whether the wind would drift him east across the Mississippi. It might take him west, or straight south. And there would be no way on earth to find that out, aloft.

Yet he said, "Sure it will drift you over the river." He looked keenly at Judith Gardner as she approached the soldiers who were ringed around the bedding ground, holding grimly to the handling lines. A girl like that—— She'd been through enough already. He warned, "You can't take more than three in this balloon; it won't get off the ground with that much weight. The girl, or one of you, will have to stay."

The driver of the car was coming forward, pushing Judith a pace ahead of him. Brent could see he was in a hurry, too, and that he was as dangerous-looking an individual as his squat companion.

The driver slurred, replying to Brent's words, "Buddy, we ain't foolin' with you—get that through your nut. We just bumped off a guy back there, and in two or three minutes a posse will be comin' down this road. Now, we don't want no shootin', with this broad here. By the time that posse gets close, if we ain't in that basket and up in them clouds out of sight, you'll be a corpse—and don't think I'm kiddin' you. That would be right dreadful, wouldn't it? The broad goes, and that balloon had better get off, for your health!"

Bill Brent looked at Judith Gardner again. He wished there was something he could do. She was very pretty, standing there so quietly and watching him so tensely. He could tell she was frightened, although you couldn't see it in her face. He could see it in her eyes. He felt sorry for her suddenly. He thought, "If Gene would only come back now!" But it was really better that Gene stayed away, for he didn't have a gun, and he wouldn't have a chance. The thing was to figure out how to obey these gunmen's orders and yet—somehow—defeat them in the end. He had to do that—and it just wasn't possible, that was all.

There was no time to think about it. If the posse got here too soon—— He called, "All right—climb up here. Maybe the balloon can get off the ground with all of us. Sergeant, remove the junction piece." The junction piece was the

Lefty's rifle barrel caught on a stay.

shackle that tied the winch cable to the holding wires. Bill said, "All right, men, ease the basket down until these people can climb in."

Every one was frightened except those two with the guns. It required an incredibly short time to do it all. The tall bandit got in first and reached down for the money that the shorter one forced Judith Gardner to hand up to him. He helped her up. She half fell over the basket edge and thrust one slender hand against Brent's shoulder for support. In that moment, looking directly at him, Brent saw that she was terrified.

All the time the squat, piratical individual was standing down there in the mud, holding a rifle on the crew. When the one in the basket was ready and had his pistol covering Brent and Judith and the men on the ground, the rifleman swung himself lithely across the wicker rim and clumped his muddy feet upon the rug.

"Get going!" he snapped. "Climb straight up into them clouds! Quick!"

Brent, feeling the muzzle of a gun against his spine, said a trifle shakily, "All right, sergeant, release all lines."

No one said anything after that for a long time. The crew, faces rigid in anxiety, dropped the handling lines, stepped back and put their hands up. The balloon, loosed entirely, paused there for an instant as if uncertain of its ability to rise. Then, moving with the wind, it dragged across the road and suddenly seemed to leap skyward at a slanting angle on the wind. The nose raked upward; the basket swung back toward the bottom fin. The hand lines crawled through the mud and water of a drainage ditch and then swept clear.

The flat, water-soaked cotton fields ringed out in a broad and shallow bowl as they went up. Overhead, the clouds seemed to press down, startlingly close and dark and wet, yet sharply lined against the horizon. There was wind up here, Brent saw; the balloon moved out across the country at surprising speed. Southeast. They were headed for the Mississippi at this altitude, he realized gratefully.

At six hundred feet above the earth the visibility was all but unlimited through air washed clean by rain. Brent's hopes rose. If this wind held in the higher elevations, they could get across the river soon and drop down for a landing. Perhaps he and Judith Gardner would survive this ordeal after all. He wondered, for a fleeting instant, how a landing with this massive sausage could be made, alone and in the wetness of a cotton field.

The tall gunman's voice slurred softly, warning, "Posse comin'! Kid, you git this outfit stuck up in them clouds! Quick!" He prodded Brent viciously with that murderous pistol muzzle.

But there was nothing Brent could do. The balloon was loaded with all it could carry, and it was rising slowly. There was no way to accelerate it. In another hundred feet or so they would be inside the clouds, but only time would put them there.

Holding his voice level, he explained, "We're going up as fast as possible right now. This isn't a high-powered airplane, you know."

"No lip!" snarled the shorter man. "You do what we tell you, see, or it'll be too bad."

Brent nodded, checking his protest. It was crowded and uncomfortable here in the basket. Four people where two ordinarily rode. Brent stood in the forward right-hand corner. The tall man was on his left, and Judith Gardner was behind him, with the rifleman beside her. It was strange how the silence made the tension more acute, drawing his nerves taut almost to the breaking point. There was no sound—no sigh of wind or creak of rigging. The lines draped vertically around them, and they floated in a quiet that was ghoulish and complete. Unbearably anxious to hasten the ascent, Brent breathed a slow, long sigh when clouds enveloped them at seven hundred feet.

The streaking cars down there on the road were gone, blotted out behind a dank and chilly mist that reached in and pressed its lacy fingers on their faces. The gunmen relaxed a trifle, yet remained acutely in command. One of them said, "Now that was smart, shavetail. You do what we tell you and we may let you out of this alive."

Brent turned to him. There was no use in trying to deceive anybody. He replied, "The balloon got to the clouds as soon as it could climb that far. I had nothing to do with it. You could have killed me, and it wouldn't have got there any quicker or any slower. There's not much you can do with this outfit. I'd rather you'd understand that —so you won't plug me for something I can't help."

They ignored him for a moment. Glancing back, he held Judith Gardner's eyes for an instant. Her lips moved in a faint, almost imperceptible smile, as if in reassurance.

Then the tall man was saying to his companion, "Lefty, we'd best git ourselves across the river, land on a road somewhere, and grab us the first automobile that comes along. Make shavetail put us down a long way from a town. We can tie him and the skirt up in the brush. They'll be there plenty long for us to scram."

"Lefty" rubbed a dirty thumb across his beard stubble in a reflective gesture. It seemed to Brent that the time required for that deliberate decision would never reach an end, for he knew his life hung in the balance of it. Lefty was the commander of this pair, and he was heartless as a jellyfish, and just as cold.

He said, "I guess that's all right for shavetail, Joe, although it would be better if we bumped him off so he can't tell where we took the road and which way we went. But this gal—we'll take her along to shy off bullets." And he turned to Judith and studied her with a casual and yet very pointed interest.

"You'd do, girlie," he said with a leer.

For the first time since the flight had started, as far as Brent knew, Judith Gardner spoke. The clouds were a moist grayness all around, framing the outline of her head and slim shoulders. Her face flushed quickly, and then went a kind of seared white at Lefty's final words. Her lips were trembling. She said, emphasizing the third word, "You're a *foul* beast," in a hushed, violent tone, and looked straight at him, brown eyes flashing in defiance.

Joe laughed quickly in that soft voice of his, and the tension broke a little. Brent saw the muscles of Lefty's shoulders smooth out as he relaxed, and Lefty didn't say anything for a minute. The four of them rode there in the crowded basket, fear touching each one in a different way.

The altimeter was showing a thousand feet now. Brent reached up, grabbed the valve cord and held down on it a minute. The climb continued for a while, and then the altimeter needle wavered and hung steady at twelve hundred feet.

They were still in the overcast. It was thicker and darker than ever at this elevation. Brent tried to study it, to figure which way the wind was blowing here. He couldn't do that, naturally. He couldn't see a thing but dank, wet mist that brushed across the basket and through the rigging, leaving silver beads of moisture on each rope and line, and dampening the faces of them all.

But he tried to appear busy, to appear important. It was essential that these bandits feel dependent on him for their safety in the air, at least. He stood there holding to a basket stay, and tried to keep his mind from running rampant with speculation and imagination. It was ironical to think that he had been sent down here to catch bugs —a task so prosaic and so boring that he thought he couldn't stand it—and had run into an escapade that was as exciting as only foreseen and delayed death could be.

For he knew now, studying Lefty's sullen, crafty face in furtive glances, that Lefty planned to kill him. One more murder wouldn't make their crime more punishable, and they were not the kind to hesitate in such a thing because of squeamishness. He could see that, and he had to stifle a sensation of cold horror.

He thought of Philippa Schallen with

a stab of poignant affection and regret. She was all any man would wish in the image of a woman, and she was now forever lost to him. Through his harried and fear-driven mind crossed the thought of Gene Sanders and their long, enduring friendship. He wondered how his family would receive word of his demise. And he thought, perhaps a little frantically, "If I could only get back there and enjoy being bored with hunting bugs!"

