AIR PROGRESS

AIR TRAILS ANNUAL • 1942

25c

30 CENTS IN CANADA

6 ARTICLES • 8 FULL COLOR PAGES • 10 SCALE DRAWINGS • 25 PICTURE FEATURES

INTRODUCTION

THE world moves on, but aviation flies ahead. Now more than ever is aviation a by-word, made so by the paramount place in armed conflict now held by air-borne troops and aërial conflict. American aviation is suddenly marching ahead with the strides of a colossus to a destination far in advance of all others; and rightly so, for here was the birthplace of aviation. American youth, through Federal sponsorship, may now grow wings to compete with the best of those from across the seas, and as loyal Americans it is our duty to assure them of strong and unfaltering pinions. This, the fourth Air Progress Annual, brings to you the highlights of air progress as seen through our pages of the last few months. Air progress in the months to come will be even more sensational under the lash of war conditions and requirements. Through it all, however, runs an undertone of thought whether applied to civil or military aviation, which is best expressed in the army air corps slogan: "Keep 'em flying!"

C. B. Colby

EDITOR OF AIR TRAILS

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AIR TRAILS ANNUAL 1942

INTRODUCTION C. B. Colby, Editor, Air Trails

AND TWENTY-TWO PICTORIAL FEATURES

C. B. COLBY, Editor • WILLIAM WINTER, Associate Editor

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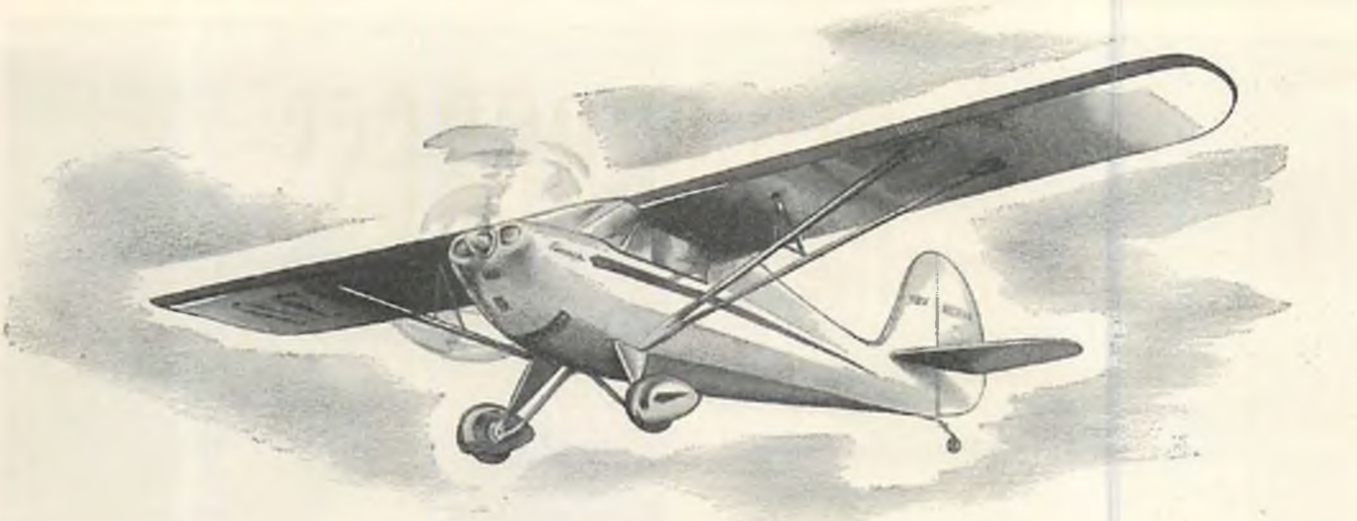

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AERONCA

AERONCA GIVES WINGS TO THE WORLD

LET'S GO! U.S.A. KEEP 'EM FLYING!

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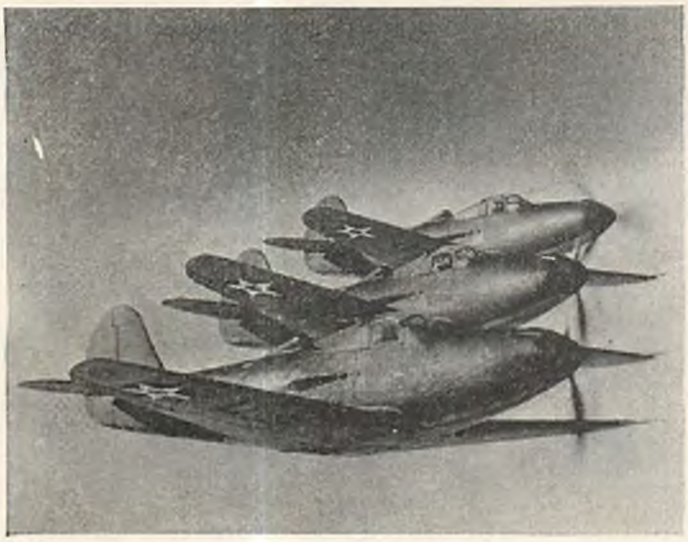
Three strikes on the enemy. Airacobras indicate advanced designs.



The Republic YP-43 will meet any invader, with pleasure.

BY MAJOR GEN. H. H. ARNOLD
Deputy Chief of Staff for Air

TOMORROW'S AIR MIGHT

"The security of our nation demands that we build without delay the strongest air force in the world."

AN air force is a balanced compound of airmen, airplanes and air bases, and to paraphrase Admiral Mahan, the most important of these is airmen, airplanes and air bases.

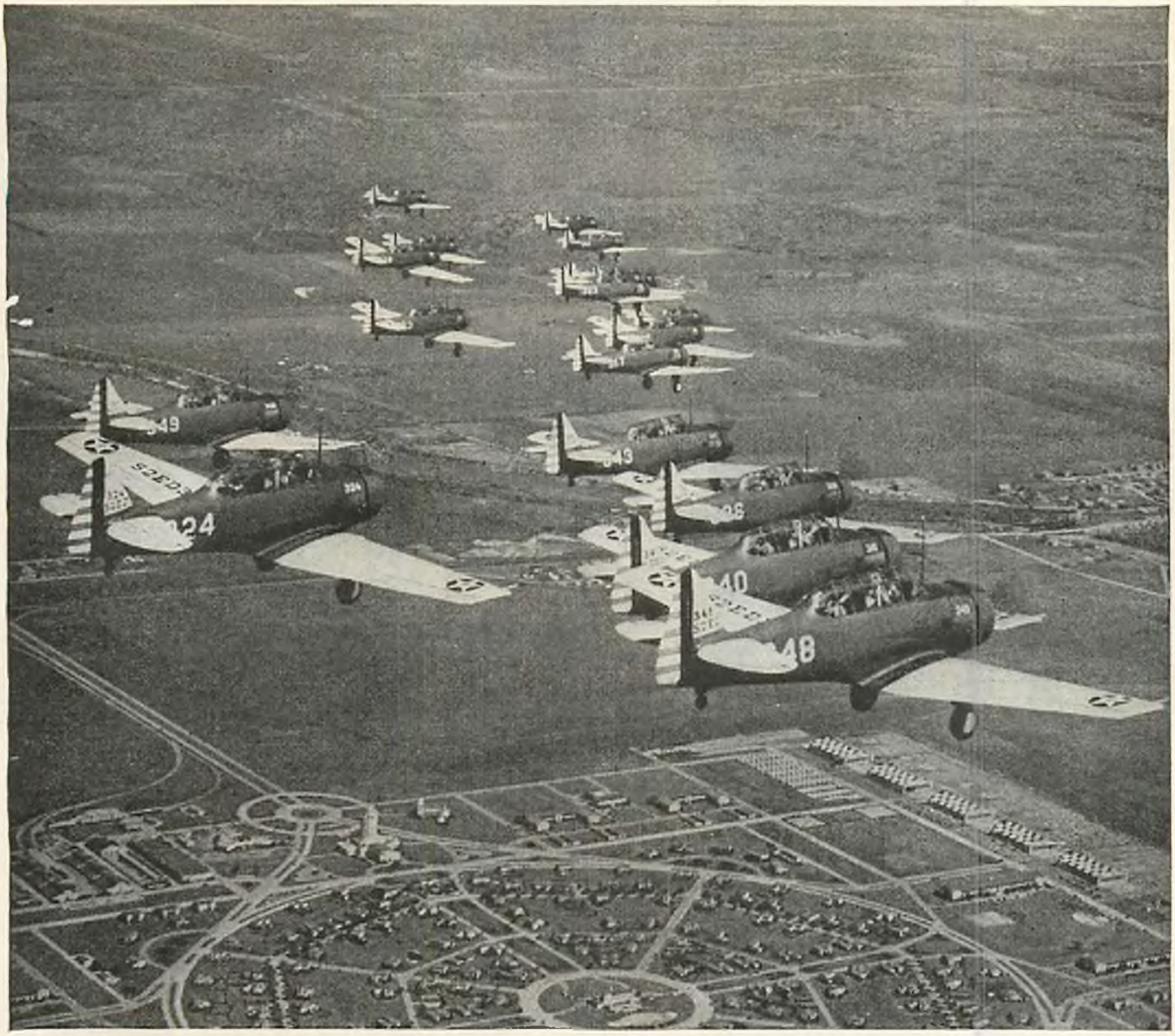
There was a time when the term "airman" referred, by common consent and usage, to the pilot. This probably grew out of the fact that the pilot first appeared on the scene as a combat crew member of military aircraft. Then, too, his will directed the air vessel in flight and his skill took it to the fight, maneuvered it in combat and brought it home again.

Now all that is changed. The bombardier, the gunner, the navigator and the engineer play roles of almost equal importance in operating the military airplane in the course of the normal mission. It requires the teamwork, co-ordination and vital play of all to bring the big bomber through a modern trial by fire. The pilot is and may always be the senior member, team captain or commander of the fighting plane, since he sits at the controls and the vessel moves at his will and direction. The others are, however, none the less essential to the successful bombing mission. Only in fighter, single-seater aircraft, does the pilot still fight alone, playing the ambidextrous role of pilot, gunner, navigator, engineer.

The ground crew of trained specialists is as essential to the success of a modern air force as are the combat crewmen. It has been estimated that it requires ten men on the ground to keep one man in the air. These mechanics, radio men, armament and instrument specialists meet the plane before *its engines have stopped* as it taxies into the flying line, and begin inspecting, overhauling and reloading it with fuel and munitions. An airplane is not only most vulnerable on the ground, but it is performing no useful mission and must, for efficiency and economy, be returned to fighting trim as soon as possible. A modern combat plane can be refitted for a succeeding mission before its crew has been sufficiently rested. This has led to the problem of multiple crews, further increasing the number of operating personnel required in an active air force.

The United States possesses the largest pool of pos-

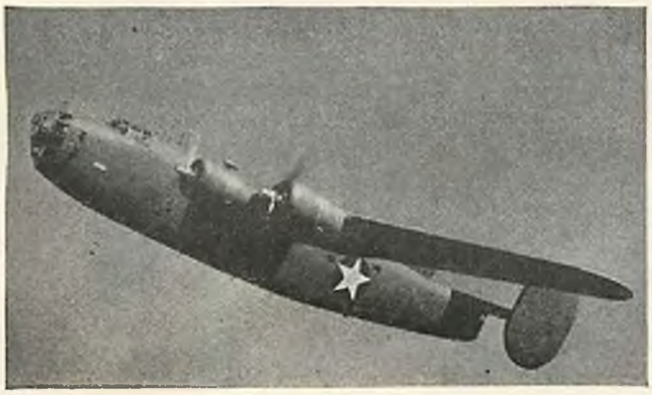
Over the unmistakable design of Randolph Field, great army training center, these future army pilots practice close formation flying.



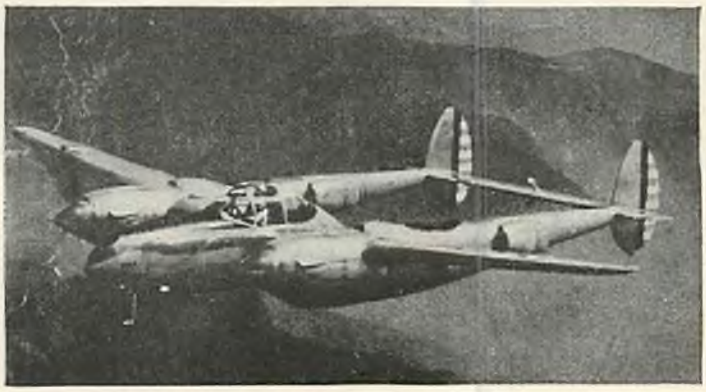
sible airmen of any nation. It has been estimated by our recruiting service that there are about 300,000 men in this country possessing the requisite degree of education, the characteristics and physical set-up fitting them for flying training, and who are in the proper age bracket, from twenty to twenty-six years. Probably one half of these can be trained as gunners, navigators, or in some one of the other functions of the combat airman. There is not another nation in the world, including Germany or Great Britain, which can produce more than half this figure, employing the same standards. We have, therefore, the manpower for the world's predominant air force.

It takes between eight months and a year to train any

(Continued on Next Page)



Proof that our engineers are out in front is the giant B-24, capable of over 300 m. p. h. with four tons of bombs. Crew of 6 to 9.

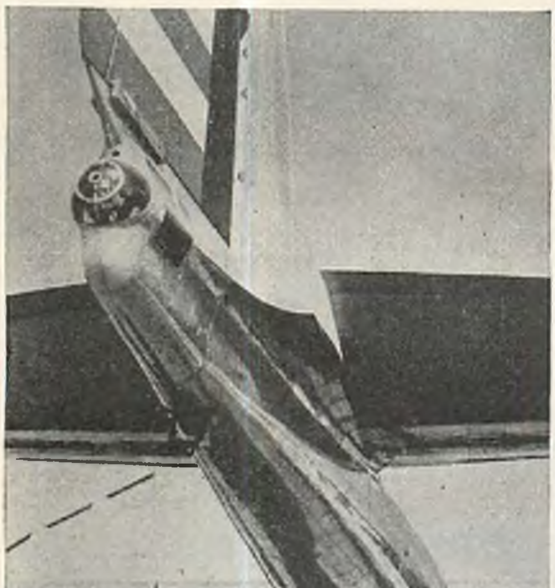


Our Lockheed P-38 supercharged fighter, with a speed well over 400 m. p. h., is one of the world's best ships in this category.

TOMORROW'S AIR MIGHT

(Continued from Preceding Page)

In an unending stream new pilot material arrives at training fields. High standard assures our manpower.



This unique view shows the tail turret of the Douglas B-19. Weighs 82 tons, has range of 7,750 miles.

of these airmen for ground or combat crews. Our school capacity is a further limiting factor. Under our present plans we are now training about 12,000 pilots and 10,000 other combat crewmen annually, and about 40,000 ground maintenance men. The expansion now in progress will permit us to more than double that figure for 1942. Thus we can have 300,000 men trained by the close of 1943.

The airplane, the second of the requisite factors in air-force building, is in many respects the more serious of our problems. First there must be a determination of what plane types to build and in what quantities. The present conflict in Europe was but a few months old when it became evident that the present-day fighting plane must have leakproof fuel tankage, pilot armor and increase in fire power. Many other improvements were indicated, such as increased speed and ceiling for fighters and increased range for bombers. The present prime headache is the indication that all new fighters and bombers alike should have pressure cabins. It is now quite clear that the new battlefield upstairs is well above the 30,000-foot level. That introduces not only new problems of oxygen supply, but calls for heating guns, cockpit heaters, de-icers, and many another device for safety or crew comfort.

After a determination has been made to build a plane in quantity, it requires a great determination to let it alone, to insure its flow at maximum production rates through the line. There is the strongest urge to introduce the new changes which recent discoveries or inventions have indicated will give it more speed or power.

Here again, in this matter of production capacity, we in the United States are favored above all other peoples. We have the basic and essential metals and raw materials in more abundance than any other nation. It has been said that we alone possess the raw material in sufficient quantity to produce 50,000 planes and the 200,000 power plants which they would require in the course of their usable life. Our engineers and designers are superior to any found elsewhere. We do not now have more aircraft-manufacturing establishments than some of the other nations, but we undoubtedly possess the requisite manpower and machinery to build the largest airplane and engine industry in existence. These establishments will probably be completed before this year has run its course.

We need make no apology for our planes' types. We have the finest single and twin-engine fighters in existence. At least two of our fighters have such performance characteristics that either of the combatant nations would sell their collective souls for five thousand of them. Our leadership in the long-range bomber field has been established ever since our first Flying Fortress appeared. At least two of our four-engine

Famous Flying Fortress used also by the British in raids against enemy bases. Our long-range bombers lead the world in load and effective range.

Our newly acquired air outposts are being armed to increase our might. B-18A bombers are based at San Juan, Puerto Rico.

Our unlimited supply of essential elements of air might is rapidly being brought to peak production to assure our position.

bombers are superior to anything in their class now belaboring the nerve centers of Europe these nights. Our latest types of medium and light bombers compare favorably with any which appeared as the playmate of the panzer divisions in Greece or Crete. No, it is not in types that our deficiency lies, but in quantity. Some of the world's other air forces started building first, many years ahead of our national determination to have an air force. We have found to our sorrow that time cannot be bought or improvised, although we are making giant strides in our determination to close the gap.

Air bases have been all too often overlooked in this business of building an air force. It is not an imposing or an inspiring or thrilling phase like airplane building or pilot training, but it is equally important. It was but lately demonstrated in the battle for Crete what an all-important consideration these bases can be in air conflict. The Germans could dispatch their aircraft, gliders and parachute troops from bases only seventy or eighty miles distant, while the British had to employ flying fields more than two hundred miles distant on the north African coast. It was a foregone conclusion to wise airmen, therefore, as to how the battle of Crete would go. The proximity of bases enabled England to gain superiority over Dunquerque for a few hours, and this permitted the escape of the embattled B. E. F.

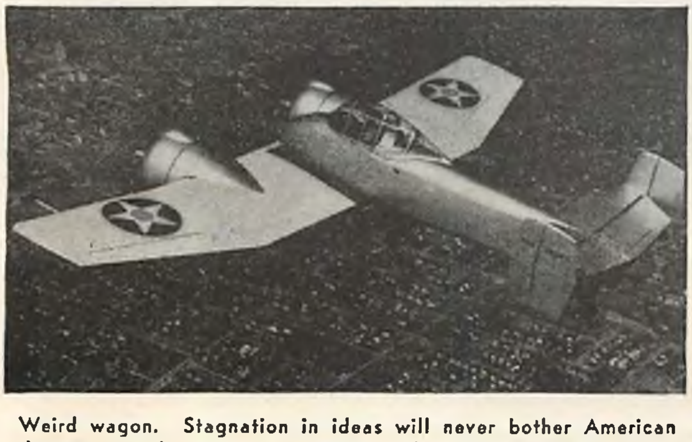
Many have pondered the delay which always ensues after each succeeding German conquest. Some have opined that it was for rest of crews; others thought it concerned bringing up supplies or perfecting plans. In reality, the best guess is that these weeks were used in preparing the new bases essential to new air conquest.

Our present determination to build new bases well eastward into the Atlantic from Newfoundland to Trinidad is a wise move in air strategy. These bases form the stout shield which may stand between the Western Hemisphere and marauding aërial hordes which can be dispatched from Europe and Africa. An air base is more than a landing field. It must contain within its framework the fuel tankage, the munitions storage capacity, the repair facilities, the housing for personnel and the technical installations and communications facilities essential to the modern air force. Generally, the central base will be surrounded by dispersion fields or subbases. The whole installation will be underground or well camouflaged and dispersed. Nothing promotes the mobility and the range of the air weapon or circumscribes such definite limitations to air operations as the provision or lack of suitable operating bases. That is a lesson which we have learned unmistakably from the present plight of Europe.

Given these essential ingredients to air forces, airmen, airplanes and air bases, it lies within our capacity to develop adequate air power for the protection of our hemisphere. It but remains to employ this mighty instrument economically and along sound tactical and strategical lines. This means that our leaders must be trained in the use of air forces. Fortunately we have about one thousand airmen of more than ten years' experience, many of them trained initially in the First World War. They have been the leaven for our rapidly expanding air force, and upon them we must rely for the air leadership in that vast new organization, the mighty American air force of the future.

We know now, as we see the burning cities, the sinking ships, the mutilated armies, the devastated countries which have fallen prey to that first nation which first conceived and first dared to employ an air force, that these are axioms of modern military strategy:

> The only adequate antidote for an attacking air force is a superior air force. Air forces have come to join armies and navies as equal, if not more decisive and terrifying organizations in national conflict and international negotiation. *(Turn to page 50)*

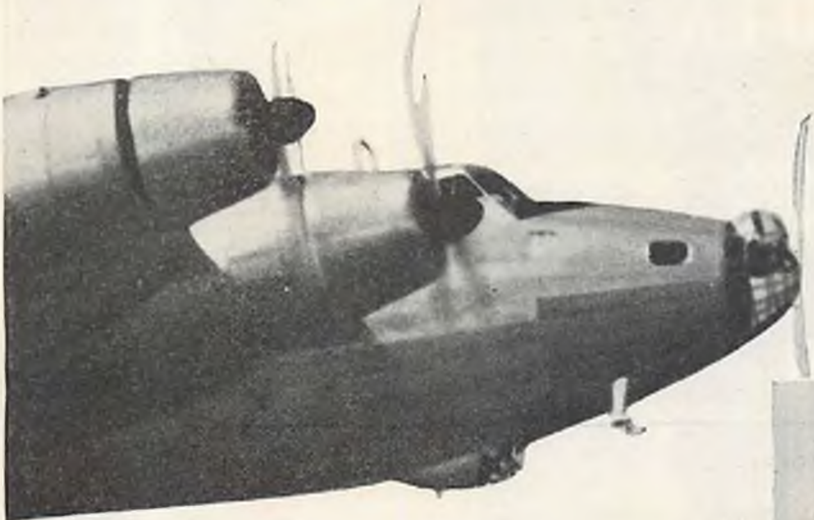


Weird wagon. Stagnation in ideas will never bother American designers and engineers. Here's the Grumman Skyrocket.

D. W. TOMLINSON, author of this article on the next probable phase in air warfare, needs no introduction to Air Trails readers. ["What of Stratoflying?" May, 1940.] Tommy, as he is known throughout the industry, is more familiar with high-altitude flying than any other man in the world. He was responsible for the research preceding the advent of the famous TWA stratoliners, the pioneer planes in stratoflying, and has aided in the development of much stratoflying equipment. Here he is at the controls of a four-engined stratoliner.

STRATOSPHERE BOMBING

BY D. W. TOMLINSON, Vice Pres. in Charge of Engineering, T. W. A.



This world's leading authority on high-altitude flying believes the stratobomber is next, and here speculates on problems, tactics.

Pursuit pilots' stratofashions, effective but cumbersome.

BEFORE the end of World War II, superbombers, capable of twenty-four hours' continuous flight, may be showering enemy territory with 500-pound missiles of death from altitudes beyond the range of the human eye.

I believe that we will see a great deal of bombing at altitudes of 40,000 feet or even higher. Interceptors operating at these levels would be seriously handicapped because the pursuit pilots must wear oxygen masks or pressure suits which greatly interfere with vision and movement. The bombers, on the other hand, having sealed cabins and heating systems, would provide their crews with comfort of flight at normal levels.

To the best of my knowledge, personnel engaged in high-altitude flying in this war have relied upon oxygen with very unsatisfactory results: such men must be given frequent and lengthy rest periods.

The superbombers of which I speak would be equipped for speed and yet have good maneuverability. On large planes of this type you can use a hydraulic boost on controls for adequate maneuverability, which appears impossible on pursuit ships.

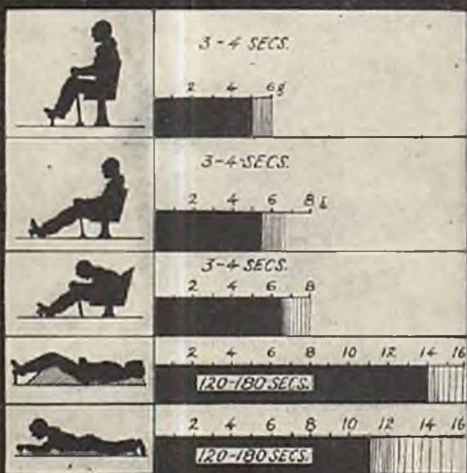
In my opinion, these four-engine bombers with supercharged control spaces would carry a crew of five, possibly seven, and would weigh upward of 50,000 pounds gross. They could carry a considerable number of 500-pound bombs—for it has been discovered from present war experience that bombs of this size do as much damage as do the larger type.

Pursuit planes which are able to reach these high levels are so near their ceiling that their performance does not permit them to maneuver rapidly. Their margin of speed over the multi-engine bombers with supercharged control spaces is so slight that it is virtually impossible for them to gain a position of tactical advantage *(Turn to page 89)*

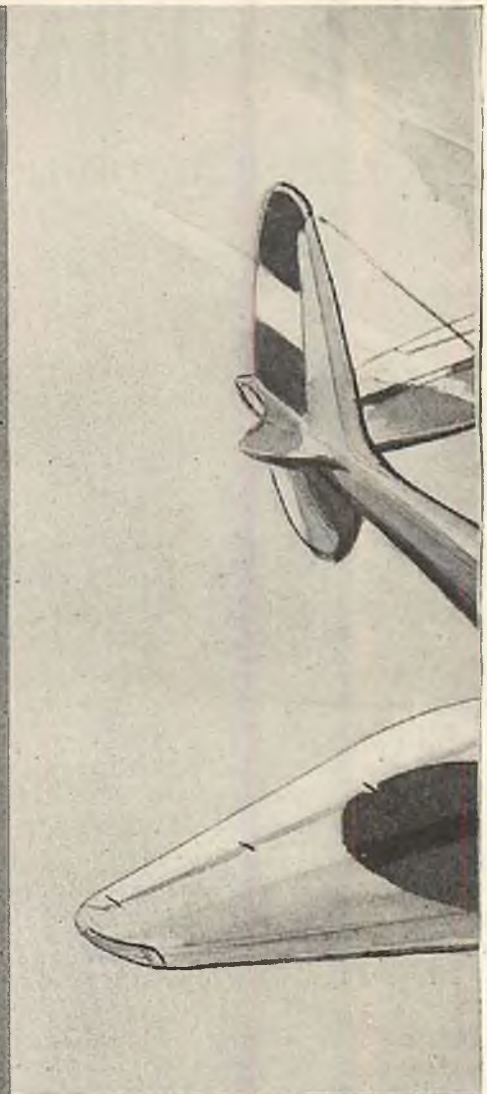
German forerunner of the stratobomber to come. The Focke-Wulf Kurier, four-engine long-range bomber appearing over England.

PRONE PILOTS

New experiments are going on with the pilot lying flat. Can these, aimed at greater speed and maneuverability, revolutionize ship design, fighter tactics?



More "G's" for a longer period of time may be withstood by pilots as their position changes from sitting to prone.



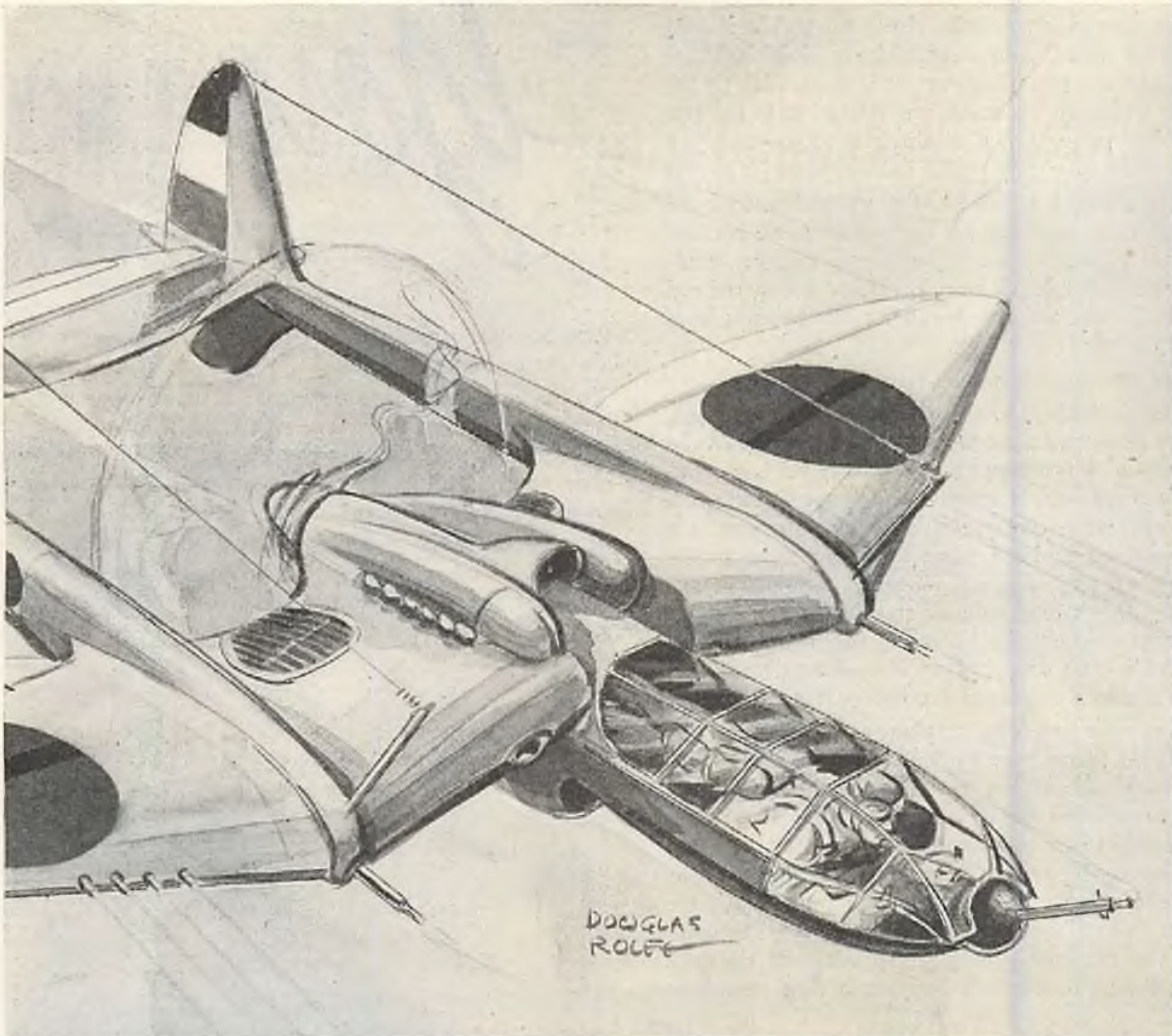
EVER since the beginning of World War II the demand for speed, speed and more speed in fighting planes has brought aëronautical scientists face to face with two thorny problems; to wit, how to get more speed without increased power (i. e., reduce wing drag), and how to overcome the tendency of many pilots, under the impact of these new terrifying bursts of speed, to suffer acceleration collapse.

Tackling each problem separately, the aircraft designers and the military medicos have been up a collective tree for very simple reasons. The first because the more they streamlined a ship to cut resistance the more they cramped the quarters of the occupants, thus decreasing efficiency; the second, because the more they dissected the physical blackout question the more they realized that they faced a law as immutable as that involving Newton and his falling apple.

Now word comes from Germany that researchers have provided what appears to be a common solution to both problems; namely, of all things, prone flying.

And why not? It's logical. Birds fly that way and make a pretty good job of it. Why should man alone attempt the operation sitting upright? Why should he, of all life that takes to flight, poise his vertebrae contrary to the air's slipstreams? He doesn't swim or go sledding that way. And the same law is operative, for the drag of a body, it seems, is a minimum when the body's greatest dimension is along the line of flight. Hence, applied to an airplane, this would mean that a man flying on his belly would permit the ultimate in compact, streamlined designs. And, as to how such a posture overcomes the physical blackout, the answer is equally as simple: in the present upright position of flying the centrifugal force acts approximately parallel with the principal blood vessels, with the result that in flight acceleration the blood has a tendency to leave the head; in horizontal poise, the centrifugal force acts in the direction from chest to back, thus approximately at right angles to the main blood vessels, so that there is no sudden displacement.

It all seems very simple and raises the question, why didn't someone think of it before? The fact is that flying flattened out is as old as the hills. Daedalus, the legendary ancient Greek, and his son, Icarus, escaped from their Crete hoosegow with wings fashioned of wax and feathers. And Da Vinci, father of aëronautics, made



Future fighter? With pancake engines assured, even our artist's conception of a prone fighter may become tame by comparison with reality.

a refined study of bird flight and from his analysis designed a small model to test his theories. Even the Wrights' first glider and airplane featured the pilot lying along the line of flight.

Undoubtedly the upright position employed in steering the automobile and the low wind resistance in the comparatively slow speeds of early aviation were responsible for the parlor-car posture of flying prevailing today. For it was not until the small, compact warplanes of 1939-40 requiring 400-500-mile speeds and tremendous maneuverability came into being that a thought was given to prone flying. It is known that Great Britain and the United States, as well as Germany, have been conducting experiments in this flight posture for some time. Apparently the Nazis, with their vast visionary research institutions, got the jump on the others in any practicable application of the principle.

As early as last spring, reports reached America that important experiments were being made in Stuttgart and other centers. And this January, London dispatches stated that a new Heinkel fighter had been perfected with a two-man crew that was lodged prone fashion in the wings. The craft, it was added, had in this way considerably reduced the air resistance, enabling a 430-mile top speed. Power was reportedly provided by two engines anchored in the wings and driving propellers through extension shafts. The same dispatch went on to state that the new British Supermarine Spitfire was equal to the speed of this latest Heinkel. No indication was made of the pilot's posture beyond the mention that the ship's body was shorter.

As in many other developments in aëronautics, the facile glider has been used in the latest tests. The results obtained apparently have been as edifying as if powered planes had been employed, particularly in demonstrating the advantage of a smaller fuselage in reducing air drag. It was shown, for example, that a fuselage of sixteen square feet in cross section was needed to contain a pilot in upright position as against a cross section of one four square feet for a pilot lying prone. By decreasing the fuselage seventy-five percent, the wind drag, in consequence, was cut considerably.

Moreover, the decrease in cross section operated against two other components of drag other than the eddy currents primarily referred to in the above. One is skin friction, which depends upon the *(Turn to page 96)*

You TRY

YOU have missed one of the thrills of thrills if you have never nosed your airplane over at 12,000 feet and roared straight down at an infinitesimal target below. From the first increase in acceleration to the last body-punishing pull-out, the world is a stage—and *you* are the center of it.

If you have never stood on the ground with head thrown back, eyes straining for the yet invisible bomber whost distant whine is soon to become a raucous, soul-shivering, snarling roar, if you have never experienced that sense of fear as the dive bomber roars by, you have missed another thrill of thrills.

In neither case would you be particularly safe.

In the first instance, as the experts have pointed out, the airplane is more complex than it was in 1917. In order to dive-bomb nowadays, say in the SBC-4, a series of necessary actions are a routine that must be followed. The throttle must be cracked to prevent torching, the propeller must be in high pitch to prevent the motor from turning up excessive r.p.m., the flaps must be adjusted to maintain a moderate air speed. The remainder of the precautions, equally essential, are naval secrets, but the point is that the airplane is so complicated that it requires constant vigilance on the part of the pilot.

Because of the modern airplane's complexity and speed, it is said that for every four pilots killed in combat, six are killed as the result of faulty judgment. What this knowledge does to a pilot in the dive is another hindrance to his morale. Knowing that he must do everything correctly, omit nothing, aim his airplane, pull the bomb-release handle, and then pull out at the correct altitude increases his nervous tension. The complexity of the airplane, the high speeds that do such devastating things to a pilot's body each time he makes a turn or especially a pull-out from a bombing dive, explain the astounding ratio.

To the man in the street the role of the dive-bomber is mysterious, awe-inspiring and fearful. To the pilot it is a business, profession or game—call it what you will—that requires all the skill, technique and resourcefulness a man may possess.

If you, as Lt. X, are detailed to lead a squadron of dive-bombers upon an objective, you would assume first of all that the objective was of primary military and strategic importance. That would mean *(Turn to page 93)*

This weird Blackburn Skua, Britain's Fleet Air Arm dive-bomber, is doing sensational work.