The minutes dragged away, each one adding to the pyramiding tension and suspense. Brent thought of jerking out the rip panel of the balloon and dropping the big bag into the Mississippi. But that would avail Judith Gardner and himself nothing, for they would be caught there and would no doubt drown before they got ashore. They might not even get a chance to swim—for Joe and Lefty might turn guns upon them in retaliation for being thus thwarted. So that idea was out. He must think of something else, and do it quickly——

Suddenly he remembered that on the sides and underneath the basket, folded carefully in their packs, were a pair of Stevens parachutes. If he and Judith Gardner could somehow manage to jump out——

The idea started a succession of speculative possibilities. It filled Brent with a flushed and trembling, a violent, excitement. He thought wildly, "If I can work this——" He considered all the problems. Would Judith jump out with a parachute, even if he managed to trick Joe and Lefty long enough to get the harness on her? At least there was the advantage that a Stevens parachute would open automatically when the weight of the jumper dragged it from its pack. There was no rip cord to be pulled. But how could they get away and leave these bandits in the basket? What trick or subterfuge could he invent?

Straining tensely to keep his voice casual, his tone low, he asked, "How far should I go before I land you two? We should be across the river now."

Lefty and Joe exchanged a glance. Lefty then looked speculatively and dispassionately at Brent. He spat a brown stream of tobacco juice across the basket rim into the mist; and his icy-blue eyes were narrowed thoughtfully. He demanded, "Once you git down out of these clouds, can you climb back up again?"

With an appearance of detached deliberation, Brent replied, "No. Not this time. I haven't any ballast. But we've been out fifty minutes now, and the wind was fresh—seventeen or eighteen miles an hour on the ground. It will be stronger aloft. The river's only fourteen miles away. I think we should be across it now."

"Think so?" Lefty said, and his voice had gone a little flat.

Brent nodded quickly. "Yes, I think so. Of course, I can't be sure until we drop out of the clouds. But we're so far from Tallorah nobody could see the balloon from there. There's no danger of being followed, anyhow, across the swamps that lie along the river."

Lefty said: "I'll do all the thinking for the crowd, shavetail. You're doing good enough at flying. I'll tell you when to start back down."

Brent turned back to look unseeingly into the clouds. It was hard to wait. Every minute added to his feeling of hopeless, desperate nervousness. He had to get those harnesses on Judith and himself before the crisis came. And he had to do that without arousing any one's suspicion.

"Lefty, when we do start down, I'm going to need some help. Have you ever flown in a balloon before?"

"Naw," Lefty retorted without interest. "Ain't you supposed to be the pilot of one, kid?"

Brent nodded. "Sure," he said. "But this is a kite balloon—a captive balloon. You don't fly one ordinarily except tied on a cable. Landing it without killing everybody, when it's flying as a free balloon, is quite a trick." He paused on the suggestion, studied the faces of the pair, watching their reactions.

Joe looked a little shocked. Lefty's face held a lurking suspicion.

"Listen here, shavetail," Lefty said, "you're up here with us, see. If there's anybody killed in landing, you'll be it!"

Smiling mirthlessly, Brent returned, "Naturally. But we'll be landing in a strange field. I'll have to stay here in the basket to valve the balloon down. Miss Gardner, of course, knows nothing about flying. It will be necessary for you and Joe to put on the harness provided for that purpose and lower yourselves on the maneuvering lines some distance underneath the basket, to be ready to steer the balloon down the last few feet when you're already on the ground. You understand?"

Joe cocked his head slightly on his long, ungainly neck. "Now," he said, "that would be just swell, wouldn't it? You git us hangin' on some ropes below the car—and then you cut the ropes, heh?" He laughed uproariously, slapped Lefty vigorously upon the back. "Lefty, can you imagine how we'd look hangin' down there on the ropes? Imagine shavetail thinkin' he'd git us in a place like that!"

Lefty spat disdainfully into the mist. His eyes, when he turned to Brent, were narrowed dangerously. "Fast one, eh?" he said. "Going to try to kid us, were you, with a gag like that!" He wagged a stubby finger under Brent's nose, and his voice was chill. "You and the skirt put them harnesses on and slide down them ropes while we set up here and keep our rods on you. You show me what to yank, and tell me when to do it, see?"

"And when you once git on the ground," Joe added, "you just plant your feet and wait for us, or we'll plant you permanent right there."

Bill Brent exhaled slowly in vast secret elation. If he had tried to put the parachute harness on in the beginning, Joe or Lefty would have stopped him instantly. Now that step was accomplished, and there was a bare chance of carrying through his plan.

Of course, this was a gamble with two lives. Brent knew that, and the thought sobered him. He looked at Judith Gardner, giving her a sharp, brief estimate. She was staring out into the mist, one arm crooked around a stay. She was pale, and her soft mouth was not so pretty when she compressed it the way it was now. Naturally, he couldn't tell her what he meant to do. He'd have to get that harness on her and then shove her overboard and let her parachute perform the remainder of the task. But she was calm enough, and he was grateful; most girls would have been weeping in hysterics by this time.

He said, "Well, I'll get out the harnesses and we can put them on. Then you can tell us when to start down, Lefty. Miss Gardner, do you think you can shin down a hundred-foot rope and not let go before you reach the ground? I mean, do you think you'll have strength enough for that?"

Judith Gardner smiled at him; her eyes were brown and very deep and very trusting. They made Bill Brent feel capable and strong and very clever to have thought of this expedient.

She said, "I'll try not to be afraid, lieutenant."

He pulled the parachute harnesses from their pockets in the basket lining and put one on Judith, bending down in front of her and buckling the straps. Then, working quickly, he climbed up into the rigging, standing on the suspension bar and reaching up to the valve and rip cords. If Lefty and Joe knew what he was about they'd slaughter him for this. Guarding the ropes with his body, keeping them out of the others' view, he cut part way through each of them—cut through enough so that a hard jerk on either one would break it at a point high up. To his surprise, neither Joe nor Lefty even watched him as he performed the sabotage. Finally he climbed back into the basket.

Another thirty minutes passed in virtual silence, and at last Joe cried, "Lefty, we're driftin' south, you know—and the Gulf is somewhere down there close! We'd best git low and look around."

Lefty whistled softly. He said: "By

Heaven, I forgot about the Gulf! All right, shavetail, take us down!"

Now was the time! Brent held his breath; he was shaking from excitement. He reached up and touched the valve cord, pulled down on it gently. His hands were sweating; he felt almost light-headed from the pounding of his heart. He valved and watched Judith's face, with quick, repeated, glances at the altimeter and at the men. The needle dropped gradually to eleven hundred feet, then to a thousand. Finally to nine hundred.

"I thought we'd see the ground before this," he said with bated breath. "See if you can see it through these clouds."

Nobody answered. Joe and Lefty were staring downward through the mist.

Judith was watching him with a look of strain and nervousness. He nodded to her, and for a moment he was so frightened, so thoroughly scared, he went quite weak all over. But he had to do it now. He reached down and grabbed up the three bags of money from the floor where they were lying. He thrust two of them into Judith's startled hands. Then, before the men looked up, before Judith realized anything about his plans, he simply shoved her violently and brutally over the basket rim.

Her single piercing scream came rising through the mist, and Joe and Lefty whirled almost together. If she had gone in silence, as Brent had hoped she would, they both would have slipped away and disappeared into the clouds before the bandits were aware that they had jumped. But the scream defeated Brent. He was standing there, a sack of money in his left hand, his parachute line snapped to his harness—and there wasn't time to jump to safety.

Lefty was swinging down upon him with a rifle, and Joe was behind Lefty, already reaching for that deadly pistol.

There was no chance. Bill Brent knew that. He knew that he was gone. But, having no weapon but his fists, he launched a wild, terrific right at Lefty's jaw.

Lefty tried to dodge, but his rifle barrel caught upon a stay, and the blow landed! Lefty staggered back, slumping down on Joe. Joe was cursing viciously and still trying to bring his gun hand free. There was no room to move, here in this crowded basket, with Lefty half sprawled across the corner. And for the fraction of a second Brent was free.

He seemed frozen in his tracks. He tried to move, and his muscles responded in a kind of sluggish unreality. With an infinite deliberation, he reached up and snapped down upon the valve cord—and the lower end came free within his hand. He snapped the rip-panel cord likewise, and then turned and dived away into the clouds.

A shot, and then a volley of shots cracked out above him, but he was already in the clear; his parachute bloomed above him in the writhing mist. He drifted down, broke into clear air. He saw Judith's parachute spread out upon the ground. Only when he landed did he realize he still had a money sack in his left hand.

OLD NAT GARDNER had two thousand acres of rich cotton land. Brent and Sanders were his week-end guests.

With Judith, they sat upon the pillared veranda, each with a frosty mint julep in one hand; and if the evening was a little muggy with humidity, no one seemed to notice it. Judith, sitting close to First Lieutenant Sanders, glanced repeatedly at William Brent.

"Dad," she said with mock reproachfulness, "what do you think of an army officer who would push a lady out of a balloon?"

Nat Gardner boomed, "Hell, if I could get a twenty-five-hundred reward for doin' it, I'd do it, too! Brent, what're you agoin' to do with it?"

Bill Brent laughed. "Wait till I get it. When I do, I'm through being a bug hunter——"

"You're just as through now," Sanders interrupted, "as if you had figured some way to destroy that balloon. There isn't another surplus bag at Scott to send down here for a replacement, and the D. O. A. is going to use their bug traps on airplanes from now on."