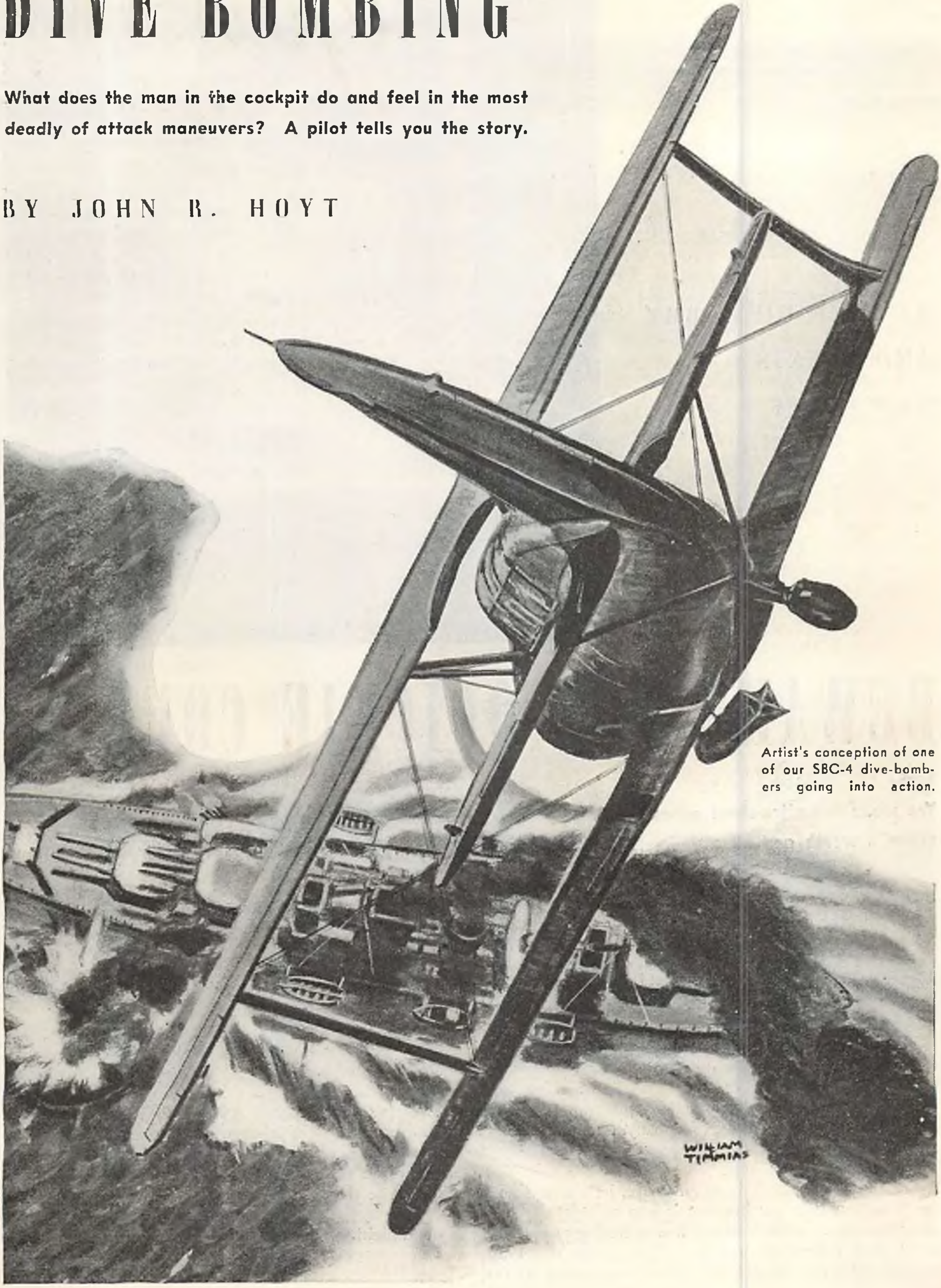
Upper left, Douglas TBD-1 designed for the U. S. navy. This ship is used as torpedo plane.

The German Stuka Ju-87. They are superior to English dive-bombers only in numbers.

DIVE BOMBING

What does the man in the cockpit do and feel in the most deadly of attack maneuvers? A pilot tells you the story.

BY JOHN B. HOYT



Artist's conception of one of our SBC-4 dive-bombers going into action.

Welding in approved schools is taught by experts using equipment and technique that are accepted by the industry.

BY JOHN DU BARRY AND ALEXIS DAWYDOFF

BEWARE THE QUICKIE COURSE!

We mean the ultra-short courses given by "gyp" aviation ground schools. Here's how to judge a school's worth and save yourself not only time and money but possibly a lost chance in aviation.

UNCLE SAM'S air-minded young nephews, from every corner of the land, are marching in solid ranks into aviation today. The bars are down, the door flung wide open. Although it has taken a European war to do it, the promise of opportunity in the air industry has at last become a thrilling reality. There may not be pilot's wings for everybody, but for thousands of us there is a workbench waiting, a fascinating paid job, and the satisfaction of aiding national defense.

Yet along the broad, crowded road into aviation lies camouflaged a freshly dug pitfall—a mantrap that may hold grief and disappointment for many a hopeful career-seeker.

It's the "quickie" course.

Before we examine this new menace, let's understand the condition that has brought it into existence. Two years ago the aviation industry was operating placidly at about sixty percent of capacity. Plane output for 1939 came to 6,000 craft of all kinds. There were about 30,000 workers in aircraft and engine plants. Everybody knew that expansion was due, but nobody knew just how soon it would come. In less than a year, production was pushing toward a 12,000-planes-a-year rate and shop personnel had jumped to 60,000. The year 1940 ended as the greatest productive period in U. S. aircraft history.

And production has still barely got a good start. Air-industry plants have doubled their floor space; *they will* double it again in 1941. Already the number of men making planes and engines has increased to 165,000. According to Secretary of Labor Perkins, an *additional* 590,000 man-years of labor will be needed before aviation production reaches its peak a year and a half hence. Every plane factory with a military order—and that means more than half of the manufacturing companies, and those by far the largest—is humming with activity day and night. Some of the giants are performing miracles of achievement. Boeing is turning out a new B17-B Flying Fortress every few days. Four Hudson bombers a day are coming off Lockheed's production line.

Yes, we said production line. You've heard of it before, in the automobile industry, in refrigerators, in electric razors, in a hundred other mass-production industries. But a production line is something new in aviation. The whole difficult, complicated task of making an airplane or engine is broken down into small steps, each performed by a different worker successively, until the finished article emerges as the sum of many individual operations.

The production-line system is what has made possible aviation's soaring output. It has brought about a change from the old days when there was time to create an airplane from the wide skill and knowledge of a few workers. It has made possible the employment of thousands of new men with less extensive skills. It has made possible shorter courses of training to prepare these men for their more specialized jobs.

And it has enabled the "quickie" school to spring up, unscrupulously to prey upon the young men who see now a chance to reach their long-cherished goal—a job in aviation.

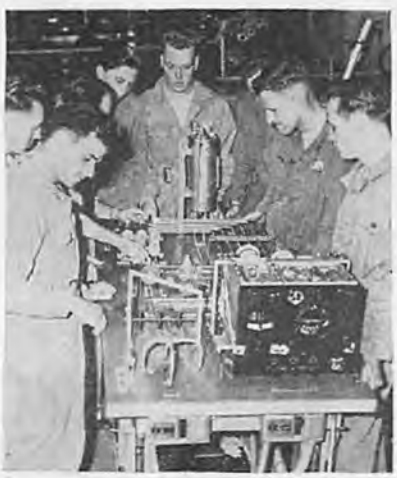
The havoc the quickie schools have wrought is not limited to the unfortunate victims whose ambitions, finances, and career prospects have been blasted. The quickies' evil effects are felt also in the distrust that reacts upon the many good, honest schools, and in damage to the national defense program so urgently in need of skilled workers.

Among the types of work where opportunity chiefly waits today—aëronautical engineering, drafting, aircraft and engine maintenance, instruments, and production mechanics—it is in the last-named field that the quickie lurks. Aëronautical engineering is too knotty for even well-qualified students to tackle in less than a year. Drafting is simpler, but four months and mathematical aptitude are minimum conditions for success. Aircraft and engine maintenance, separately or together, face government licensing requirements for civil use, and for military craft the army and navy use their own enlisted and trained mechanics. Instruments demand about six months of study. Production mechanics, or in other words factory work, offers the biggest scope, for here are found the largest number of jobs opening up in aviation and the easier skills.

Production mechanics for aircraft *(Turn to page 94)*

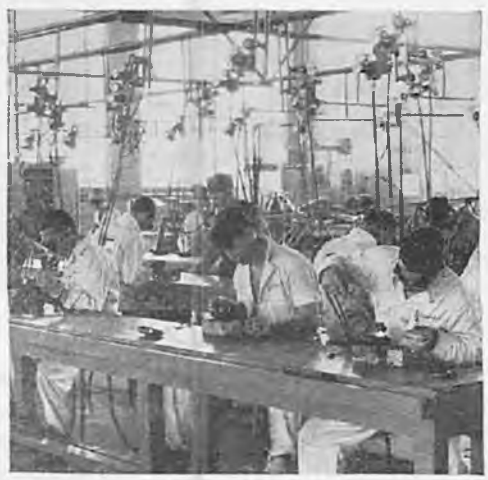
As compared with the hit-or-miss instruction on old and obsolete equipment in the fly-by-night schools, approved courses feature new and "live" equipment helping student keep abreast of latest advances.

Advantage of instruction at an accepted aviation school is that the tools, methods taught are those found in industry today. This makes the student familiar with his job.



Such instruments as automatic pilots and other expensive equipment are not found in "quickie" course schools.

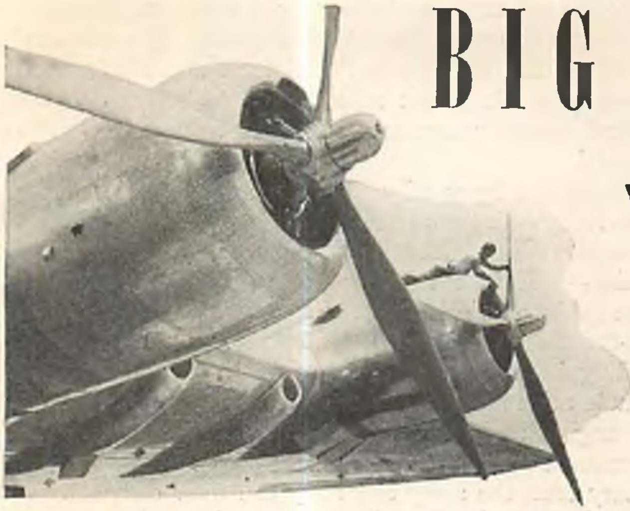
Although instructors in sheet-metal work need not be government-licensed, those teaching aircraft and engine mechanics must be.



Nice welding-instruction layout. Plenty of equipment and adequate instructors for frequent contact with student mark the honest air school.

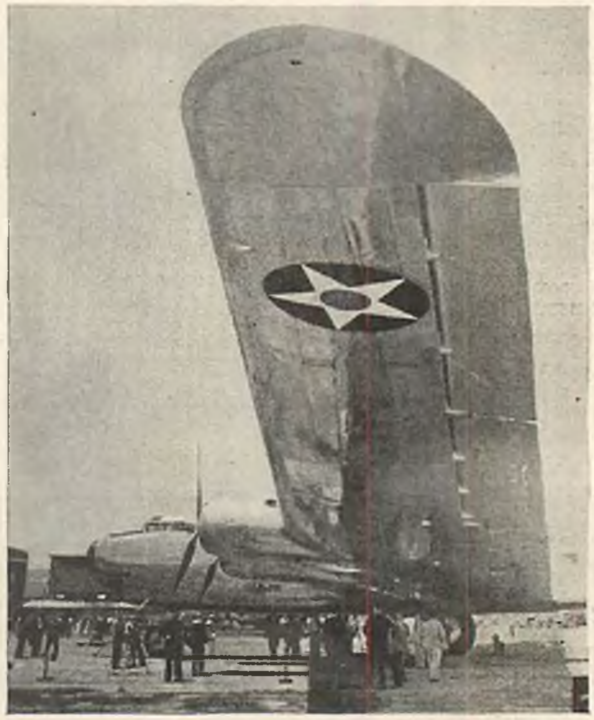
BIG BOY BOMBER

World's largest bomber, truly a hemisphere defender.

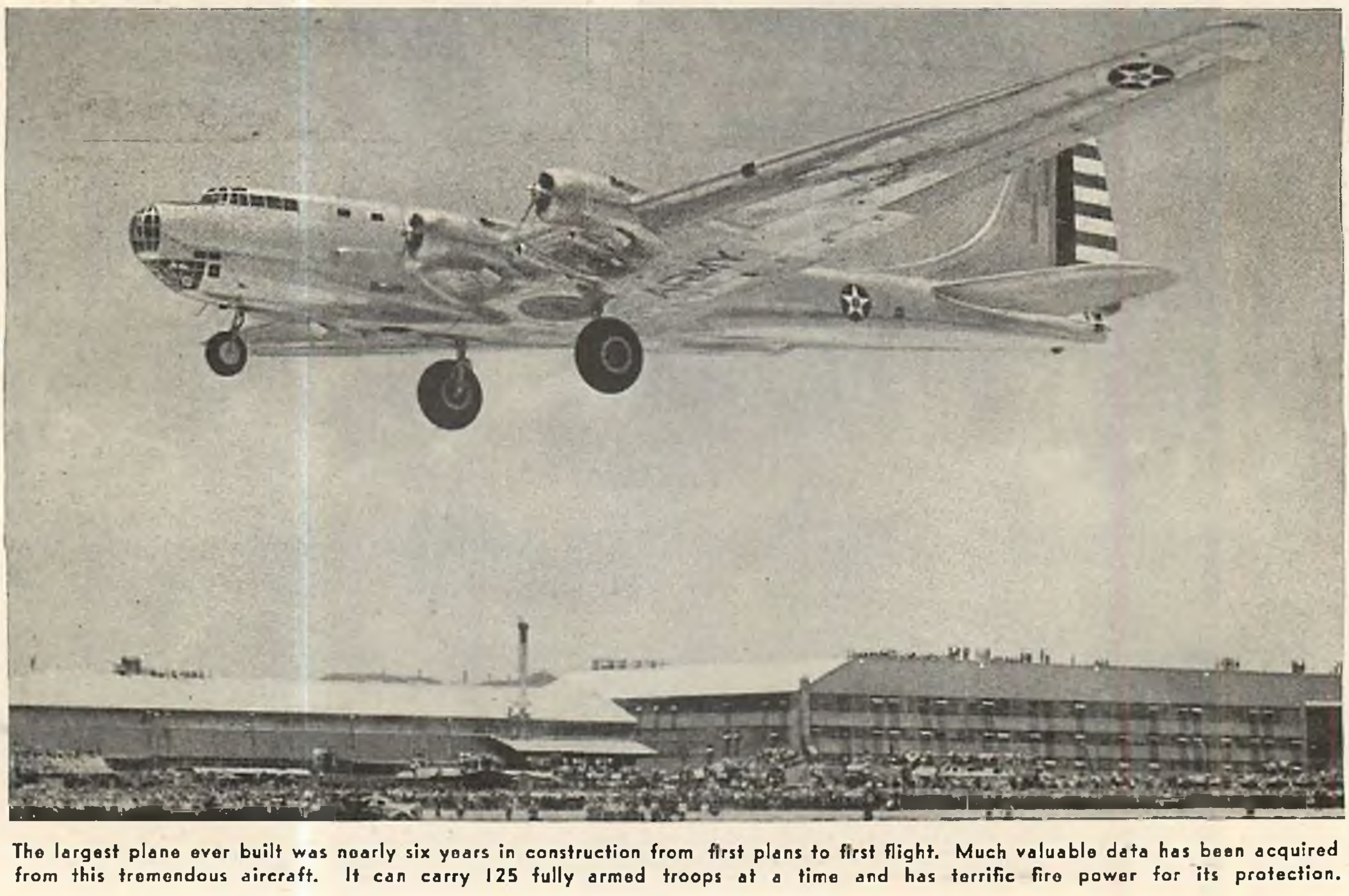


The size of engines may be judged from size of man.

Biggest nose. The transparent nose compartments of the Douglas B-19 bomber house, top to bottom, pilots, gunner and bombardier.

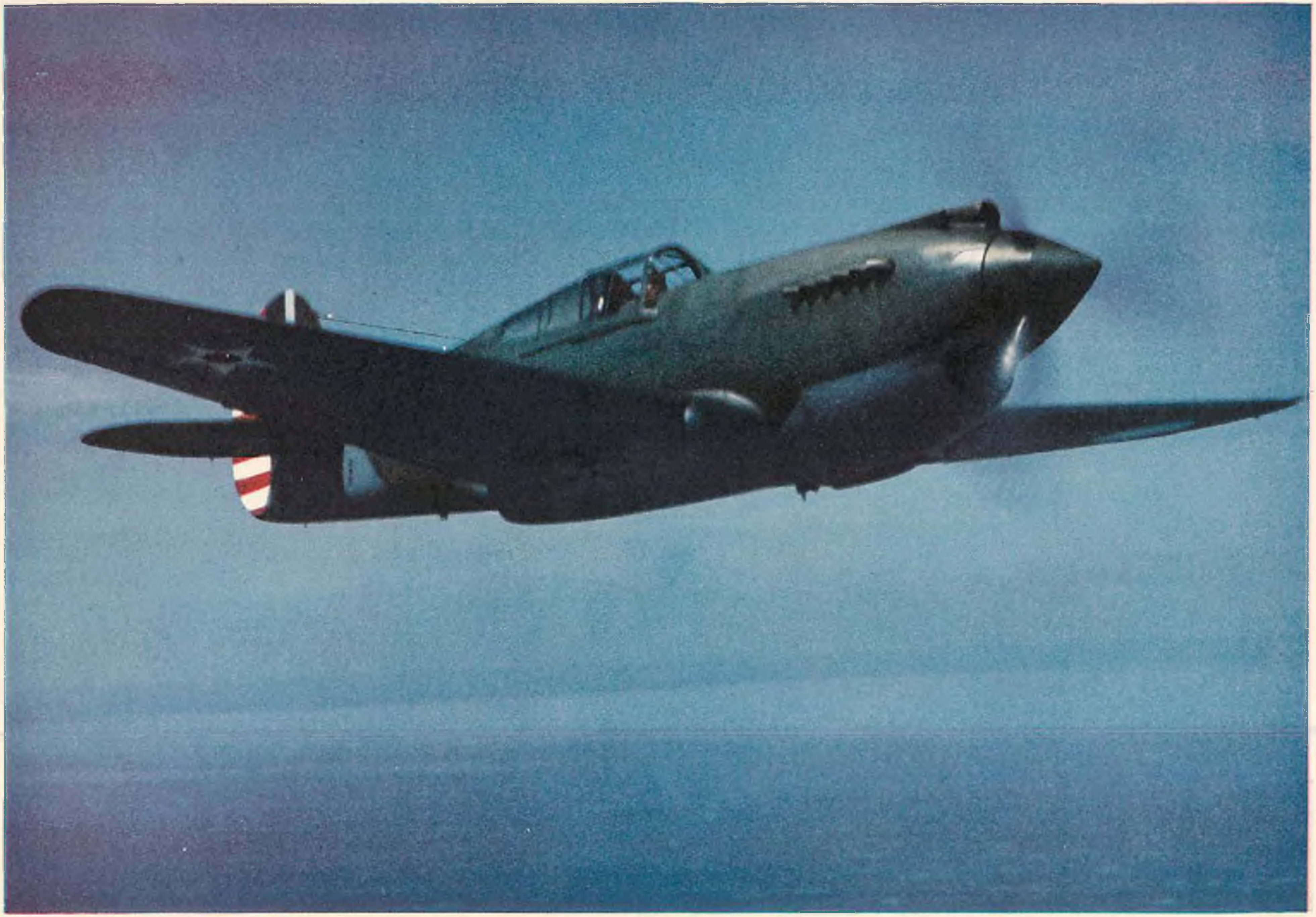


The 212-foot wing takes on an odd shape when seen in perspective. This ship can fly to Europe and back nonstop.



The largest plane ever built was nearly six years in construction from first plans to first flight. Much valuable data has been acquired from this tremendous aircraft. It can carry 125 fully armed troops at a time and has terrific fire power for its protection.

BELL P-39 AIRACOBRA

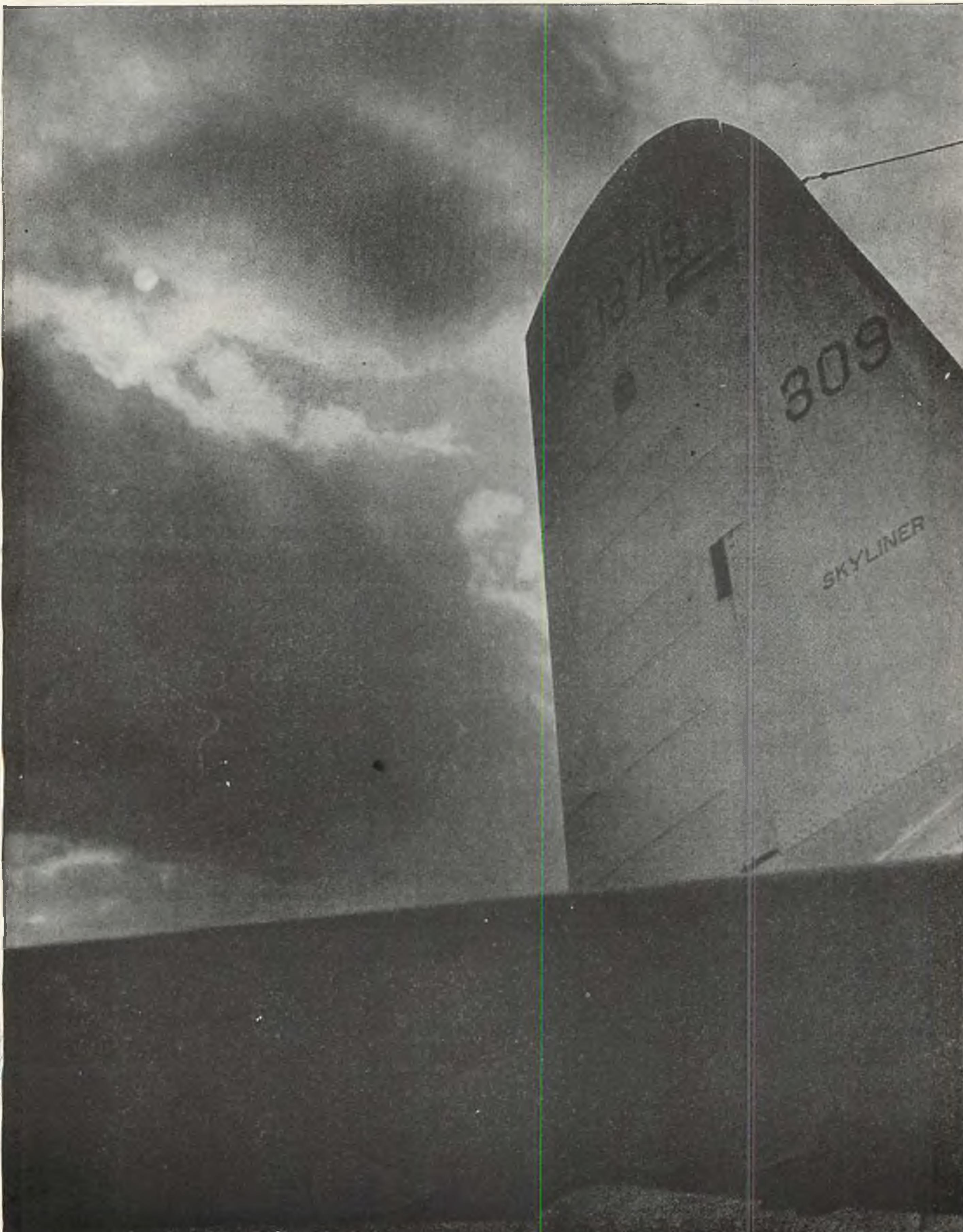


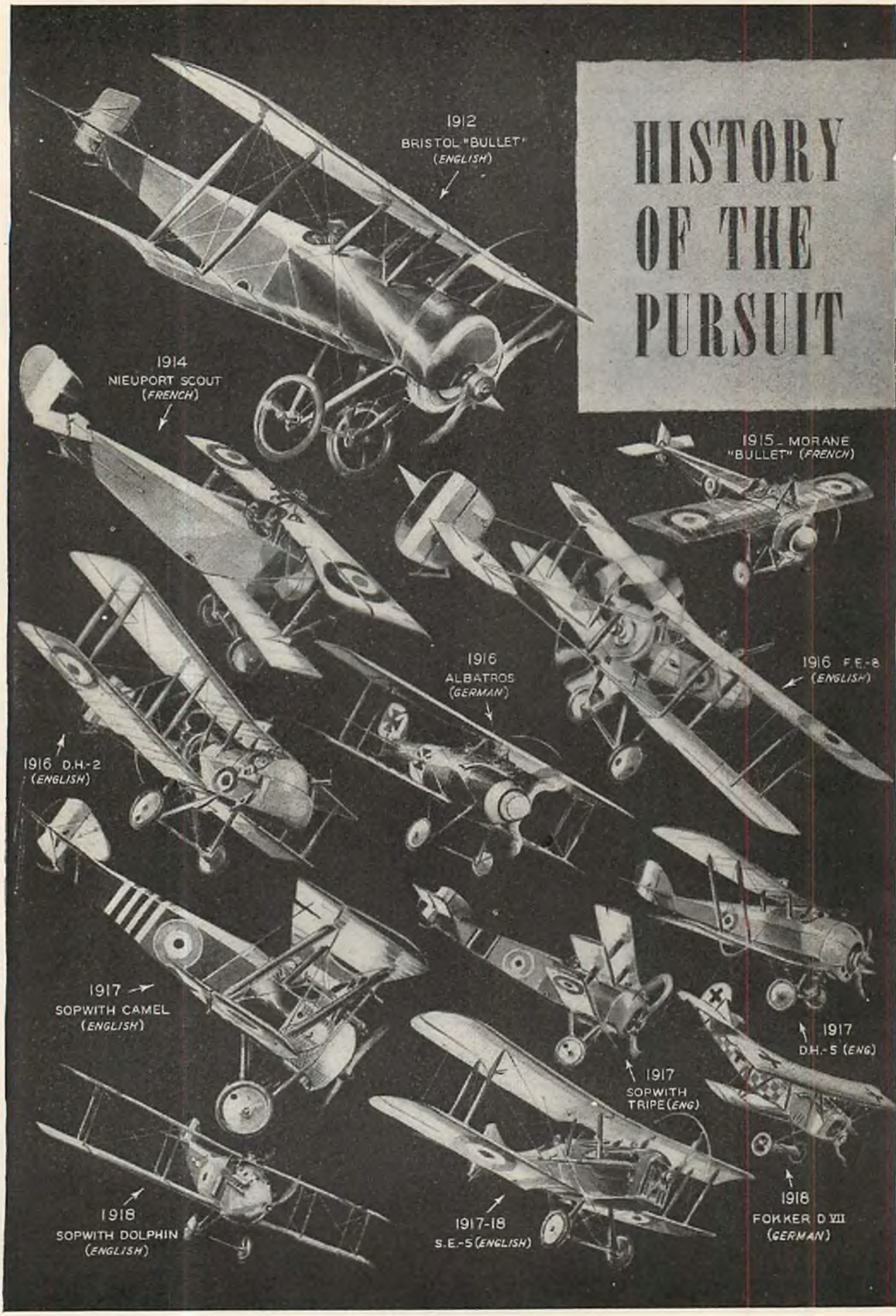
CURTISS P-40

GRUMMAN MARTLET

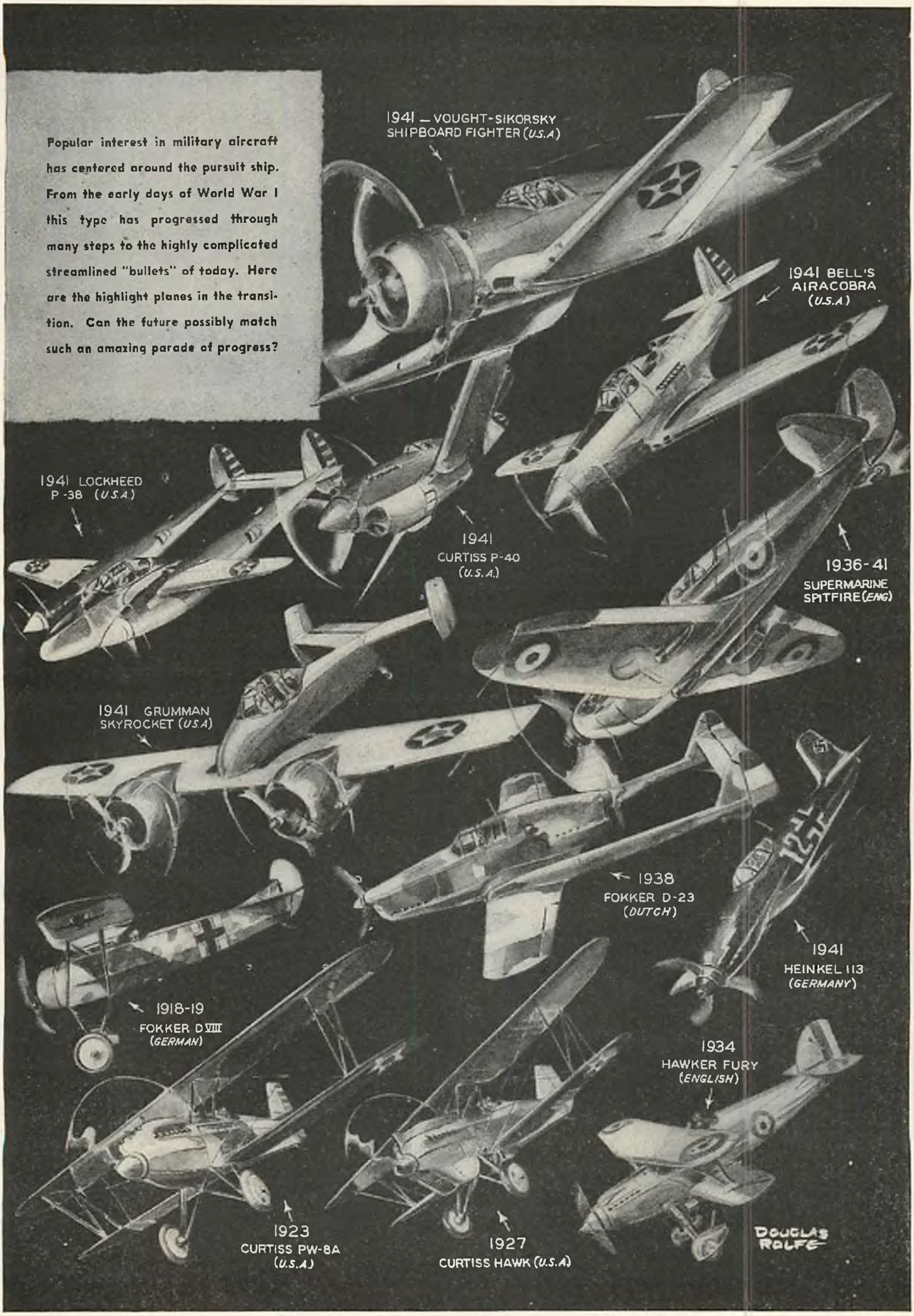
MARTIN PBM-1

AIR PROGRESS PICTORIALS




HISTORY OF THE PURSUIT
1912
BRISTOL "BULLET"
(ENGLISH)
1914
NIEUPORT SCOUT
(FRENCH)
1915 _ MORANE
"BULLET" (FRENCH)
1916
ALBATROS
(GERMAN)
1916 F.E.-8
(ENGLISH)
1916 D.H.-2
(ENGLISH)
1917
SOPWITH CAMEL
(ENGLISH)
1917
D.H.-5 (ENG)
1917
SOPWITH
TRIPE (ENG)
1918
SOPWITH DOLPHIN
(ENGLISH)
1917-18
S.E.-5 (ENGLISH)
1918
FOKKER D VII
(GERMAN)

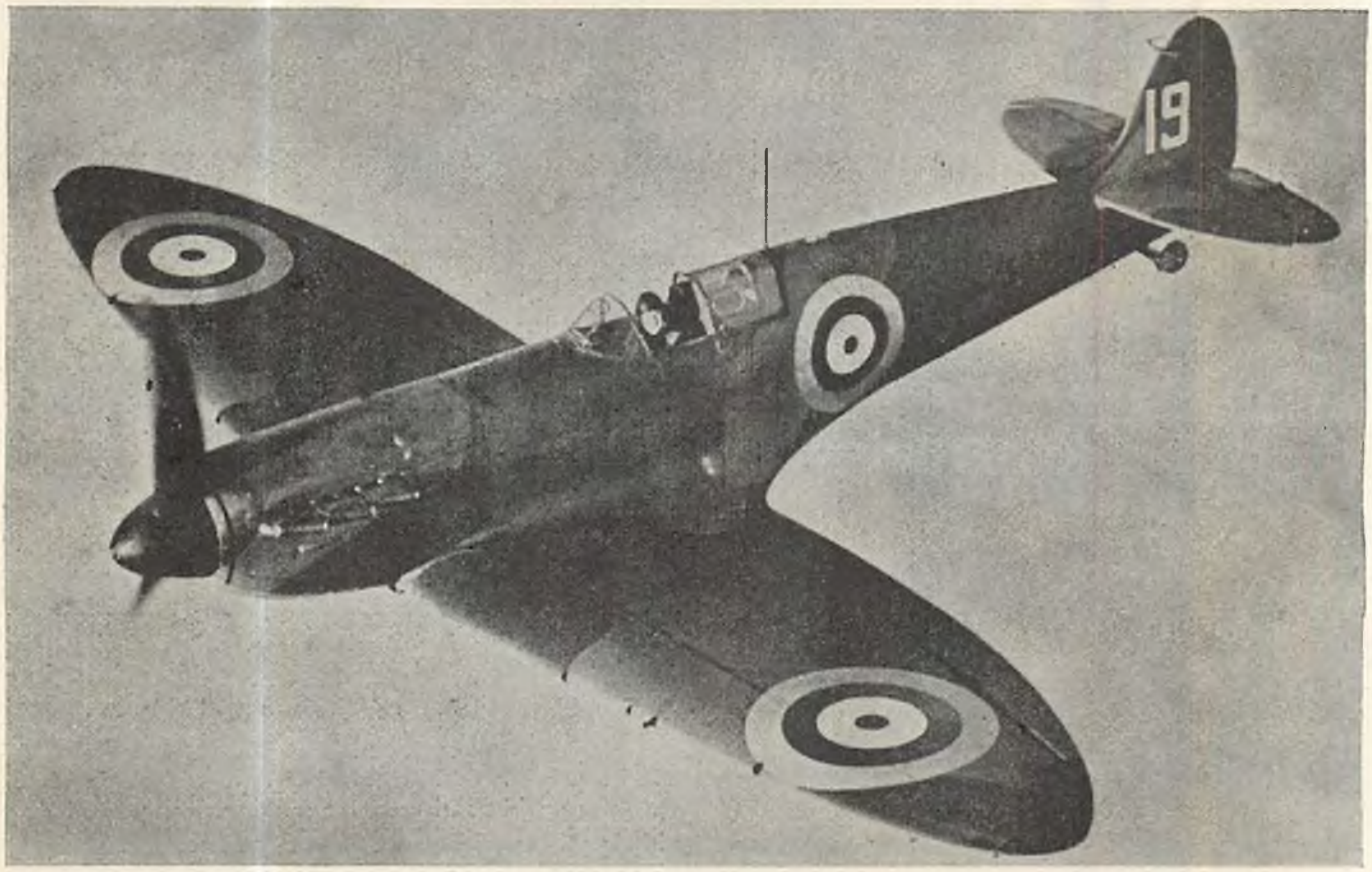
Popular interest in military aircraft has centered around the pursuit ship. From the early days of World War I this type has progressed through many steps to the highly complicated streamlined "bullets" of today. Here are the highlight planes in the transition. Can the future possibly match such an amazing parade of progress?



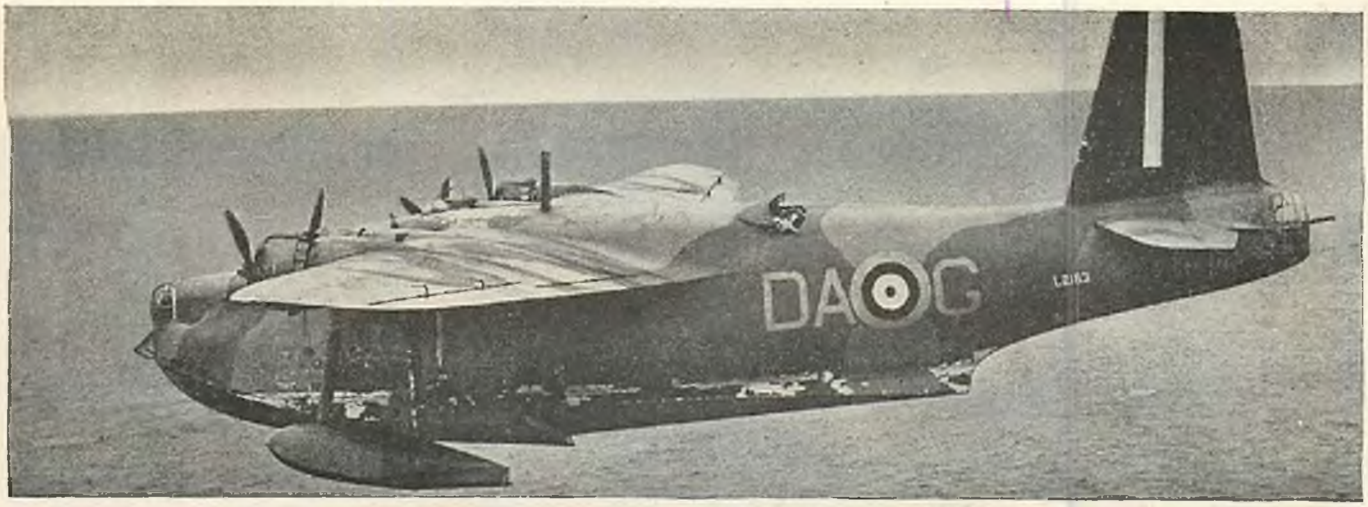
THEY FIGHT FOR ENGLAND

Surprise package. When these Boulton Paul Defiant fighters first appeared the Germans took them for single-seaters. Four-gun turret accounted for dozens. Over Dunkirk one gunner alone accounted for five Stukas. These ships have a speed of over 300 m. p. h.