Brent smiled thinly in the darkness. He said, "However that may be, I'm going back to Scott and do a lot of heavy dating with the commanding officer's daughter, and if I'm lucky——"

Sanders put in thoughtfully, "Bill, you're pretty smug about this business. There's one thing I'd like to know: I guess those birds have been lost in the Gulf, all right, because it's been ten days, but I don't quite see why they didn't have the sense to valve that sausage down!"

Bill Brent lighted a cigarette. The match flared upon his face, which was inscrutable. His eyes were veiled. "Valves have failed," he mused. "Control lines have broken, once or twice. Without Judith's and my weight, the balloon would have ascended to a great height, especially after it climbed through the overcast into the sun and the warmth expanded the hydrogen. There was a strong north wind aloft. Oh, any one of several things could have happened. But why worry? The men were killers, and having them killed that way saved the State a lot of money. As to how it happened—well, why even speculate? I'm satisfied to be going back to Scott. That's really what I wanted, anyhow."

He did not see Judith Gardner's knowing glance.

# ROCKET SHIPS

*(Continued from page 36)*

that the human body can survive an acceleration of 1 gravity, or 32 feet per second per second. We step this up a bit in order to conserve fuel energy, confident that man could stand possibly 3 gravity under these conditions in perfect safety. As we sizzle through the dense atmosphere we are reminded that we already are withstanding the comfortable rate of 18 miles per second in our planet's orbital rush around the sun.

From the motive power of the big tail-end step we get an initial velocity of 2½ miles a second. When it is burnt out, we discard it by parachute to prevent its crashing upon our neighbors' heads below. Lighting the third step boosts our speed to 5 miles a second. Finally we drop this one, too, ignite the second step, which easily will raise our velocity to the required 7 miles a second.

Before we think of what's going on outside our hermetically sealed cabin, let's see what's happened to us inside. We notice two extreme sensations. First, the rapid acceleration, like going up in a high-speed elevator, makes our weight seem fourfold; we are pressed downward, and to ease our discomfiture we recline in special vertical hammocks. Second, as the motors are shut off, upon overcoming the earth's gravitational pull, and we "free-wheel it" along at breakneck speed, we experience a counter feeling of weightlessness. The reason is that the force of gravity varies as to the square of the distance. This is simple to understand, the captain tells us: for example, one of us weighing 150 pounds would tip the scales at 37½ pounds at 4,000 miles, 16½ pounds at 8,000 miles, and only one pound at 48,000 miles. On the moon, which has only one sixth the attraction of the earth, this person will weigh only 30 pounds.

As the rocket spins skyward, our magnetized shoes come in handy, prevent us from gliding and floating about aimlessly. We notice no up or down in the earth sense; and the captain warns us that if we ventured outside we would remain suspended in space; what is more, we would be left behind, forever retaining the present velocity, if suddenly the engineer decided to increase the ship's acceleration. We would go on and on at the same speed, in the same direction, forever and a day.

No one reports any physical injury from the weightlessness of things, and everybody's heart seems to be functioning all right. To offset a queer psychological reaction, the engineer states that a feeling of substantiality could be given by constant acceleration, or by rotating the ship about its longitudinal axis.

Having adjusted ourselves inside, we are curious about the outside of our ship. For the first seven miles we went zooming through the lowest layer of the earth's highly frictional atmosphere—the troposphere. The next 60 miles consisted of the well-known stratosphere. At 70 miles we crashed through the reputedly dangerous Kennelly-Heaviside layer of so-called ionized gas. For the following 130 miles, with the air thinning to the vanishing point, we leaped from the earth's atmosphere and were well settled on our course through the great trackless space. There were occasional vibrations on the radio, but it is doubtful now that we shall communicate with the earth.

As we whiz along we are still subject to the earth's strong gravitational pull: with our motors shut off, it acts as a brake gradually diminishing our speed. The captain warns us that we now face our two greatest dangers: the sun and the meteorites. To circumvent the former, however, we have painted one of our sides black and polished the other to brasslike luster, the one to reflect the scorching rays when we want them, the other to deflect them when we don't want them. Moreover, as a further guarantee, our ship has been built with double walls which act like a thermos bottle.

Pressing our faces against the windows, we keep a sharp watch out for the myriad whistling meteorites supposedly in our path. Some are said to hiss earthward at 26 miles a second, but most of them are consumed by friction. Coming within our orbit, one of these flying needles would mean instant destruction. Luck is with us, and we escape them.

Sailing along in fine fettle, our ship reaches a distance of approximately 220,000 miles, a point at which the pulls of the earth and the moon are equalized and neutralized. Up to this point—several hours out—our speed has diminished to 1½ miles a second. Now, without resorting to our motors, our speed picks up under the steady pull of the moon's attraction. For the next 20,000 miles we worry how to provide enough braking in order to land safely.

We discuss it with the skipper. At the start he had vetoed retarding rocket motors fixed at the bow on the ground that they would alter the design of the ship and offer, too, a hazard in the back-blow of exhaust flames. Owing to the absence of air, a parachute is no good. The skipper finally veers his ship around to the left by starting the left motors and gets the vessel into the moon's orbit. We circle it stern first, slowly dropping down upon the surface, as the decrease of speed throws off the balance between the centrifugal force of the ship's velocity and the moon's attraction.

The earth ship lands in good weather, getting in on schedule at the junction of the two extremes of temperature. The great space vessel comes to rest on the side of a volcanic mountain after less than a day of travel, most of which was consumed in the difficult landing. The temperature question presently seems of little moment to us. What occupies us most are the millions of meteorites bombarding the moon. Fortunately, we had anticipated this peril and had worked out a theoretical shelter beneath the volcanic ash, which has a low capacity for conducting heat and provides a safe refuge from external irritations.

After a fortnight of successful exploration, during which we gather specimens for scientific research on earth and make numerous recordings with their delicate instruments, we start for home. The motors of the No. 2 step are re-ignited, the ship rising without difficulty. Due to the low gravity pull, the necessary escape velocity is only a mile and a half.

Once out of the moon's gravitional grip, which is brief—20,000 miles—we strike the inverse attraction of the earth, and begin a long coast. We glide to within 50 miles of the earth at a clip of 6 miles a second. Here's where our parachute comes in handy. Thrown out, it catches in the deep, thick atmosphere and slows up our speed to 4 miles. Under this retarding force, the space ship gradually falls to earth. This maneuver alone has required 24 hours.

The rocketeers believe this voyage will blaze the trail for large-scale spatial operations on many planets. They now are even talking of shooting a rocket to Jupiter 484,000,000 miles away, with a bulk 1,341 times that of the earth. For a trip to near-by Venus they have evolved a rocket weighing 21,000,000 tons, costing $3,500,000,000. With the moon as a jumping-off place, they believe this could be made cheaper.

To reduce their difficulties, an Austrian engineer has invented a floating island to be towed or built 600 miles off the earth. The scheme of Guido von Pirquet, it would circle the earth as a satellite at a velocity of 4½ miles a second. Chief purpose: to act as fuel-

## November Contest

The following readers were winners in the November "Gullible's Travels" contest with the indicated number of allowable, correctly picked errors:

First prize, $5—Joseph T. Prazak, Winooski, Vt., 83.

Five prizes of $2—Ray Meyer, Louisville, Ky., 80; Frank Drugos, New Brunswick, N. J., 79; Anselm Kickbush, Owosso, Mich., 72; Walter Leszczynski, Salem, Mass., 71; John Jennings, Gibsonia, Pa., 65.

Five prizes of $1—James Lindeman, Port Arthur, Ont., 63; Ray Raffels, St. Louis, Mo., 62; Bert Dunham, Okmulgee, Okla., 60; Victor Hall, Calgary, Alta., 55; Hayden Wilcox, Huron, S. D., 54.

ing station for moon ships. The cost would be $10,000,000.

So much for space travel. On the earth itself, rocketeers admit the prospects of achievement are more certain of immediate accomplishment. Already they have to their credit mail rocket flights in several countries, including the United States. A rocket shooting mail over the mountains near Graz, Austria, is part of the daily mail service of that country.

For Atlantic passenger and mail service, a rocket already has been designed. Soaring through the stratosphere at 10,000 miles an hour, or about 2¾ miles a second, it will describe a parabola at 600 miles and drop to its destination on a parachute. Time of flight is set at 50 minutes. From New York to Chicago a rocket will whistle in less than 20 minutes. But for distances of less than 1,000 miles, rocketeers are doubtful whether their vehicles are practical. As a substitute for automobiles, airplanes and other modes of earth travel, their use is a matter of speculation.

One of their most profitable uses, however, will be in the meteorological field. Able to ascend to dizzy distances, rockets will carry instruments which will record weather changes days in advance of current calculations. This goal alone, rocket men feel, is of enough public interest to encourage their thankless, pioneer efforts.

# MOTORS

*(Continued from page 26)*

high flash power or burning point, and secondly, because being a vegetable oil it would not mix with gasoline, which would reduce the lubrication value of the oil. The oil was fed from a gravity tank to an oil pump bolted to the back of the motor. After leaving the pump, it was forced through a copper pipe to a union on one of the central supports. Coinciding with this union was another copper pipe running along the inside of the hollow crankshaft which conveyed the oil as far as the long-end web. The remainder of the shaft was drilled to form oil channels.

There were three outlets for the oil. One was at the neck of the long-end crank web which lubricated the thrust box. The second was at the crankpin, oiling the boss of the master connecting rod, big-end pins, big-end ball bearings and then passing down the hollow connecting rods to oil the wrist pins, bushes, piston and cylinder walls. The third channel ran between the two cam-gear wheels on the eccentric shaft, where it lubricated the cam-box ball bearings, rocker arms, and valve guides.

Owing to the fact that centrifugal force was so strong that the oil could not be used over again, the oil consumption in a rotary motor was considerably higher than that of a stationary engine. Some types used as much as 2.4 gallons per hour.

The valve timing was an interesting feature of the rotary engine, shown in Fig. 4. Two circles, representing the range covered by the four strokes (suction, compression, power, and exhaust) are divided into black and white paths. As shown in the first circle, the intake valve opened 4 degrees before top-dead-center and closed at 56 degrees past bottom-dead-center. The length of the induction stroke is indicated by the heavy black line.

Ignition occurred 22 degrees before top-dead-center on the compression stroke.

The exhaust valve opened 68 degrees before bottom-dead-center and closed at 4 degrees past top-dead-center. There was an 8-degree overlap on the valves which allowed for the comparatively slow opening and closing, due mainly to the eccentric motion of the engine.

*Don't miss the next article in this series in the April issue if you want to gain more knowledge of motors.*

# AVIATION

*(Continued from page 18)*

After you have 50 solo hours you may take your private pilot's test—a somewhat more difficult flight test, but no mental examination if you have already passed the examination on the Air Commerce Regulations.

A private pilot may carry passengers as guests, but not for hire. If he is the employee of a company he may carry executives, other employees and guests of the company, provided no charge is made for the transportation. He is not allowed to give flight instruction or to carry cargo for hire. He is, however, permitted to demonstrate planes in flight to prospective purchasers.

IT may be, as you get "in" on the aviation doings around your airport, that you will have a chance to carry a few passengers or do other flying for *pay, perhaps in your spare time or on* holidays. To do so in licensed aircraft, you must first get a commercial license, of which there are two grades, the limited commercial and the transport. For the limited commercial 50 hours of solo flying time are required, for the transport license 200 hours. You must have been certified by the medical examiner as physically qualified for a commercial license. That means that you have to have 20/20 vision or better without glasses in each eye, pass various other eye tests, and be normal and healthy in every way. Any mastoid trouble, or any defect of the inner ear—which gives you your sense of balance—is especially disqualifying. The examination is rigid and waivers for minor defects are given only to thoroughly experienced pilots, generally in connection with renewing licenses of long standing.

For either of the commercial licenses you must pass very thorough and rigid flight tests which require expert skill in handling a plane. They are the same for both licenses, except that the limited commercial applicant does not have to make a cross-country flight. For either license you must pass practical and theoretical tests in elementary engine and airplane mechanics and rigging. For the transport license you must also pass examinations in meteorology and air navigation. There are no educational requirements for licenses beyond the ability to pass these examinations. Any person with a grammar-school education and a fair amount of intelligence can apply himself and learn enough to pass them.

You may take the test for any kind of license any time you are qualified, and it is not necessary to have any license beforehand, except, of course, the student license.

Limited commercial pilots have all the privileges of private pilots and in addition may carry passengers on flights within ten miles of their home airports or other areas specified in their licenses. Transport pilots may carry passengers for hire anywhere within the United States and possessions. In addition, transport pilots, and they alone of all government-licensed pilots, may give flight instruction for hire. For more detailed information you should secure a copy of Aeronautics Bulletin No. 7 mentioned above.

Many pilots expecting to do part-time or even full-time commercial work around their home-town airports get their flying experience gradually as they get the money, or perhaps as they are instructed by transport-pilot friends. They study mechanics, navigation, and so on informally and take the examination when they feel that they can pass. However, if you want to enroll in a flying school for a ground school and flying course, you will find the average cost of a limited commercial course around $550 and the required time to complete it about 20 weeks. A course taking you from the beginning to the place where you should be qualified for the transport license will cost about $1,775 on the average, though the prices charged by various schools range from around $950 to $2,900. The average time to complete a transport course is about 46 weeks.

The applicant for a license must furnish the plane (his own or a rented one) in which he is examined by the inspector for the Bureau of Air Commerce. But there is no charge in connection with securing a license except the fee paid to the medical examiner ($10 for a first examination and $6 for a license renewal examination). Student, amateur, and private licenses must be renewed every two years, limited commercial and transport every six months.

All the foregoing refers to flying that is done in accordance with the Air Commerce Regulations as set up by the Bureau of Air Commerce of the Department of Commerce. A good many planes operate without licenses and are flown by pilots without licenses, who do all kinds of things. This is possible because the Federal government, under the United States Constitution, has no authority to regulate flying which does not involve the crossing of a State line. If the regulations are violated in any way, the Bureau of Air Commerce can cancel the license of the plane or pilot, or both. But it cannot stop a person from flying within one State and it can fine a person only if his violation involves flying in some commercial capacity across a State line or a boundary between the United States and a foreign country, or anywhere at all within the District of Columbia, Alaska or other territories and possessions of the United States. So far as the Federal government is concerned, an unlicensed plane may be flown by an unlicensed pilot over a State line for pleasure alone.

The operation of unlicensed planes either for pleasure or profit within a State, however, depends on the absence of State laws forbidding it. Practically all the States have aviation laws, most of them requiring that all planes within their borders be licensed by the Federal government.

So the young fellow who experiments with hay-wire planes is very likely to run into legal trouble if he doesn't break his neck first—which is more than likely. Any young man interested in learning to fly is urgently advised to carry on his activities in accordance with the Federal regulations, even if his particular State does permit unlicensed flying. Any other course of action will be injurious to aviation and probably fatal to the rash person pursuing it.

All we have said about flying so far applies to the person primarily interested in pleasure flying or in such commercial flying as he may gradually work into in his own locality.

What about the person who is considering the flying side of aviation as his permanent profession?

First of all, you want to decide what kind of flying you think you want to do or might be able to do. What flying jobs are there? What are the probabilities of getting one? What are the qualifications? How and where does one prepare himself? How much money can he expect to make?

THERE are dozens of miscellaneous flying jobs and new ones are being made all the time. They include the well-known airport jobs of short-hopping passengers and making charter trips. There are also flying instructing, crop dusting, piloting aerial photographers and mappers, aerial advertising, demonstrating and selling planes, flying business executives in company planes, playing aerial chauffeur to millionaires, experimental and test flying, watching for forest fires, and so on.

It is impossible to say anything definite about the probability of getting a good job in miscellaneous flying. Generally speaking, it would be a good idea for you to have a good connection or a job waiting for you before you spend too much time or money on a flying course, especially if it is necessary for your future welfare that you spend it carefully and wisely.

Your success as a pilot in miscellaneous flying would depend not only on your ability as a pilot, but also to a very great degree on your ability as a business man or salesman, on your energy, initiative, imagination, and personality. It also would depend very largely on such factors as your location, your competition, and whether you happened to be unlucky enough to have an accident or two and ruin your reputation, perhaps unjustly but effectively nevertheless. It would also depend very largely on the times. Depressions hit miscellaneous flying hard. For instance, miscellaneous operators carried about 1,840,000 pay passengers in 1930, but only about 907,000 in 1933. By 1935 the number had climbed to only about 1,000,000. Incidentally, that shows you how small the business really is. Practically all of our 122 million people wear shoes, and many of them ride in automobiles, but only one out of a hundred or so pay for an airplane ride, even once a year.

At the beginning of 1936 there were 6,199 transport pilots, not counting 987 employed on air lines, and also 909 limited commercial pilots, making 7,108 commercial pilots altogether in miscellaneous operations. There were 6,872 licensed airplanes, not counting 459 on the air lines. (How many licensed planes were being used non-commercially and how many pilots with commercial licenses were doing private flying, it would be hard to say.) There were over 6,700 private and amateur pilots who owned a good many of the licensed planes.

From these figures you can very easily see that there are more licensed commercial pilots than there are licensed civil planes. This is due partly to the fact that the army air corps and the aviation branch of the navy for several years have been releasing from 200 to 300 pilots annually into civilian flying. The air lines have not absorbed nearly so many.

However, the situation is loosening up a little. The air lines have been taking on more pilots in the past few months. Also the air corps has recently been giving the reserve officers more active duty. That takes off the market a number of those who would otherwise be looking for flying jobs. Also the navy has been in need of pilots for the 150 or so airplanes on the new aircraft carriers *Enterprise* and *Yorktown*, being commissioned early this year. The navy will continue to expand under present authorization until 1942. That means fewer navy-trained pilots in civil aviation, for a while at least. But, according to the present schedule, some time in 1940 the navy is likely to start relieving naval reserve pilots at the rate of about 20 to 30 a month. That would make competition keener, but it is a rash man who would say anything with assurance about 1940 aviation.