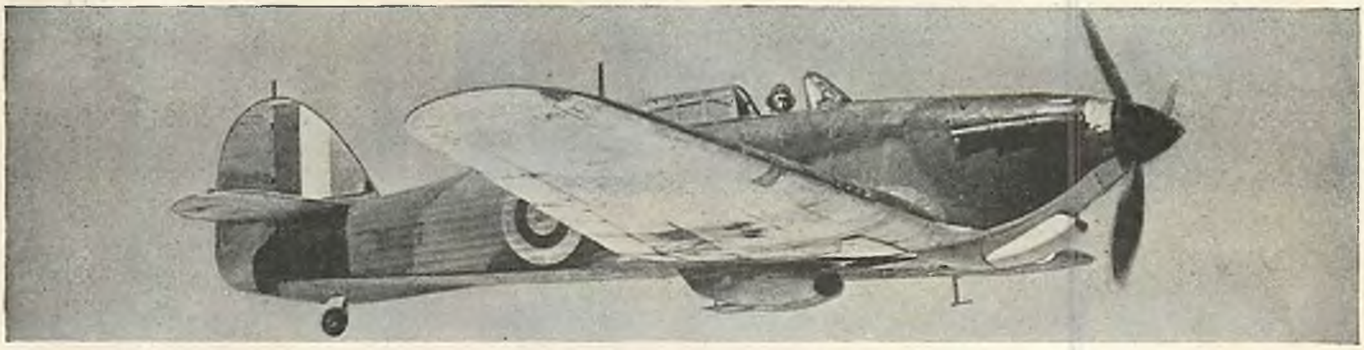
The valiant ships that defend Britain and carry the war to her enemies.



The best in British pursuit is the Supermarine Spitfire. This sky-sweeper with a speed of over 360 m. p. h., eight guns, and a climb of 11,000 feet in five minutes has proven to be iron ring around England, and has prevented German conquest of the air over England.



Battered but unbowed. This Short Sunderland long-range patrol boat has a speed of over 200 m. p. h., many gun turrets, and a range of 2,000 miles. This ship has held off combined attack of several fighters at once. Strategy is to fly low, preventing attack from below.



Storm warning: Hurricane approaching, Nazis take cover. Hawker Hurricane, sports eight guns and a speed of around 335 m. p. h., somewhat under that of the Spitfire. Many of these are in use in Africa and have been literally "big blows" to the Italians.

Peanut Special. This nickname affectionately tags the U. S. Brewster navy fighter used by England. Speed around 320.

Parachute delivery. This Bristol Bombay transport, although too slow and underarmed, transports troops and parachute units.

Designed as a torpedo-bomber, this Beaufort bomber has been used in coastal work. Note the rear-fire gun turret.

Gladiator enters the arena. Unusual as biplane fighters are, the Gloster Gladiator proved effective in Finnish and African action.

Popular emigrant. Lockheed Hudson bombers overseas in large numbers have won praise.

THEY FIGHT FOR ENGLAND

Continued from preceding page

Off to war. This Boeing flying fortress is one of many used in long-range bombing.

Fastest patrol boat. The Saro-Lerwick long-range flying boat is used in ship convoy.

Sea hawk. The new Fulmar fighter designed for sea duty is armed with eight forward guns.

More flying fish. With torpedoes slung beneath, Albacores patrol above Channel.

Douglas DB-7 arrives in England. Used as bomber-fighter.

This Blenheim medium bomber does yeoman service. Speed is 295.

Big baby. Consolidated B-24 flown to England joined ranks of heavy-duty bombing arm.

The Curtiss fighter well liked by English pilots. Copies of our army P-40s.

The new Botha, with unique rear gun turret, is giving Germany competition.

Some of these Fairey Swordfish torpedo planes dealt smashing blows at Taranto.

The Wellington, bomber of geodetic construction, can take plenty of gun punishment.

Blackburn Skuas, Fleet Air Arm's dive-bomber-fighters, are outstanding against enemy.

Standard R. A. F. equipment for counterraids is the Armstrong Whitworth Whitley.

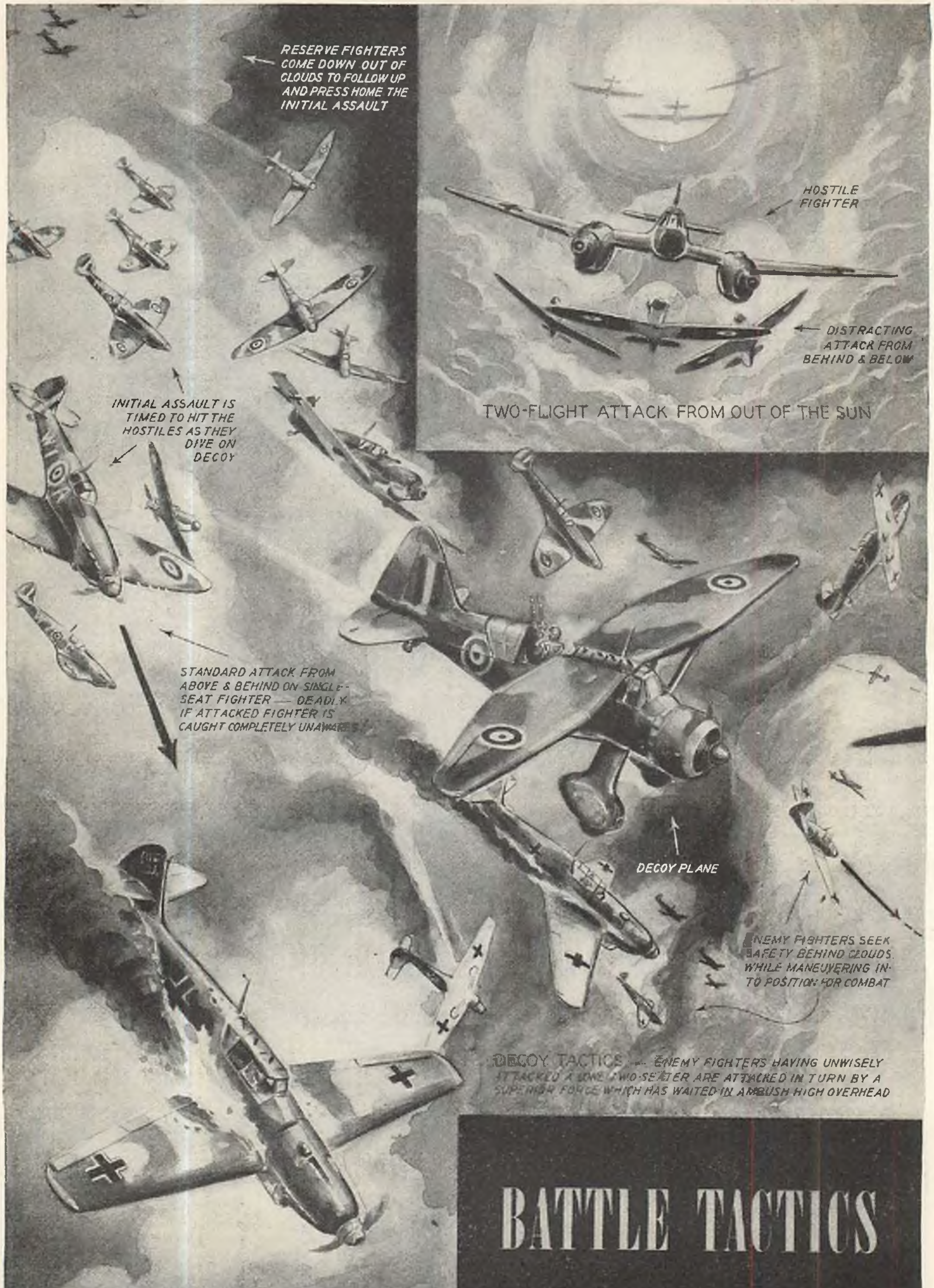
England now has a lot of these famous Handley-Page Hampdens.

Consolidated PBY-5 long-range patrol boat flew across to join.

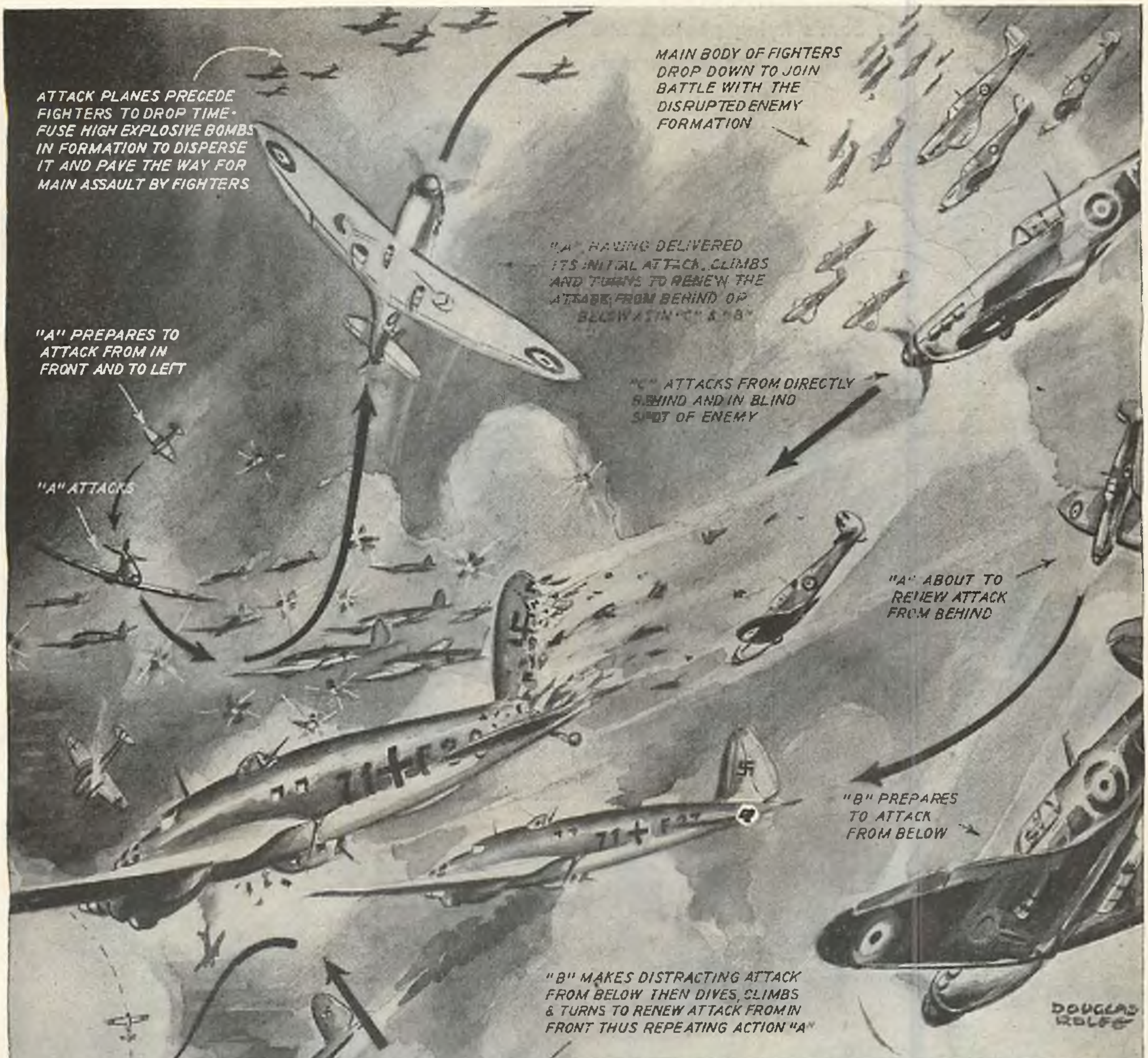
Slightly resembling Lockheeds, these Flamingos, commercial ships, do war service.

Grumman ships designed for our navy are seeing service. Their speed is about 325.

Between scraps North African troops practice on Westland Lysander observation-bomber.



BATTLE TACTICS



GROUP ATTACK ON UNESCORTED BOMBERS
SHOWING CONCERTED FLIGHT ATTACK ON SINGLE BOMBER

THE LIFE OF A FIGHTING PILOT DEPENDS UPON HIS ABILITY TO UNDERSTAND AND USE MODERN BATTLE TACTICS. NEW ARMAMENT, DESIGNS, SPEEDS AND CEILINGS ALL CHANGE AIR STRATEGY. HERE ARE EXAMPLES.

CANNON ATTACK ON BOMBER

At the Air Corps Technical School, Lowry Field, Denver, Colo., Uncle Sam's flying photogs are taught their trade with latest equipment.

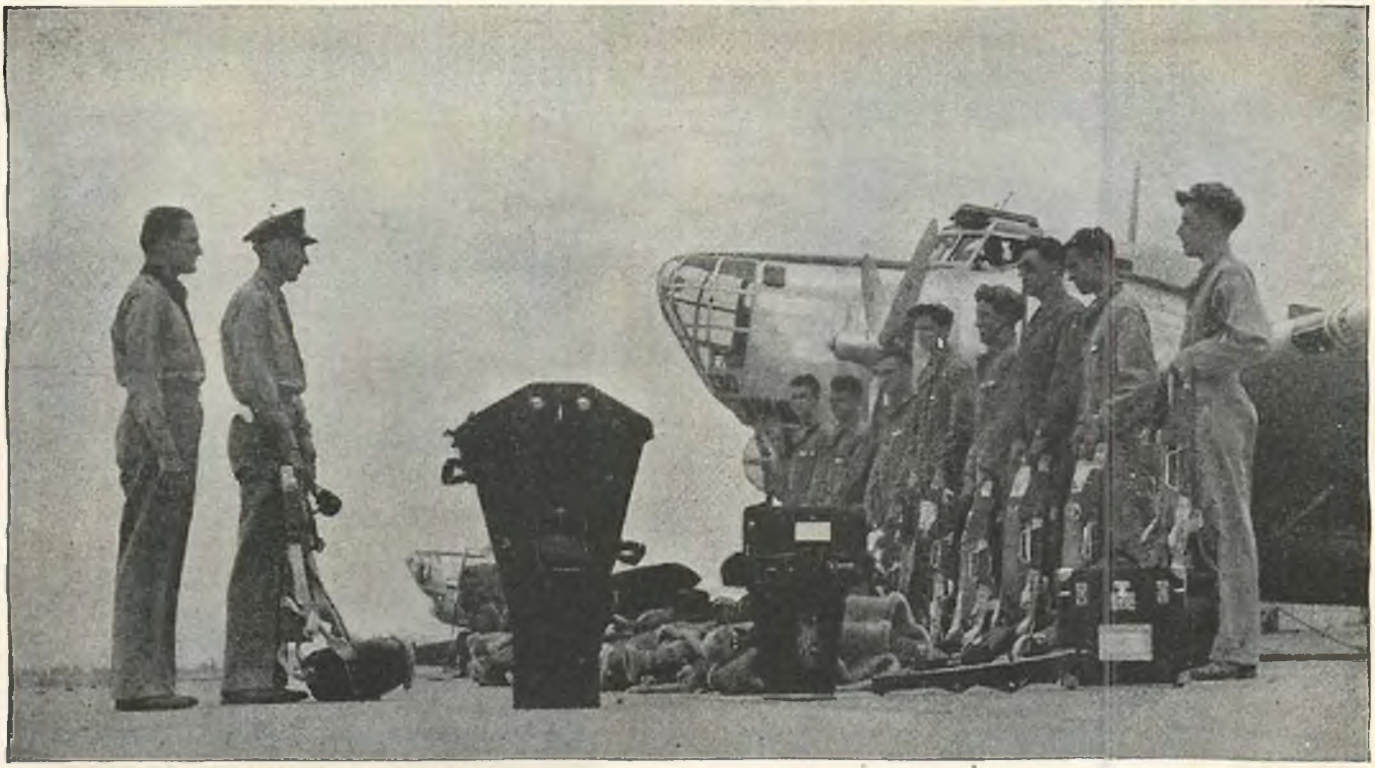
ARMY SHUTTER-BUGS

Shoulder cameras! Students must be taught how to handle valuable charges.

Before they go aloft with cameras, practice on dummy mounts in the classroom is obligatory. This is an electrically driven K3B.

Shutter-bug's tools. Left to right: carrying case, K3B aerial camera, view finder, K7C altitude camera, K3B wide-angle camera.

Going aloft. Fairchild K7C high-altitude camera is loaded into plane. Students have to be able to assemble these in flight.



Now get this, you guys! Last-minute instructions as, with equipment before them, students prepare to go aloft for air training.

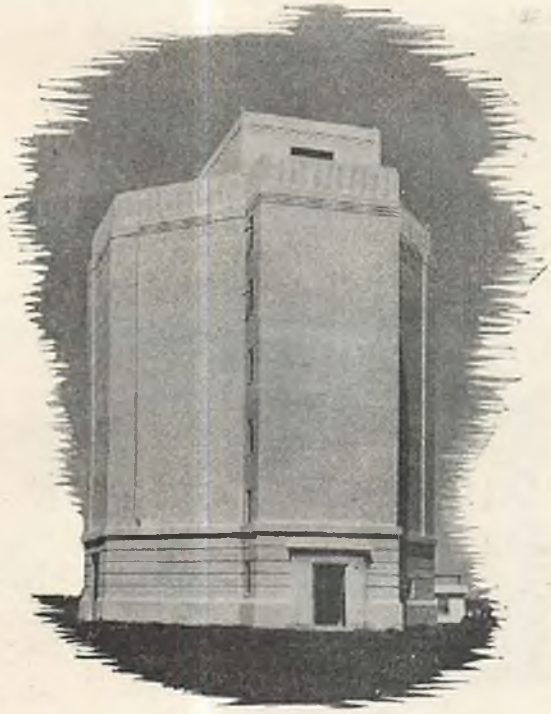
Shooting. Here the camera, mounted in belly of the ship, is being operated by heavily garbed instructor. Note oxygen tanks.