For the present, however, with prosperity coming back, the military competition lessened, the flivver plane perhaps around the corner, and semi-flivver planes like the Taylor Cub selling fast, the immediate prospects for the miscellaneous operations flier are brighter than for a long time. It must be remembered, however, that as yet it is a small business and success depends more on yourself as a business getter than as a pilot.

There are some branches of miscellaneous flying, such as test flying, which require high skill and special ability as a pilot. However, the requirements of many kinds of miscellaneous flying are less exacting than for military and airline flying. You must, of course, have a transport license to make any real headway. If you have had your flying training in one of the military schools it gives you valuable prestige, for army and navy pilots enjoy widespread public recognition as good pilots. If you can go to one of the commercial flying schools which are on the approved list of the Bureau of Air Commerce, you will be assured of good training and will also enjoy a certain prestige, depending on which school you attend and how well known it is in your locality.

But in case you can't get in or decide against entering a military school, or if you don't have the money or time for one of the extensive commercial courses, you can get adequate instructions from one of numerous independent instructors and small schools. Lists giving addresses may be had from the Bureau of Air Commerce. You can also get lists of operators doing aerial mapping and pho-

tography; dusting, spraying and seeding; exhibition flying; aerial advertising; and charter, taxi and sight-seeing.

As to the money you make in miscellaneous flying, it is more or less as a young chap at Roosevelt Field, Long Island, summed it up: "You don't make much money, but you have a lot of fun." There are so many young commercial pilots anxious to get flying time that the pay for them is little or nothing. A man who makes much money generally has used his imagination and initiative to make himself a good job. If you own your own planes or plane you may go broke, but you are not likely to get rich unless you happen to be a very exceptional business man.

IF you are pretty sure that you want to go into flying professionally, you will go, of course, if possible, to one of the best schools. If you hope to get a flying job on an air line, it will be practically necessary for you to do so. In such a case, if you are the right age, a citizen of the United States, unmarried, well educated enough, healthy enough and lucky enough, you will train either at the Naval Air Station, Pensacola, Fla., or at the Air Corps Training Center, San Antonio, Texas. If you fall down on certain of the above qualifications, but are rich enough, you can go to one of the several top-flight commercial schools which specialize in training a man for an air-line job, take two years to do it, and charge him close to $5,000 for everything, including board. The very best commercial schools are almost as rigid as the military schools in their requirements for graduation.

Though peace-loving people everywhere deplore the increasing armaments of the world, the result is good news for the flying aspirant. Today it is easier to get into a military flying school than it has been for years. The army and navy are actually offering bonuses and competing with each other for men to take their courses. Recently the navy was outbidding the army, but the army is raising its bid. The air corps authorities are conducting a campaign, urging men with two years of college work or its equivalent to apply and take the physical examination. Flying cadet vacancies at Randolph Field, the Primary Flying School at San Antonio, are going begging. The quota at present is 150 students per class and it is not being filled. And there is a possibility that the quota will be increased soon.

To be eligible for appointment as a flying cadet, you must be at least 20 and not over 26 years old, a citizen of the United States, and have a sound physique and exceptionally good health. Your vision, hearing and nervous system must be first rate. Only one out of about ten applicants passes the air corps physical examination for flying.



You must have two years of college or be able to pass an examination in the following subjects: United States history, general history, English grammar and composition, geography, arithmetic, algebra, plane and solid trigonometry and elementary physics.

If you think you might qualify, write to the Adjutant General of the Army, Washington, D. C., or to the Chief of the Air Corps, Washington, D. C., asking for further information and application blanks.

If your application is approved, you will be instructed to report at an air corps station for examination. If you are the successful one in ten, you will be ordered to Randolph Field for training. Classes begin on July 1, October 15, and March 1 each year.

After eight months of primary and basic training at Randolph, you will be sent to Kelly Field, the famous alma mater of army fliers, for four months of advanced military flying. That is, if you don't "wash out." Only about 40 to 50 out of 100 originally hand-picked men get through Randolph Field. The rest are sent home, expenses paid, usually because of failure to pass the flying work.

When you graduate from Kelly Field, you will be given your "wings" and rated "Airplane Pilot." You will also immediately get a commission as a second lieutenant in the air corps reserve, for the air corps is abandoning its custom of keeping Kelly Field graduates on flying-cadet status for a second year.

And here is good news indeed for the man who wants to pile up flying experience. The air corps expects to quit its practice of giving a Kelly Field graduate only a year or two of extended active duty with a tactical squadron at Selfridge, Langley or some other field. Instead it intends to give each man three years as a second lieutenant, and then promote him to first lieutenant and give him two more years. And after the first three years of commissioned active duty, he will be made a present of $500 in cash, on top of all his regular pay. A man doesn't have to stay in all those years if he has a better job waiting for him outside, but can generally be released from active duty any time he requests it.

During his year as a flying cadet, a man is paid $75 cash a month, and in addition is royally fed in the flying-cadet mess, for which $1 per man per day is allotted. He is issued his uniforms and equipment—everything from flying goggles to toothbrush—and given free room in barracks. As a second lieutenant on active duty he gets a total of about $205 a month with living quarters on the post, or $245 without quarters, but has to pay for his uniforms, food, club dues, and so on.

During his training at Randolph and Kelly he will get flying instruction that compares favorably with any in the world, about 325 hours of flying altogether, including instrument and night flying, radio beam work, and so on. He will get instruction in airplane and engine maintenance, theory of flight, navigation, maps, meteorology, radio, and several other subjects of a general and military nature. If he takes observation at Kelly, he'll get training in aerial photography and other special work; if he is assigned to bombardment, he will get a lot of experience in dual-motored planes, similar to the big transports. If he takes attack, he will fly those slick, low-winged "flying machine-gun nests" which have been pictured so much. If he takes pursuit aviation, he will fly the bulletlike new pursuiters. In any case, he will have a chance to

fly some of the finest airplanes in the world.

Beyond the extended active duty mentioned, there is little chance for a young man to remain permanently in the air corps unless he is already a regular army officer through having graduated from the United States Military Academy at West Point, N. Y. West Point graduates who can pass the physical test and who wish to do so may go to Randolph as student officers. They wash out just as quickly as flying cadets, however, and are sent back to the infantry or whatever their branch of the army may be.

Last summer about 50 reserve officers who had trained as flying cadets were commissioned in the regular air corps. Others will be commissioned in small numbers from time to time, but in general the flying cadet must count on returning to civil life sooner or later. For that reason a young man should remember that civil aviation has not yet grown to the point where it can absorb all the pilots being trained by the military schools. It is true that a large part of the pilots hired by the air lines have had military training, but you cannot count on landing such a transport job. Unless a young man is marking time for want of money to educate himself for the future, or unless he has two or three years to devote to adventure which is pleasant but probably of little value so far as his future is concerned, he should think twice before he joins the flying cadets.

Not only the army is paying people to fly. The navy is doing the same thing. A class of new flying students is entering training every month at Pensacola. Next month in AIR TRAILS we will tell you about learning to fly in the navy. And we will tell you about the only chance in the United States for a young man to get flying instruction free of charge without being required to have any college education at all or any examination on college subjects. We will also tell you about the pay of air-line pilots and the kind of training an air-line pilot has to have.

*Follow this series of articles. It is the most important reading for 1937 to those who intend to enter aviation.*

# GULL WINGS

*(Continued from page 33)*

Gnôme-Rhône 14-Kes radial air-cooled engine. This is a 14-cylinder, supercharged gas mill that develops 945 h.p. at 13,940 feet altitude. The motor is inclosed in a French version of our own N. A. C. A. cowling and is fitted with a three-bladed metal propeller. The normal armament carried by the ship consists of two Oerlikon 20 mm. quick-firing guns. These are mounted below either wing in large fairings at the point of attachment of the wing struts. Empty cartridge cases are ejected through slots in the V bottoms of these fairings. As an alternate armament, four Chatellerault machine guns may be mounted in the wings to fire outside the propeller disc.

The Loire 46 is not as clean as some of our latest model low-wing pursuit planes, but the disadvantage of external bracing is more than balanced by the really remarkable visibility afforded by the gull-type wing roots. I should like to see some American designer produce a fighter combining the best features of both types. Imagine a full-cantilever gull-wing single-seater with retractable landing gear of the Grumman type, powered with a 1,150 h.p. Twin Wasp. Row-de-dow! There would be a battle bird for you—a star-spangled American eagle that'd carry old Uncle Sam's fighting eaglets right up to the highest cloud pinnacle in the bright blue sky!

# "DEAR HARRY—"

*(Continued from page 27)*

pumping faster. Will I never get out of here? What a thought. For want of anything better to do, I level out.

Something is pressing on my stomach. It's the safety belt. I happen to glance at the air-speed meter. It reads 160 miles an hour!

The plane shoots out of the cloud.

I blink as the sunshine strikes my eyes, breathe a sigh of relief—and suddenly realize two things. The ship is inverted and it is diving.

Back with the stick once again. The dive becomes vertical and then the plane levels out.

Clouds are all around me. I carefully avoid them and seek lower levels where they are not. Clouds no longer interest me; in fact I do not care to go anywhere near them again.

I let the ship lose altitude and scan the earth to get my bearings. Funny—I do not recognize the countryside. Apparently I've flown far from the airport, farther than ever before.

For a half hour I fly in one direction after another trying to spot some familiar landmark. Nothing doing. And the gas is getting low. What now?

Trying to think as logically as possible, I decide that the first step is to take on gas. Where? I know there must be air fields around—if they can be found. I strain my eyes looking for any such. Time passes.

There is a field!

My eyes fasten on a welcome sight: a hangar, windsock and landing field—yes—and a gasoline pump.

This will be my first landing on a strange field, I recall, as I circle widely. Therefore, great caution is in order. I study every feature of the field below, note very, very carefully the position of ol' Mr. Windsock, and then prepare to come down.

First flying a mile away from my objective, I turn and start back, letting the plane drop until the wheels seem to be almost touching the ground. Every second or two I give the motor a burst to keep it cleared out.

The air field comes rushing to greet me. Now. I cut the gun and let the plane settle. The wheels touch ground, and a split second later the tail skid. Almost a three-pointer. Not bad!

While a mechanic, the air field's only inhabitant, fills my tanks, I inquire the way to Skyways Airport.

"Ever been there before?" the mech asks.

"Sure have," I reply, "I'm a student there. I took off on my first solo this morning, played around in the clouds a while and lost my way. Guess I'll go back now."

The mechanic stops pumping, looks at me blankly, then grins and starts pumping again.

"Yeah, just like that," he scoffs. "You're some kidder."

And try as I will I can't convince him that I am really on my first solo flight. He won't believe me, not then at any rate, but maybe he does later when I attempt a take-off.

Forgetting that the ship is heavier with the load of gas and that the motor has had time to cool, I jump off the dirt too soon.

Down the field I go a-roaring, at an altitude of twenty feet, unable to climb higher. A cylinder or two cuts out momentarily. The plane drops, hits hard and bounces. I manage to hold it in the air this time and the air field is left behind. Now I must stay in the air, or crash.

Ice-cold sweat breaks out on my brow, as I see a line of trees lying in wait for me. I ease back the stick and push hard on the throttle, though I know it's wide open. The ship rises slowly—oh, so slowly.

*Crash!*

The landing gear smashes through the treetops. I close my eyes and wait for the next and final crash. It comes not! Opening my eyes, I find that the plane is still afloat, and furthermore, climbing. Soon all tree-busting danger is past.

By the time the good old home airport is in sight my composure is somewhat restored and my heart action is nearer normal. With all caution, I glide down to a landing—not a landing to write home about, but, anyway, a landing.

Kinley and Norwood hasten forth to greet me.

"Where have you been?" Kinley puts the burning question. "We've sent six ships out looking for you."

I relate my tale in its entirety. Their faces are pictures to behold.

"Do you mean to say," Norwood demands, "that on your first solo you flew blind through a cloud, landed on a strange field, took off with a cold motor and flew back here to make a safe landing?"

Kinley prefers action to words. He inspects the fuel tanks.

"Just as Sterling says, they're full," he tells Norwood.

Norwood scratches his head and suddenly looks hard at the landing gear of the plane. There, caught on the struts are tree branches and leaves.

"That settles it," Norwood announces. "The story's true."

Then he addresses me.

"Sterling, when a solo student tries to fly blind it usually means his end. If he gets lost, he nearly always becomes panicky and either stays up till the gas gives out and comes down in a heap, or tries to land anywhere and cracks up. That you should extricate yourself from both those situations is remarkable. You may yet make a pilot."

And what do you think of that grand speech? High praise from a guy who earlier in the season predicted that ten thousand years of instruction wouldn't make me a pilot.

Well, with my solo behind me I'll forge on to new adventures. What they'll be—who knows? But when you open my next letter you'll know.

Yours till that date,

STEVE.

# WINTER SPORT

*(Continued from page 55)*

heater, if you have the use of a car, is helpful in preheating the motor before trying to start it. Park the car near the flying field; whenever you have trouble with the motor, take the model to the car and let the warm air from the heater help restore its life. The heater will also keep the car warm enough so any repairs or adjustments to the model can be made without freezing your fingers.

While on the subject of frozen fingers, we offer a bit of advice. Treat motors with respect, whether they're rubber or gasoline. Cold fingers are doubly sensitive to the "bang" of breaking rubber bands or to the kick-back of the propeller of a balky motor. Gloves should be worn to help keep your fingers nimble.

Rubbers or galoshes are desirable in the wardrobe of the winter modeler. If the ground is frozen and hard underfoot, they'll help warm your feet. If the sun has thawed the ground, rubbers will make excellent mudguards. Many times we've chased models through fields where the mud was so thick that ordinary walking was impossible. It was necessary to do a sort of snowshoe shuffle to prevent the ankle-deep mud from pulling off rubbers. And needless to add, it was a big comfort after coming home from flying to park those mud-incased rubbers outside the back door and walk into the house without a trail of incriminating mud tracks.

Winter flying gives you no false impressions about your model's ability to fly. Gusts and tricky currents soon eliminate the poorly built planes. Good flights must be credited to the model, and not to helpful up-currents. Just as the severe climate of the North is credited with producing a sturdy and hardy people, so the rigors of winter flying improve the breed of our flying models.

——G. S. L.

# CONTACT!

*(Continued from page 54)*

the other held at the same height as the top of the cylinder of the motor. Then, by means of the adjusting nuts, lower the trailing edge of the elevator till it rests flat on the piece of wood. Check the center-of-gravity position by balancing the model near the fuselage on your fingers at the front main spar. Moving the battery board will bring the center of gravity to this point.

## FLYING

A large, level field with short grass makes test hopping simple. The first step is to lower the rear of the elevator about 1/8" below the zero-degree setting so it is at a slight positive angle. In this nose-heavy condition, the model will taxi across the ground tail high, a perfectly safe condition if the air is calm. The timing on these test flights should be limited to about 15 seconds. After the first test flight has shown the model to be nose heavy, raise the trailing edge of the elevator, trying a test flight after each 1/8" increase. These test flights serve as a check on the rudder settings as well as the elevator adjustment. Correct any tendency to circle tightly with a suitable movement of the rudder tab.

The elevator should be raised in easy stages until the model leaves the ground in a nice climb and shows a good glide with power off. The advantage of starting with a nose-heavy adjustment will eliminate any danger of stalling, with resulting serious damage.

Any trouble in getting a flat glide is probably the result of too little climb under power. Raise the elevator a trifle to remedy this. Even with reduced throttle setting on the Brown Junior motor, at 3,000 r.p.m. the climb was steep with a nice recovery into a flat glide when the motor cut out.

High grass in the flying field will probably prevent taxiing the model for any distance. In this case the best procedure would be to set the elevator at zero incidence, making sure that the wing setting and the center-of-gravity location check with those given. With rudder set neutral, let the model take off. For the first few flights guide the model by running alongside, holding the wing tip. Watch the flight closely. If the model stalls, the remedy is to lower the elevator. A violent whip stall will necessitate elevator adjustment of as much as 1/8". If the model insists on flying about 15 or 20 feet above the ground without climbing, the action of the model after the motor stops will be the key to the trouble. A dive after such a flight shows the model is nose heavy; the elevator should be raised. A nice glide after this kind of flight shows you are flying with too little power. The cure is to advance the throttle and increase the propeller r.p.m. Another favorite maneuver of poorly adjusted gas models is to take off, bank sharply and dive into the ground. Correct this by moving the rudder tab and raising the elevator.

In correcting elevator settings, make all major changes by means of the adjusting nuts. After you're satisfied with the elevator setting, seal the adjusting nuts with cement and use the tabs to make any additional changes. Our model circles to the left under power in circles of 150-feet diameter, and when the motor cuts out, the model glides in a sweeping right circle.

The flaps introduce new complications into the model's adjustments. Even at low angles they tend to stall the ship. This danger can be minimized if you'll take the precaution to lower the flaps about 5 seconds after the motor has stopped.

The flaps can be timed accurately with little trouble. One of the experiments during flap testing was to lower them with power on. The model nosed up sharply and continued in a stalled-climb attitude until the motor cut out. The "glide" was a series of whip stalls and dives with a rough nosing-in landing. However, with no changes in set-

ting, the flaps were lowered after the motor had been cut out. The stalling was still present, but greatly reduced. The landing this time was bumpy, but not dangerous.

The model has been flown without cowl and door. There was little noticeable change in the flight. Without the door the difference in flight was not visible. Without the cowl the flight is a trifle slower and the left circle under power is tighter.