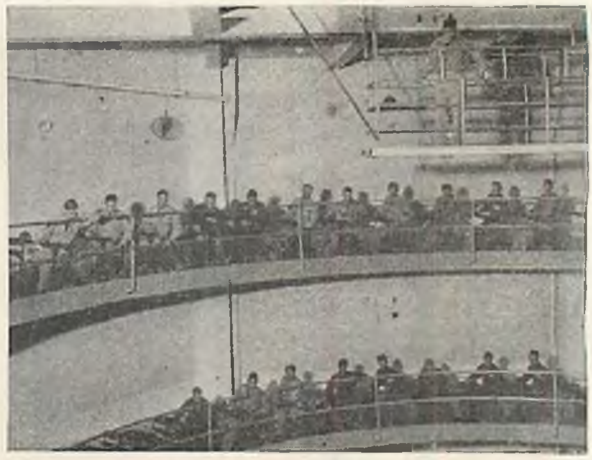
Special delivery. Films are dropped by parachute near a portable darkroom where they are quickly developed and printed.

Trailer darkroom awaits films. Crew develops, prints them with complete photo equipment.

Darkroom gang. After graduation all will be experts.

Here photos are cut and mounted to make continuous picture of terrain photographed.

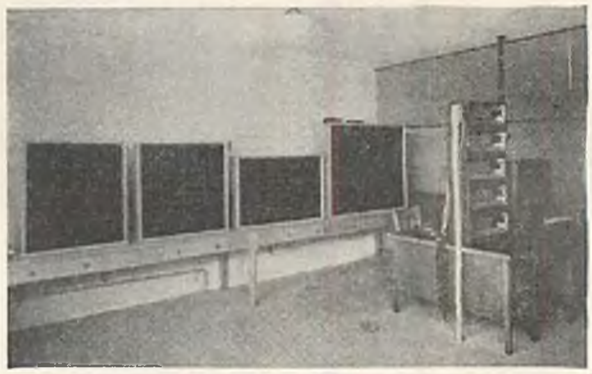




From the circular galleries about the walls these student observers report the simulated artillery flashes via radio.

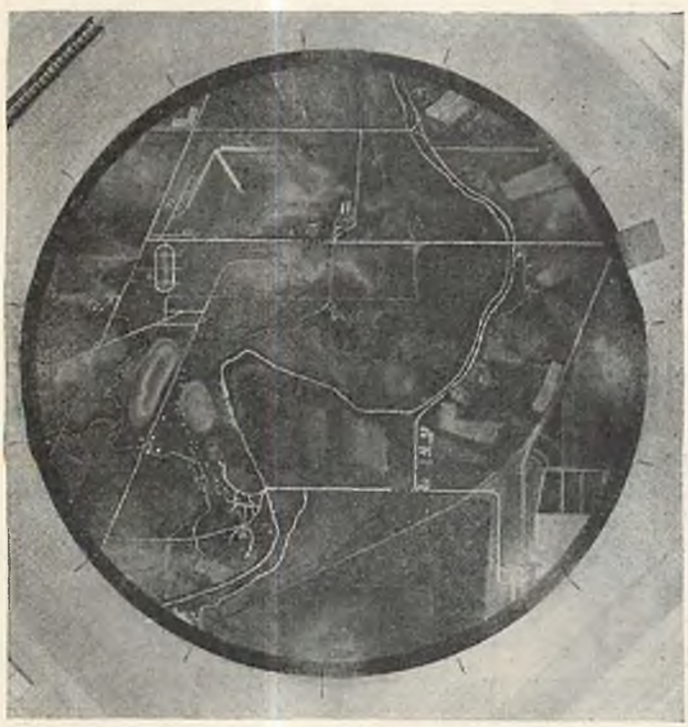
BOMB BOX

In the miniature range building at Kelly Field, Texas, students of the advanced Flying School learn observation on a small scale without leaving ground.



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

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



Spotter's-eye view of the floor of the Bomb Box showing the diorama of the battlefield. Six hundred lights flash simulating shells.

Realism in miniature. This close-up of the battlefield diorama shows the soldiers, trucks, tanks and cannon.

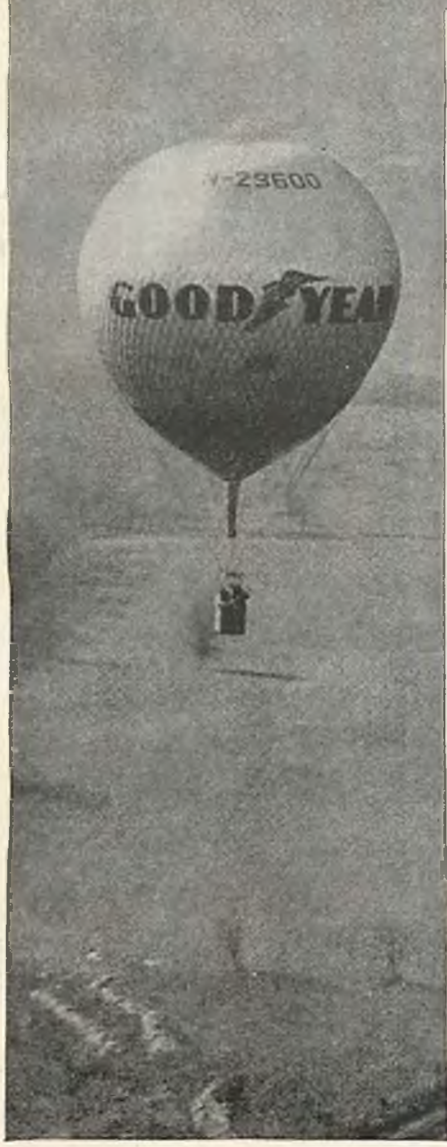
RUBBER JOINS THE RANKS

Rubber is important in the development of our rapidly growing barrage-balloon units.

A lot of rubber is needed in the upstairs war these days, with new purposes being found constantly. Here are shown several of them.

Ladies' aid. Doing their part to speed preparedness. Workers finish leakproof tanks.

Sealed with safety, these rubber-protected leakproof tanks fit into bomber's wings.



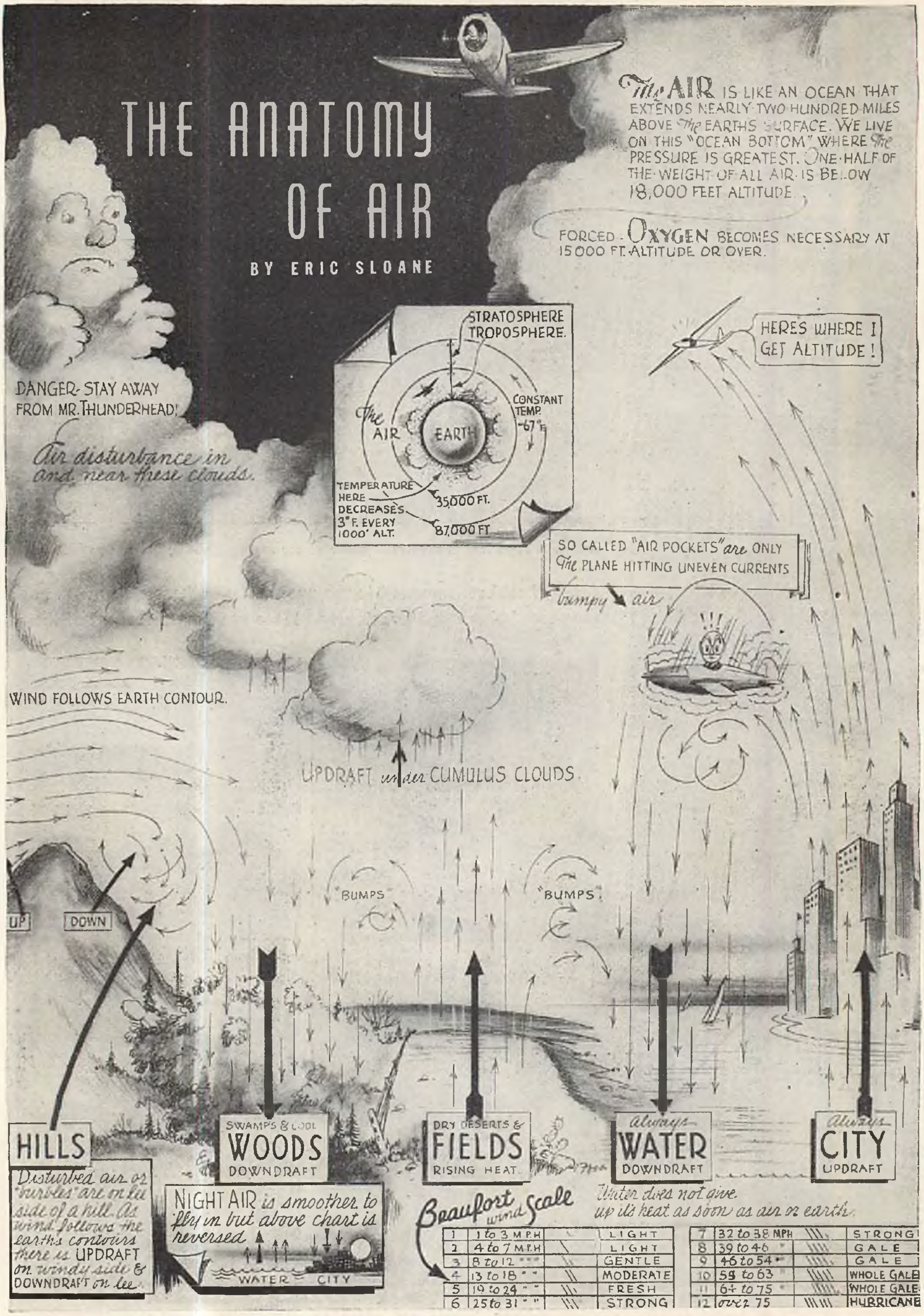
These training balloons depend on rubberized fabric for their gas envelope.

Here finishing touches are added to rubber lifeboats for seagoing planes.

These flotation bags of rubberized fabric will save many landplanes down at sea.

THE ANATOMY OF AIR

BY ERIC SLOANE



1	1 to 3 M.P.H	\	LIGHT
2	4 to 7 M.P.H	\	LIGHT
3	8 to 12 " "	\\	GENTLE
4	13 to 18 " "	\\	MODERATE
5	19 to 24 " "	\\\	FRESH
6	25 to 31 " "	\\\	STRONG
7	32 to 38 MPH	\\\\	STRONG
8	39 to 46 "	\\\\	GALE
9	46 to 54 "	\\\\	GALE
10	55 to 63 "	\\\\\	WHOLE GALE
11	64 to 75 "	\\\\\	WHOLE GALE
12	over 75	\\\\\\	HURRICANE

These parachute soldiers at Ft. Benning show you the tricks they've learned. It may come in handy some day.

Water landing. L. to R. Unbuckle crotch straps and sit in straps. Unfasten chest straps and fold arms until over water. Raise arms and drop.

After landing, 'chute may be collapsed by running around it or into it. If another person is there, have him grab pilot 'chute and run upwind.

Pulling right shroud lines causes 'chute to drift left

Pulling left-hand lines will make 'chute swing right.

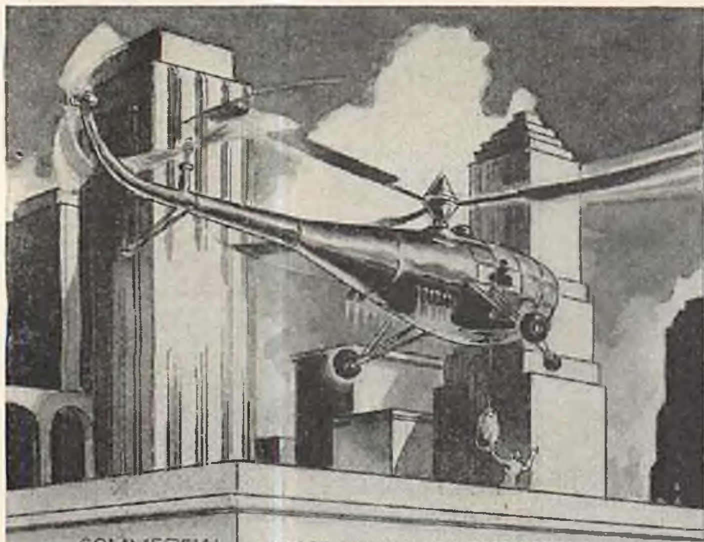
To turn right, pull front right and left rear lines.

To turn left, pull rear right and left front lines.

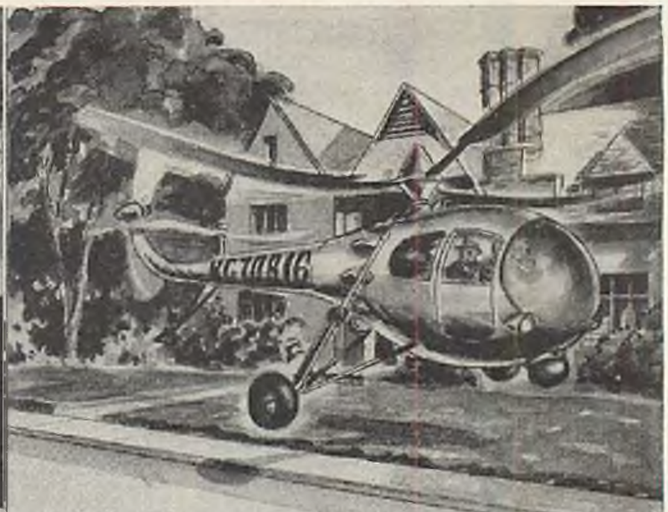
To turn around pull shroud lines crosswise behind.

As you land, grab front lines to spill 'chute at once.

To spill 'chute upon landing, if unable to run around or into it, pull front lines, now on bottom, spilling air.

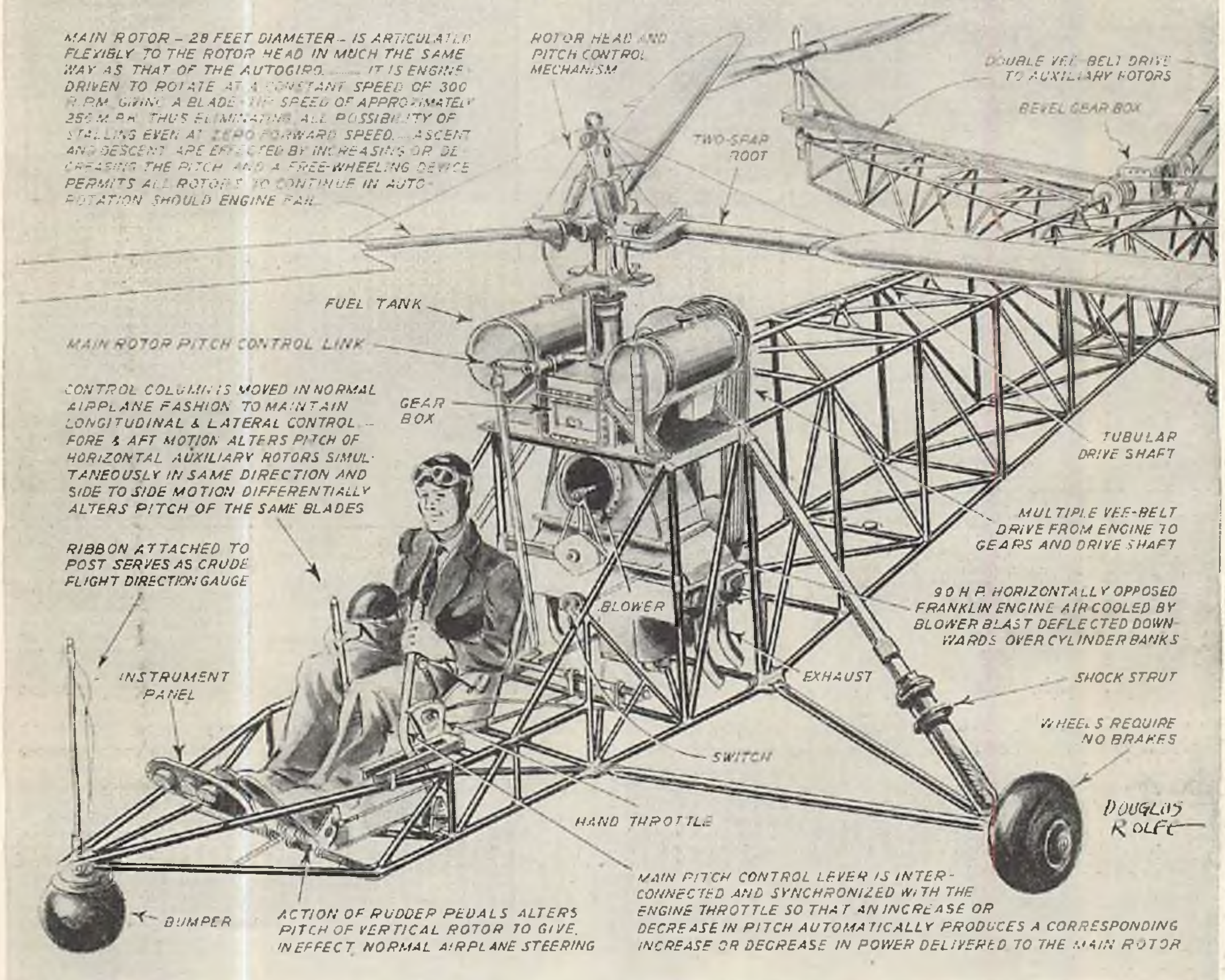


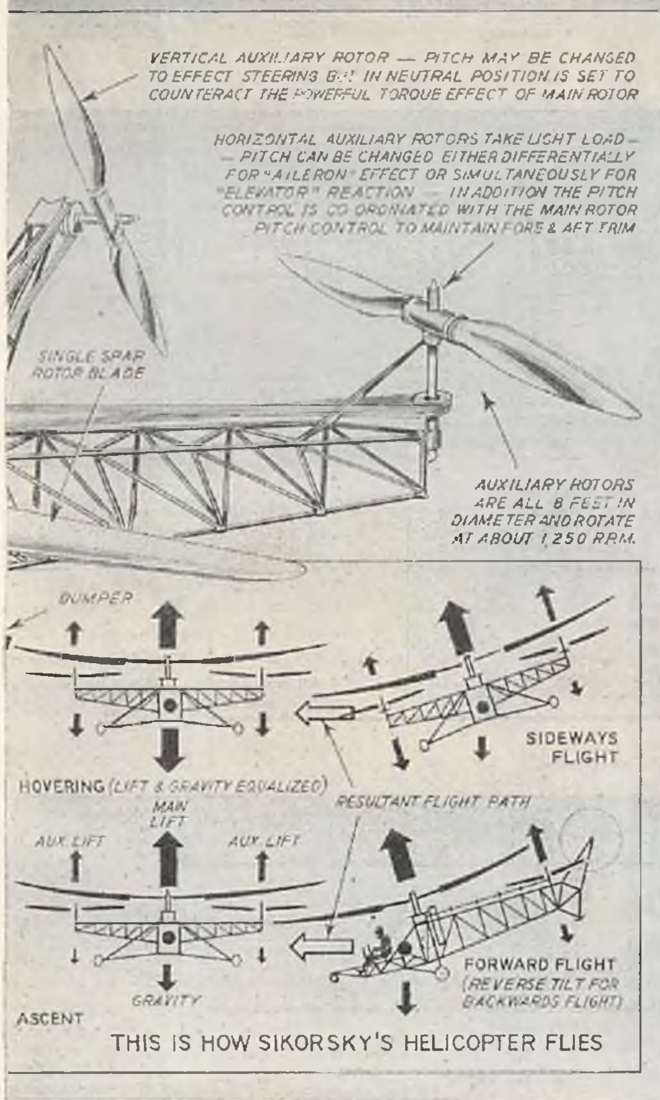
COMMERCIAL *AIRPORT SHUTTLE FOR PASSENGERS AND MAIL*

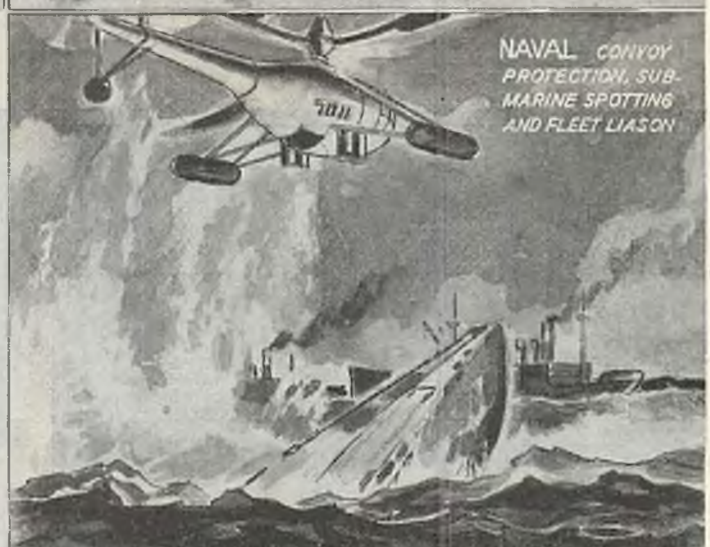


PUBLIC *POPULAR FLYING AND TAXI SERVICE. CAN GET IN AND OUT OF ANY PLACE LARGE ENOUGH FOR ROTORS TO SWING*

VERTICAL FLIGHT HAS A FUTURE!