The original model, the cooperative product of three builders, will soon celebrate its first birthday. During that time it has logged about 250 flights. These flights have been packed with thrills, which included loss overnight in a field and thorough soaking by a sudden thunderstorm. Despite its experiences, together with one-sided arguments with fences, trees, and telephone wires, the model is still strong and healthy. We suspect it will turn in many more flights before it can finally be persuaded to retire.

Let the Model Workshop editor hear about your own Sky King. He'll be glad to help with any difficulties you may encounter in building or flying, and to compare performances.

### DATA

| | |
|---|---|
| Wing and center section.. | 1 lb. 4 ozs. |
| Elevator and rudder..... | 4 ozs. |
| Fuselage complete with ignition, motor, propeller, and landing gear ..... | 4 lbs. |
| Total, ready to fly... | 5 lbs. 8 ozs. |

| | |
|---|---|
| Wing area..... | 7.4 sq. ft. |
| Elevator area..... | 1.64 " " |
| Rudder area..... | .63 " " |
| Wing incidence..... | 1½ degrees |
| Elevator incidence..... | 0 " |
| Dihedral ..... | 11 " |
| Center of gravity location: ... | 5½" below wing, 4¼" back from leading edge |
| Propeller diameter..... | 15 in. |
| " pitch (average)..... | 6 " |
| " r.p.m. ..... | 3,200 |
| Mixture ratio ..... | 6:1 |
| Direction of turn under power... | left |
| " " " in glide ..... | right |
| Flap area..... | .87 sq. ft. |
| Best flap angle..... | 15 degrees |

### MATERIAL

(balsa unless otherwise mentioned)

#### Wing

2 main spars ¼x1¼x42"
2 rear spars ¼x¾x42"
2 leading edges ⅜x¾x36"
2 trailing edges ⅜x1¼x36"
1 piece for wing tip ⅜x1¼x36"
10 pieces for ribs and covering 3/32x2x36"
2 flaps 3x3/32x36"
1 sheet dural 1/32x12x12"
3 36" pieces of No. 14 wire for flaps

#### Elevator and Rudder

3 pieces for spars ¼x½x36"
2 pieces for ribs 1/16x2x36"
1 piece for rudder rib ⅝x⅞x8"
1 leading edge ⅜x⅜x40"
3 pieces for trailing edge and tips 3/16x⅞x36"
1 piece of soft copper wire for tab hinges
1 piece of tin-can metal, two 2" machine screws and nuts for attaching tail, 2" of 3/32" outside-diameter brass tubing, and short length of No. 14 wire.

#### Cabane

1 piece ¼x1¼x6x½" pine for cabane spar
1 piece ¼x¾x6½" pine for cabane spar
1 piece ¼x3x36" pine for ribs
3 pieces 3/32x2x18" balsa for covering
2" brass tubing ⅛" inside diameter
8 machine screws ⅛" diameter, and nuts to fit
Bamboo
4 small screw eyes and short length of 1/16" galvanized wire

#### Additional Material

5 yards of silk for covering
1 pint of colored dope
1 pint of clear dope
8 ounces of cement
2 ounces banana oil

——G. S. L.

# SPEED PROP

*(Continued from page 59)*

The backbone of this mechanical device is of dural, such as is commonly used in making thrust bearings, 1/32" thick and 3/4" wide. Drill nine holes of .020" in diameter in a strip as shown in sketch #1, four holes for each slot and one for the shaft. Then, with a razor blade, cut out the metal between the slot holes. This is a bit tedious, but not difficult. If you have a file which is thin enough, insert it into the slot and smooth the edges. Otherwise take a strip of emery cloth about 2" long and 1/8" wide, put a few drops of oil on it and smooth the slot walls down with this. Watch your step, as it is very easy to wear a bulge in the slot. Bend the two sides up in the places indicated with round-nosed pliers. Make sure the shaft hole is in the center and that the top and bottom ends of the slots are equidistant from the center plate. The side arms should be filed down to the thickness of 1/64" to lighten the device.

The shaft is .016" wire. The loop is made by bending the wire around a piece of .020 wire held in a vise, as in sketch #3. The cross piece is .020 wire. Slip two washers on the shaft before putting it into place, and insert the cross piece. Put a drop of solder at the point where the shaft cross piece and the outer washer meet. Make springs as shown of different wire sizes from .014 to .020. The springs are designed so that they may be interchanged in a second, depending on what size of rubber is used and on whether you want the propeller higher pitched or lower pitched longer.

The face plates are 1/32" sheet balsa with grain running parallel to the shaft. They are cemented to both sides of the dural backbone (make sure you don't get any cement in the slot) and a piece is cemented on the front. Trim, and coat the balsa with a thin layer of cement.

Make the spring hinges of .016 wire as shown. Cement them to the blades and to the balsa faces.

The blades of the propeller may be either microfilm or solid wood. Obviously microfilm blades, weighing about .008 ounces at the most (which is about average for a 16" propeller) should be used for the greatest effect, as the total propeller weight would be no more than for an ordinary wooden one. In making blades, either wooden or built up, the only thing to keep in mind is the fact that the hub must be allowed for. Cut each blade shorter by half the length of the hub.

When the propeller is stationary, it should have a slight sweepback. This sweepback comes out when the propeller rotates. The wire spring hinge should be bent so that there is a low blade angle when there is no tension on the rubber. If the angle under full power is too low to suit your purpose, triangular blocks may be used as shown in sketch #9 to increase the pitch. If the pitch at full power is too high, restrict the distance that the cross piece will move.

BELLANCA TWIN ENGINED BOMBER

Before flying a model with this pitch-control device, the propeller must be carefully checked for static balance, equal pitch on both blades at a particular instant, and track. Check the balance by supporting the propeller at the hub on a razor blade. If one side falls low, sand it lightly and balance the propeller again. Follow this procedure until it balances. Wind the rubber about 200 turns and observe the angles of both blades. If they are not alike, bend the spring hinges, until they are. Then release the propeller and see if it tracks—that is, if both tips move in the same flat circle. If it does not, bend the shaft at the backbone in the proper direction until it does. Continue this treatment in increments of 200 or 300 turns until full power is reached.

Then hold the motor stick lightly at the point of balance of the stick and propeller together and release the propeller. It should unwind evenly. If it "bounces" in your fingers, make sure that the rubber has not crept up the shaft. If it hasn't, the propeller is either unbalanced or the blades are not at equal angles. Discover the cause of trouble and correct it. The propeller is now ready to be used.

Put it on a model whose performance you are familiar with, so you can make a comparison. The model should not

climb as high as with the regulation type propeller, but should remain at a cruising altitude much longer—in fact, should remain at the cruising altitude until it is practically wound out, and should reach the ground just as the last wind is out. If it glides down perfectly dead-stick, and this will be true in eight out of ten cases, use the next smaller size rubber, which will enable you to get more winds and consequently longer duration.

Another advantage of the device is that planes so equipped do not climb high. This should be an incentive to you indoor modelers who are handicapped with low buildings. As an example of its tendency to fly low, a model equipped with the original device on 500 winds consistently flew for over 7 minutes, not once gaining an altitude of more than 15 feet, and instead of $^7/_{64}$" rubber as was originally used on the model, it was flown on $^5/_{64}$", which was found to be wholly adequate.

The pitch-control device, of course, may be easily adapted to outdoor models by simply beefing up the parts.

# WAR PLANE

*(Continued from page 42)*

A $^1/_8$" sheet tapered strip to fit under the trailing edge to the tip of each pattern will insure a straight edge without "fussing" when the top cover pattern is laid on.

After the cement has set securely, "toenail" rib 1 and the tip to the board and remove all other pins. Flow a coat of cement all around the edges and across the tops of all ribs. Do this quickly (a tube of cement is the solution for speedy application) and then pin the top covers on, trailing edge to trailing edge first, leading edges next, and then the tips. This is when the $^1/_8$" tapered strip comes in handy; it permits the tip edges to be fastened together uniformly by pinning through several cut-to-shape scraps at the tip edges to prevent buckling. After the cement is thoroughly dry, remove the panels from the board and sand the rough or square edges to the final shape. Hold the right wing panel to the light and cut the aileron out.

The tail surfaces are built in the same manner as the wing panels, but are easier to do. Note that oversize rudder and elevators are arranged so that scale surfaces may be substituted. Soft iron wire may be used for hinges, but less trouble will be encountered if the controls are spot-cemented on.

Cement the wing panels to the fuselage frame by the spars. Be sure to have $^1/_2$" dihedral angle or more. The wheel wells and strut ways may now be cut out. Additional space, $^1/_2$" wide, between ribs 1 and 2 directly behind the stub spars must be cut out to notch for the latch control and the landing-gear axes and then replaced later.