ESSENTIAL FEATURES AND CONTROLS OF THE SIKORSKY-VS-300 HELICOPTER ARE EXPLAINED IN THE DRAWING AT LEFT. THE VS-300 RECENTLY BROKE ALL EXISTING HELICOPTER ENDURANCE RECORDS AND WILL BE DEVELOPED.

FUTURE DESIGNS WILL BE SIMPLIFIED, CLEANER-LOOKING AND HIGHER POWERED BUT PROBABLY WILL REMAIN COMPARATIVELY SLOW. DESPITE THIS, HELICOPTERS HAVE A DEFINITE PLACE IN AVIATION AS SUGGESTED IN SKETCHES.

"ON INSTRUMENTS"

When you look out of your plane and can't see a thing—that's when you appreciate your instruments. What dials look like in Link Trainer.

NORMAL FLIGHT. Here are our instruments as they look in normal flight. Top row, L. to R., compass, air-speed indicator at 120, turn and bank indicator centered, vertical speed at 0. Second row, clock, altimeter at 2,360 ft., gyro-compass and gyro-horizon show position.

GOOD CLIMBING TURN. Air-speed indicator shows drop to 104 m. p. h., turn and bank indicator shows turn to right, with ball centered, the vertical speed indicator shows 650 ft. per min. climb. Altimeter shows gain and gyro-horizon shows plane in banked climb.

FAST CLIMB. Although at a lower altitude, we are climbing at 91 m. p. h., gaining 800 ft. a minute, according to vertical speed indicator. Turn and bank indicator shows plane heading straight but not quite level (ball not quite centered). Gyro-horizon shows climb and tilt.

SIDE SLIP. Hold onto your hats! Note tilt of compass, which stays level with horizon, gyro-horizon showing tilt, and the ball of turn and bank indicator far to left. This latter is indication of left slip. In correctly executed turns centrifugal force keeps ball in center.

DIVE. Gosh, look at that air-speed indicator, 155 m. p. h., and vertical speed indicator showing 900 ft. per min. loss of altitude. Turn and bank indicator shows a straight dive, but get your left wing up just a hair. Look at gyro-horizon and you'll see how nose has dropped.

SPIN. Here we go! Instruments fail to show gyrations of our plane, although turn and bank indicator indicates right-hand spin. The gyro-horizon whose parallel white lines always mark the true horizon shows nose dropped and plane banked to right. Actually compass is spinning.

STALL. Here it comes We're about to fall off to right. This indicated by the turn and bank indicator and gyro-horizon. Note air speed has dropped to 50 m. p. h., at which speed ship loses flying speed and goes into a stall. Note vertical speed indicator also.

POOR TURN. Watch your turns or this will happen. Bank was steep enough according to gyro-horizon but not enough rudder, and plane has slipped down to inside of turn. Note vertical speed going down, and turn and bank indicator ball to right. Make turns at cruising speed.

BANK. Here we have a normal bank. The air speed is about right, 116 m. p. h., ball is centered in turn and bank indicator, which also indicates right turn. Gyro-horizon shows bank to right and vertical speed indicator shows no loss of altitude. Let's call it a day!

LANDING. It's all over. Plane approaches stalling speed, but note altimeter shows we are just off ground, where we should be. Nose is high as shown by the gyro-horizon, and plane is going straight and level per turn and bank indicator. Well, how's flying blind, pilot?

TAYLORCRAFT ALBUM

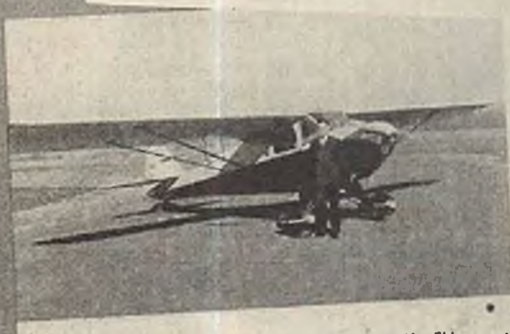
C. G. Taylor originated the light plane. Today his plant in Ohio is the industry's latest.

First of a long line. The original Taylor Cub No. 1 with 40 h.p. Salmson (French) engine. C. G. Taylor on left.

First Cub's birthplace. Here in old factory at Bradford, Pa., fire-razed in 1937, the long line of Taylor ships began.

And now the first Taylorcraft. Built at Butler, Pa., this ship, with a 40 h.p. engine, marked further progress.

The well-known Taylorcraft factory at Alliance, O., where for many years the Taylorcrafts were developed and built.



Taylorcraft up to date, and "C. G." himself. This newest and smartest Taylorcraft is the 65 h.p. Duo-Tone De Luxe.

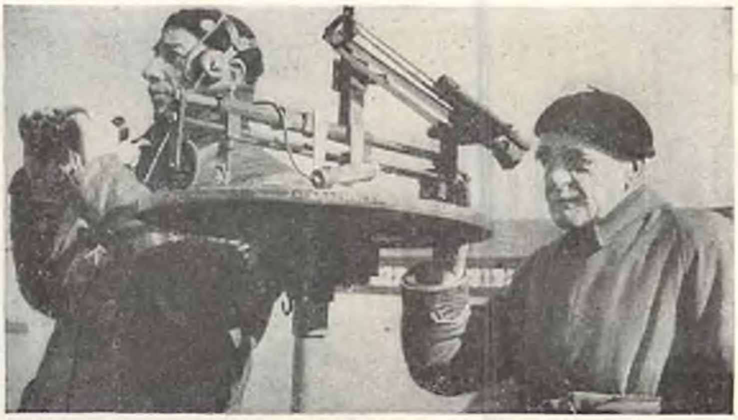
Product of success. This new quarter-million-dollar factory was demanded by growing popularity of Taylorcraft ships.

Taylorcraft Tandem. Designed particularly for use in CPTP programs, new tandem trainer has excellent flying and training characteristics. Engine, 65 h.p.; range, 300 mi.

Taylorcraft tricycle. The new tandem trainer is the first light plane to be offered with either standard or tricycle landing gear. Right, the roomy interior of the new trainer.

SKY SCANNERS

Someone recently said there are no more civilians in England, everyone is in the service. One of the most important groups of civilians is the aircraft warning service composed of men past military age. Rain or shine, day or night, they man their posts.



With the aid of complicated spotting scope, range, height and speed of the invaders are computed. Instrument rotates to follow planes.

This middle-aged observer and spotter reports by phone the movements of both friendly and enemy aircraft.

Post relief arrives to take over the next stretch of duty. The wall of the circular pit bears compass and section numbers of post area.

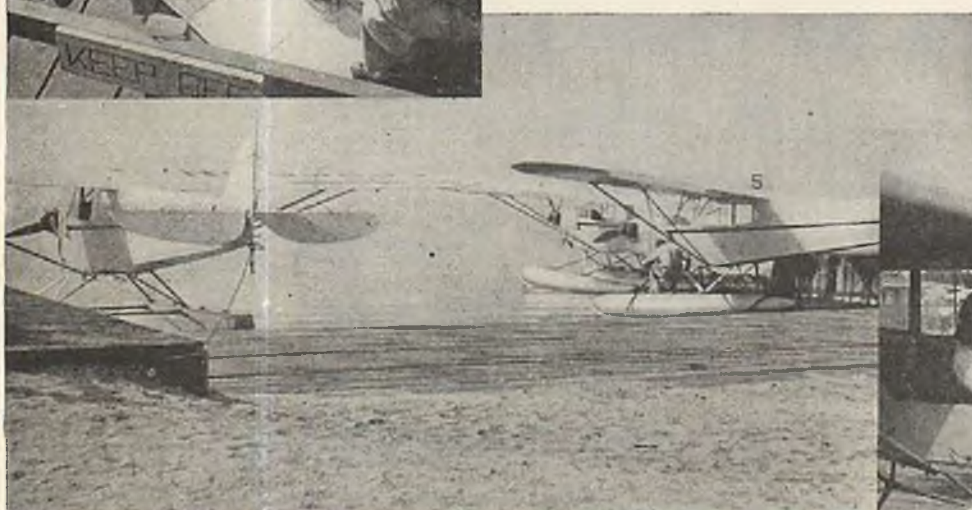
A detailed log of all aircraft observed is kept by each post for reference. England's spirit shows in this fine old gentleman's face.

PONTOON PARTY

Where to? Once wings are earned, group flights are planned by leader.

And then you do this! The instructor gives Adelphi College girl students the low-down on what to expect from their ships before they go aloft to practice.

These girl students at Garden City, Long Island, N. Y.,



Classroom on floats. The three float-equipped Cubs await the rush. Two ships have pneumatic floats, a new development in seaplane equipment.

Give her a twist, will you? Students learn correctly how to spin the prop from behind. Student in the ship works the switch and throttle during the procedure.

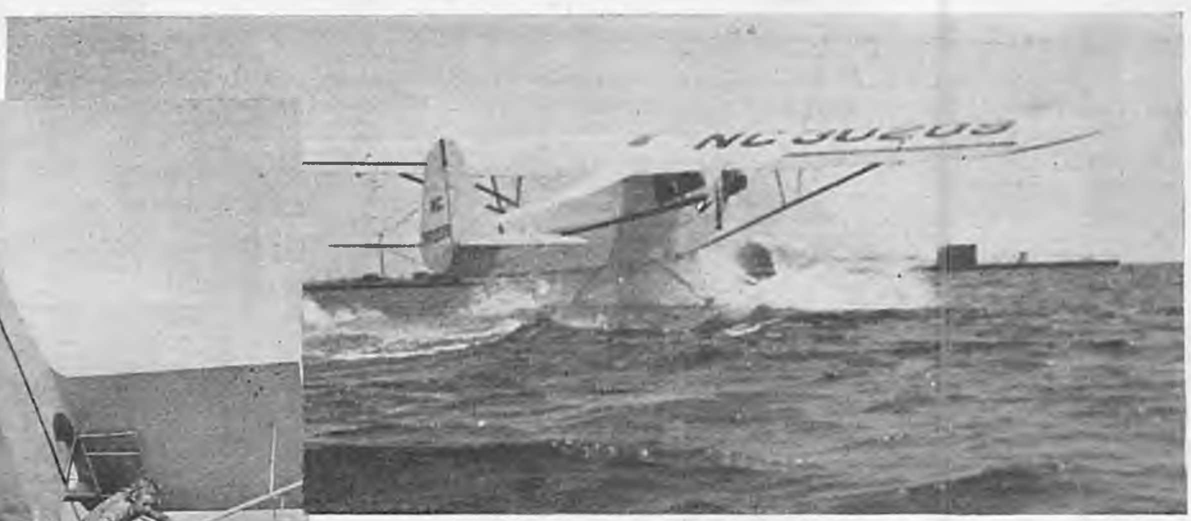
Not content with knowing how to fly, the students are intent on knowing WHY they fly, studying instrument details.

Time clock and individual cards enable the instructor to keep close check on each student's air time and course progress.

Light but tough. The McKinley pneumatic floats used on two of the Cubs provide rugged and safe landing gear.

And don't worry! Last-minute advice from her instructor sends this smilingly confident miss off on first solo flight.

take part of their Civil Pilots Training in seaplanes.



Rough-water runway. These rugged ships make light of choppy water and even use it to advantage in a take-off. Floats stick to glassy water.

Well, powder my nose! Once in a while there's a nose-over, but the slow landing speed and pneumatic floats make it seldom serious, except to pilot's dignity.

DESTINATION UNKNOWN

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

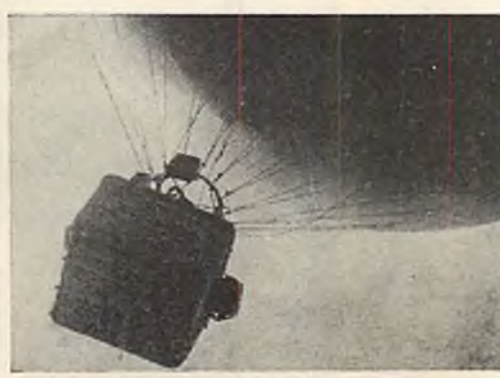
Full house. Here in the Lakehurst hangar we see four of these training balloons ready for flight.

Before take-off each balloon is carefully inspected and inflated. Weights hold it to floor.

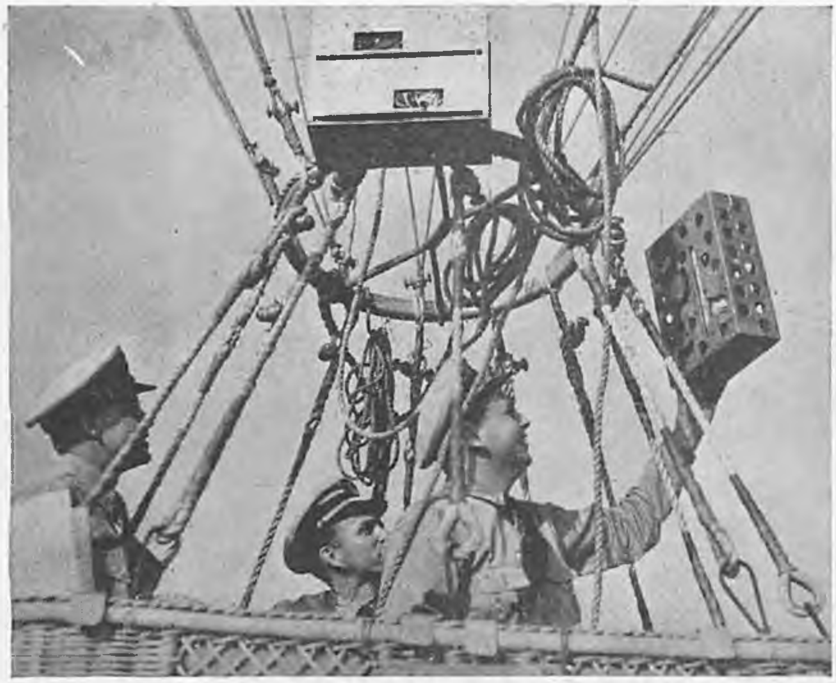
Sandbags hold bag steady while basket is attached.

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

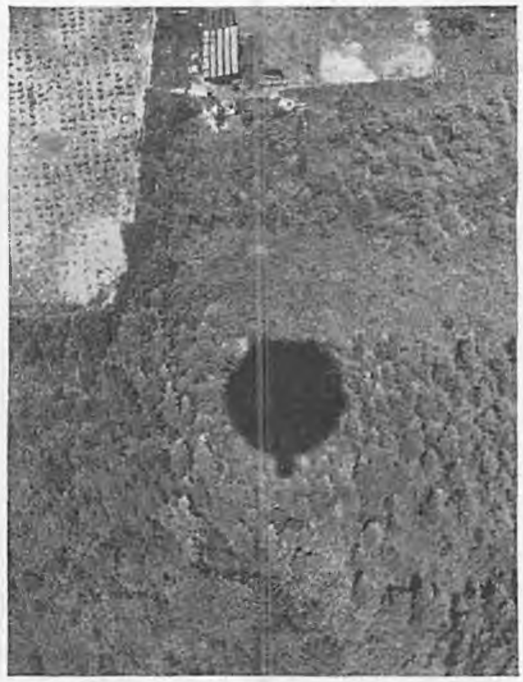
Take-off. A handful of sand falls and up goes the ship.



Destination unknown. Up into the sky sails the balloon, to drift with wind currents until it lands.



Officer checks box containing altimeter, thermometer, and variometer. Direction may be changed only by entering air layers flowing in different directions.



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

Valving helium through top vent seen through appendix.

Hanging onto rigging, crew waits as the basket plows through shrubs toward landing spot.

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

Sailors who have followed flight of balloon via truck arrive to assist in packing the basket.

Carrying news of crew and destination, these two carrier pigeons start toward home base.

Now for home. Balloon and gear are packed. Let's get going.

Tomorrow's Air Might

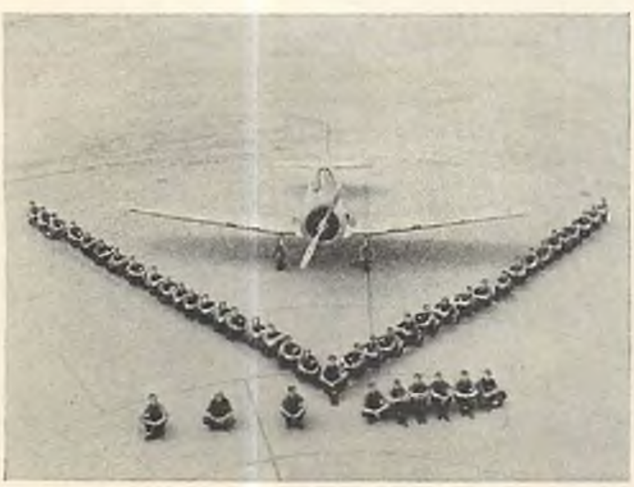
(Continued from page 7)

Living slogan by Southeast Air Corps Training Center Cadets.