## CONTROL MECHANISM

The idea is the same as in the Folkerts Special and *Time Flies* (see AIR TRAILS, January and February) except for the adaptation to this particular model. This one is very simple and should not be overlooked. The principle is like this: suppose the motor is unwinding; the diminishing tension of the motor lets the spring at the rear pull the control bar forward. The control bar moves the cranks on the aileron control and the latch bar forward, easing the aileron down gradually as the torque diminishes and releasing the landing gear, which has been set manually. Make the parts of the size wire indicated on the drawings. The wire guides on formers 7 and 8 prevent the control bar from buckling.

Cut $^1/_{16}$" slots through the ribs to the top cover to install the latch bar and cement balsa back in the slots. The landing gear hinges or axes require $^1/_4$" slots. Be sure to include the tension springs when cementing the landing gear in place.

## FUSELAGE COVERING

Make certain the control mechanism works freely. Cement the tail surfaces on and cover the fuselage frame as follows: the top and sides from the cowl back to former 6, the sides between 6 and 7, the top half between 7 and 9, the bottom half between 7 and 9, the wing fillets, and then the bottom "patterns."

If the insides of the back cover patterns and the outsides of the fillet patterns are coated with cement and dried, they can be shaped with the fingertips, the fillets especially. Pins and rubber bands are a great aid in covering with sheet balsa.

## PROPELLERS

A $^1/_8$" sheet retainer washer cemented in the nose receives the nose plug. A scale propeller may be carved if desired. The flying propeller is carved as a speed type. Leave the blades thick at the spinner and taper to at least $^1/_{16}$" at the tips. Sand the prop between coats of dope until it has a high gloss. Attach the prop to the nose plug in the usual manner, but bend a winding loop at the front.

## COMPLETING

Attach tail skid, radiators, wheel covers and then spray or brush all over with thinned clear lacquer. Sand carefully with very fine sandpaper, and then coat the whole model with aluminum lacquer (one-half thinner, one-half clear lacquer with fine aluminum powder

added). Do *not* use dopes, for they will draw the wood out of shape. Now place the cockpit cover patterns, insignia, exhaust stacks, numerals, tail surface threads, and paint the tires black.

### FLYING

The original model weighs exactly 1.5 ounces, ready to fly. Use three loops of $^1/_8$" flat lubricated rubber, equipped with an S hook. Cut a $^1/_2$x$^3/_4$" door forward of former 9 in the side of fuselage below the middle longeron. Hold the model upright and drop the rear of the motor through the fuselage and engage the S hook to the rear-hook device, through the door. Replace the door, with a tissue hinge. Make all glide and flight tests in tall grass. If the automatic aileron raises too high, cement a wire stop to the wing so it can be bent to adjust the height of the aileron.

Happy landings!

### MATERIALS

1 $1^9/_{16}$x$1^7/_8$x$2^1/_8$" cowl block
1 $^3/_4$x$1^3/_8$x6" prop block
14 $^1/_{64}$x2x18" covering
3 $^1/_{32}$x2x18" formers, radiators
2 $^1/_{16}$x2x18" ribs, spars
1 $^1/_8$x2x18" shore strips, etc.
4 $^1/_{16}$" sq.x18" longerons
48" of #12 wire, 12" #14, 12" #
12" #8, 12" #4
2 oz. clear lacquer, 2 oz. thinne
drams fine alum. powder, 1 d
black lacquer, 1 oz. tube ceme
1 pr. $^1/_4$x$1^1/_4$" wheels, 2" of $^1/_{16}$" a
tube, 4 $^1/_8$" washers, 3x3" thin s
celluloid

# FRENCH FIGHTER

*(Continued from page 56)*

the same manner as the tail. Shape the wing pieces first to the gull shape seen on the front view before carving to agree with the rib sections given. Sand smooth and assemble with pins and cement, as illustrated in the detail on the plan. Support the tips with small blocks until dry. The completed wing is then attached to the fuselage in the manner shown and the wing bracing struts added.

Cement the landing gear strut in place as required by the plan. Shape the pants, hollowing them out if workable wheels are to be used. However, the pants may be left solid if the visible sections of the wheels are carved and glued to their bottom surface. Cut the tail skid from a sheet balsa scrap and cement in position.

Give the entire model at least one filler coat of white shellac or clear varnish to fill the pores. Sand lightly between coats if more than one is to be given.

The entire model is finished in silver, for which silver bronze powder and bronzing liquid, or aluminum paint may be used. Trim with red. The insignia are French circles in which the colors are the reverse of the similar British emblems.

For the detailed model, the control outlines are either scored before painting or outlined with fine black lines after painting is completed. All minute details may now be added. The three-bladed prop is constructed of scraps mounted free to revolve on a pin.

### MATERIALS

1 5x$1^1/_4$x$^7/_8$" balsa
1 $1^1/_4$" sq.x1" "
1 $^1/_2$x2x12" "
1 3/16x2x12" "
1 $2^1/_4$x$^3/_8$x$^5/_8$" "
1 $^1/_{16}$x$^1/_8$x24" balsa or bamboo
1 vial cement
1 pr. $^5/_8$" wheels
4 large French insignia
2 small " "
silver bronze powder and bronzing li
or aluminum paint
scrap celluloid
plastic wood
red dope or lacquer
blue dope or lacquer
fine sandpaper and pins
white shellac or clear varnish

# GLIDER

*(Continued from page 49)*

too, if you launch the glider to a high altitude and it doesn't recover, you'll have a good chance to get under the glider and catch it before it hits the floor. The modeling clay on the nose serves admirably in cushioning the landing.

When adjusted, the original model climbed in a right bank until the peak of the altitude was reached and then, banking to the right, it glided to the ground in rather tight circles. Each builder has his individual method of launching. We use a side-arm motion. That is, hold the model with the wings vertical, as though the model were doing a vertical bank. Swing your arm forward in a wide circle, giving the model additional speed with a snap of the wrist just as your arm reaches its most forward position. The natural bank of the model is opposite to the bank at launching. Thus, if you're right-handed, your model should glide in left circles after it reaches its peak altitude.

This model can be flown outdoors. It will not qualify for official outdoor glider contests; however, it will deliver excellent flights. Being lighter than the average outdoor glider, it will need less of a rising current to carry it away. Any high-ceiling building will serve for indoor flying. A good launching on a record flight will probably send the model as high as 80 feet. But there are plenty of good flights to be made with a 40-foot ceiling.

### SPECIFICATIONS

*Wing*
Aspect ratio ..... 6.
Span ..... $13^1/_2$ i
Area ..... 30 sq. i
Incidence ..... 0 degre
Sweepback ..... 5 degre
Dihedral ..... 14 degre

*Elevator*
Span ..... 5 i
Area ..... 7.7 sq. i
Aspect ratio ..... 3.
Area ..... 25% of wing are

*Rudder*
Height ..... 2 i
Area ..... 3.2 sq. i
Aspect Ratio ..... 1.2
Neutral setting
Area ..... 9.4% of wing are

Total Weight ..... 26 ou
Best official flight (record) .. 43.6 seco

### MATERIAL

$^1/_8$x3x18" semi-quarter-grained b
for wing
$^1/_{32}$x$2^1/_8$x12" (same variety) for
surfaces
$^3/_{16}$x1x18" for fuselage
banana oil, microfilm solution or b
polish; wax, cement, modeling c
#10-0 sandpaper

## Cross Winds

### Answers for February

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B | A | Y | | V | E | G | A | S | | P | A | Y |
| A | G | O | N | I | C | | R | A | F | A | L | E |
| R | A | D | I | A | L | | I | C | A | R | U | S |
| | V | E | T | | A | P | E | | G | E | M | |
| E | E | L | | S | T | A | L | L | | N | N | E |
| I | S | S | U | E | | R | | I | O | T | A | S |
| D | | | A | V | I | A | T | O | R | | | T |
| E | A | G | L | E | | S | | R | E | E | V | E |
| R | U | E | | R | H | O | N | E | | N | O | R |
| | G | N | U | | A | L | A | | W | A | L | |
| D | I | E | S | E | L | | M | A | I | L | E | D |
| S | T | R | E | A | M | | E | N | T | I | R | E |
| T | E | A | | L | A | I | R | D | | D | Y | E |

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| Waco Model "A" | Boeing P12E |
| Nieuport 17 CI | Boeing P12F |
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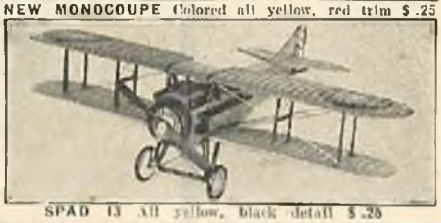

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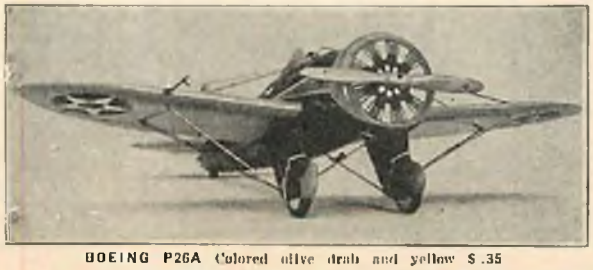

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NOTE. These are actual photographs of models built from AIRCRAFT kits.

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