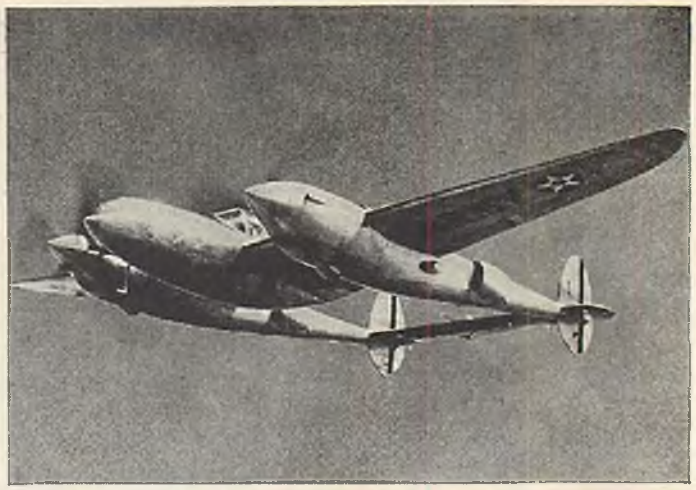
The nation which would survive in these times must provide sufficient airpower to gain and to maintain air superiority in any theater which it would control.

The security of our nation demands that we build without delay the strongest air force in the world.

We know that air forces are no longer mysteries, either in building or in employment; we have read aright the lessons from burning, stricken Europe. We know that air forces are but balanced compounds of airmen, airplanes and air bases. We have the capacity, the opportunity, the materials, the manpower to build the world's mightiest air force, and we have the plan, the initiative, the determination to see that job through.



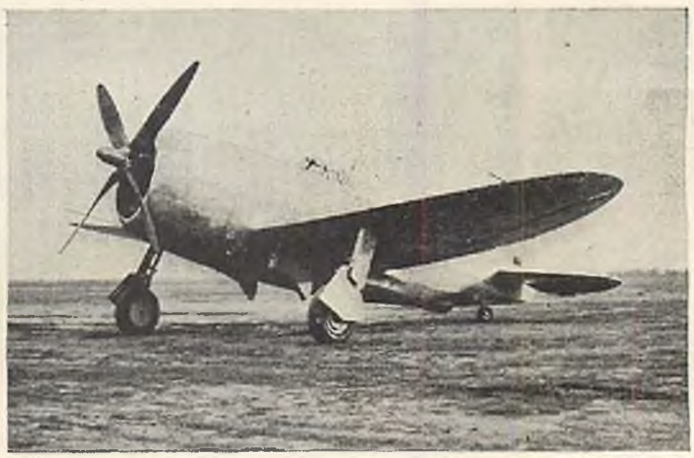
Victory "V" and "V" in international code by flying cadets.



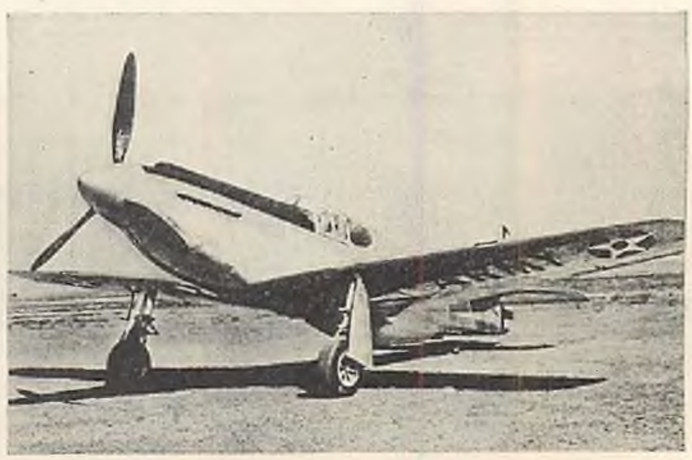
Lockheed P-38, powered with liquid-cooled Allison engines has machine guns and cannon in center nose. Speed over 400 m. p. h.

SEEN AT WRIGHT FIELD

Some of our newest ships being tested at Wright Field as seen by our photographer during a visit.



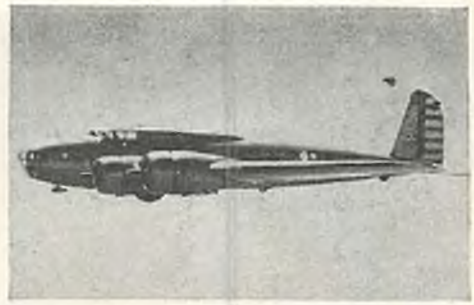
First 2,000 h. p. single-engined fighter is the XP-47B by Republic. Heavily armed and armored, service ceiling of 8 miles.



The North American XP-51 "Apache" being tested by army is also Allison-powered and will be heavily armed. Note belly radiator.

Twin-engined medium bomber by Douglas. B-23 with tail turret is an improved version of the Douglas B-18A, popular medium bomber now practically obsolete.

Twin-engined fighter. Douglas A-20A has speed of 325 m.p.h. Nose guns fire forward from streamlined coverings. England has many of these planes renamed Havoc.



The Boeing B-17C heavy bomber, equipped with leak-proof tanks and armor, has new flat blisters on sides. England finds them ideal for long range bombing raids against Germany.

New basic trainer. Fleetwings XBT-12 has top speed of 195 m. p. h. Spot-welded steel fuselage gives strength. Training planes must be rugged and stable to fly.

Twin-engined bomber. The North American B-25 has a speed of well over 300 m. p. h. Note the tail turret gun. This ship is particularly well armored and armed.

Army gets B-24s. Under the name Liberator, England has received many Consolidateds. Has tail turret. These will do similar work as Flying Fortresses. Now used in great numbers.

For officers' use. This Beechcraft AT-7 will be used for light transport work and training of aerial navigation. Note shielded radio antenna on the top of the fuselage.

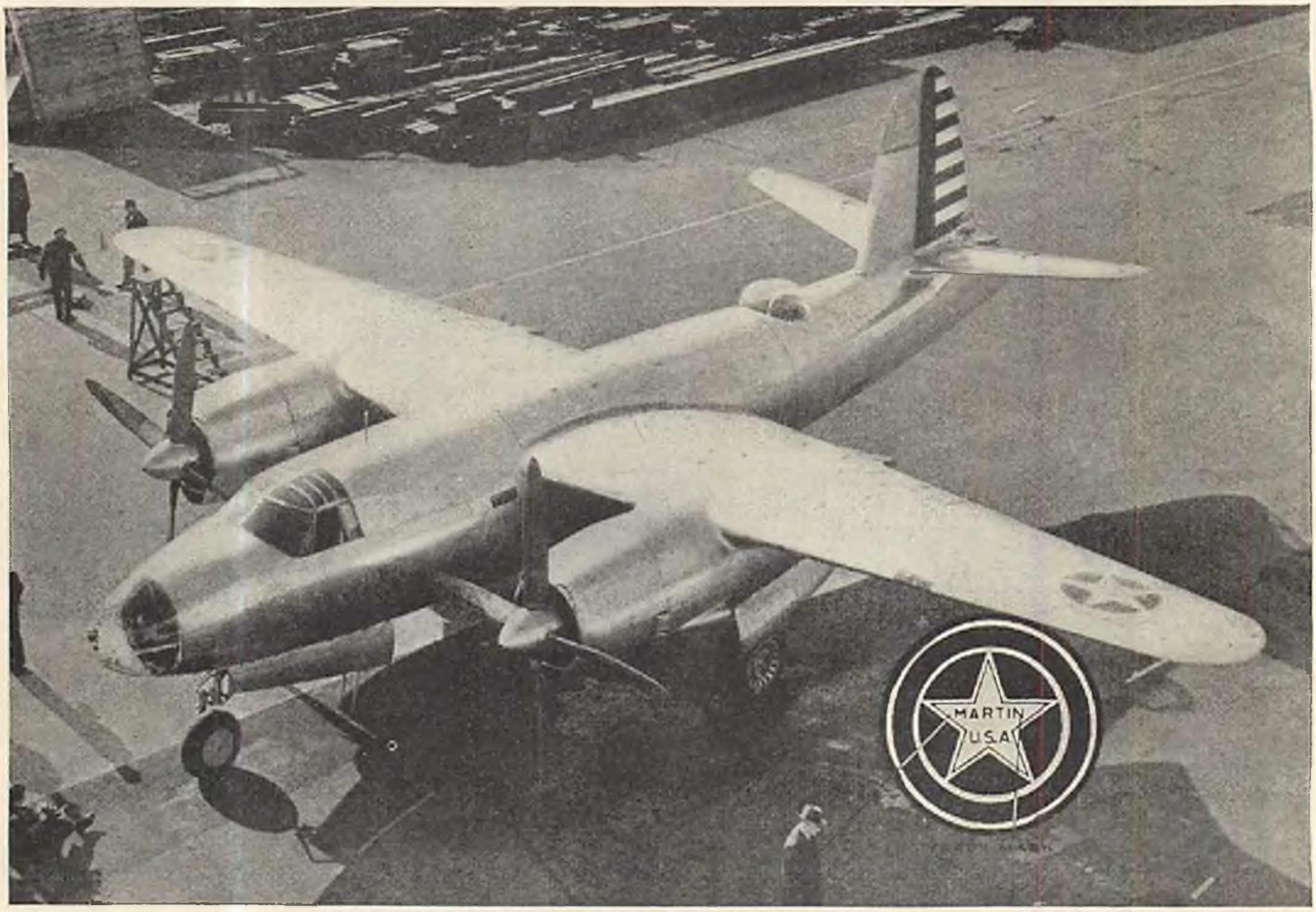
Tough trainer is the Fairchild XPT-23. This primary trainer also bears the materiel division insignia, MD, on tail. The army believes in the use of low-wing trainers.

Still used here and abroad. This P-36A by Curtiss has speed of 323 m. p. h. and 1,000-mile cruising range. This was the forerunner of the Curtiss P-40, Allison-powered fighter.

Giant killer. The Bell P-39 with Allison in rear of pilot has a shell gun in nose, as well as many machine guns. One of few fighters with tricycle gear for rough fields.

Flying sunroom. This Vultee BT-13 trainer has fully inclosed cockpits. Full radio equipment is used in training cadets. Maximum visibility is important in trainers.

Designed for observing. The famous North American O-47A is kept up-to-date. Speed is 243 m. p. h. Ship beyond is Republic P-43 fighter which insisted on being in picture.

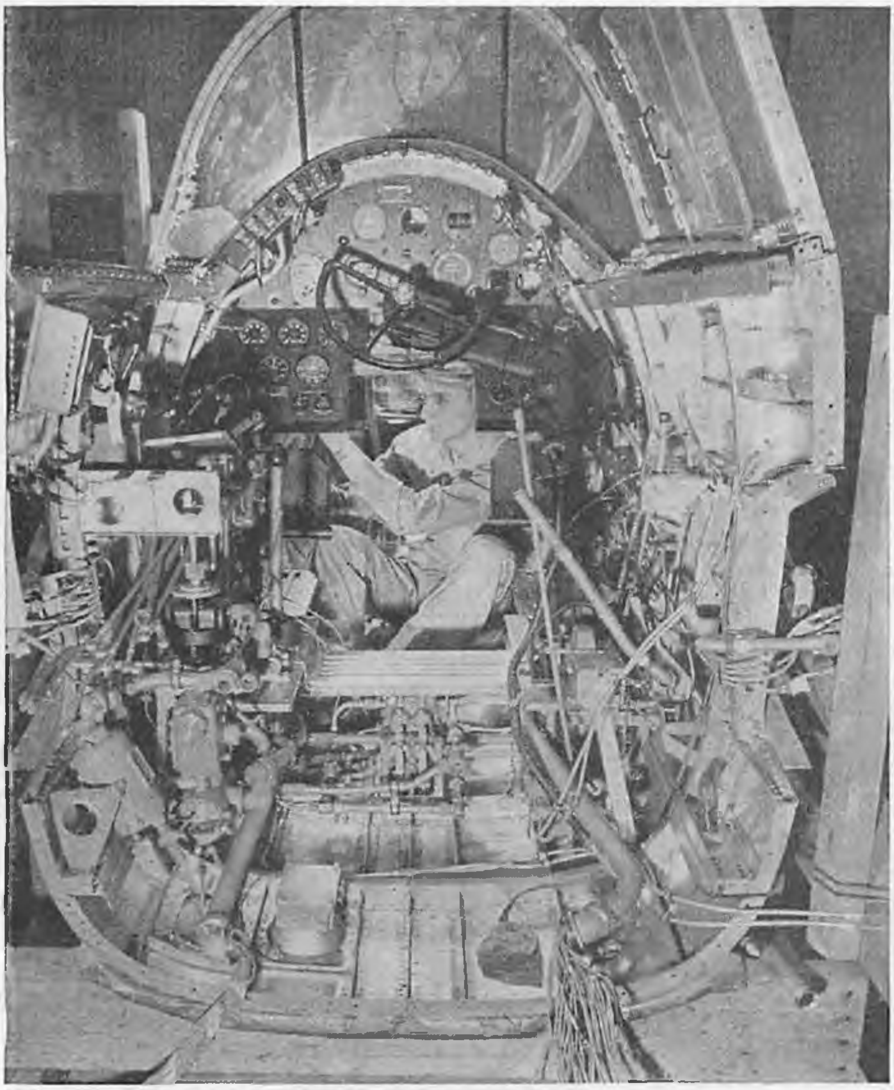


The B-26 air corps medium bomber, climaxes 32 years of manufacturing for Glenn Martin.

BOMBERS BY MARTIN

Glenn L. Martin, with models of early Martin bomber.

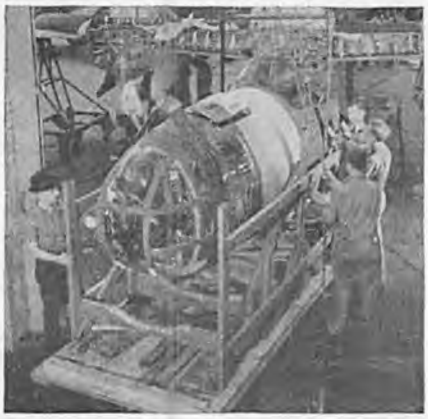
BUILDERS of dependable aircraft since 1909, Glenn L. Martin's first airplane was made in an old church. The latest Martin planes, British Marylands and Baltimores, army B-26s and navy PBMs, roll off the production lines in the giant Baltimore plant where approximately 17,000 workers are now employed. By 1942 a new bomber assembly plant in Omaha and further plant additions at Baltimore will boost the pay roll to 42,000 workers and floor space to 5,192,725 square feet—equivalent to twenty-four square blocks in Manhattan. Martin, *one-time barnstormer*, has followed the up-and-down manufacturing trail for thirty-two years from California, to Cleveland, to Baltimore. The post-war Martin bomber and recent B-10 were marvels in their day. Now under construction is the greatest of Martin ships, a four-engine navy flying boat rumored the biggest ship in the world.



Planes aren't autos. Strength, light weight, and the complex gadgets of war make British Maryland a machine of 25,000 individual parts and 150,000 rivets. This is nose.

CRATING A BOMBER

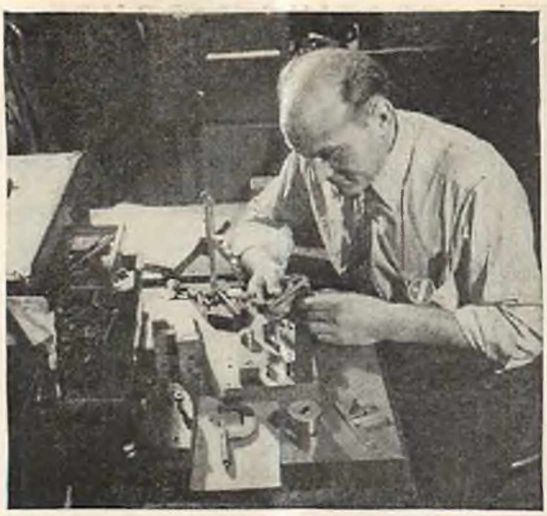
Nose, center section and tail section of Maryland come apart for shipment.



Bundles for Britain. Nose section of a Maryland bomber being loaded into crate.

Off to the wars. Every day a trainload of airplanes departs for points unknown.

Design at Martin is a never-ending job for many hundreds of engineers and draftsmen. Note small mock-up in lower right corner.

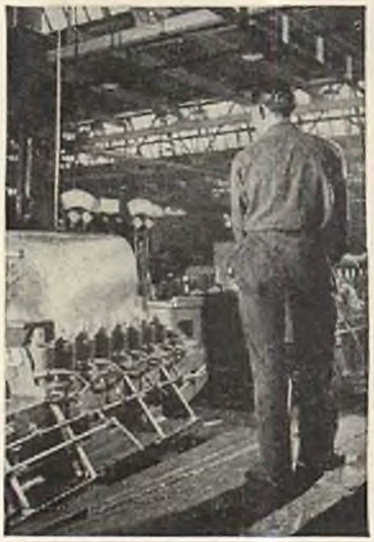


Toolmaker's craft is one of oldest in the industry. This expert is measuring a tool intended for a Martin bomber. Skilled toolmakers are in demand.

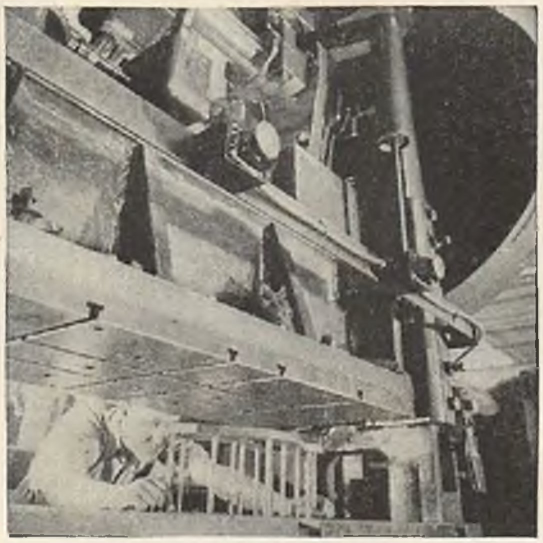
Worth their weight in gold, these machine tools in the shops cut castings and forgings to thousandth of inch.

Richard A. Pilling sets up one of the band saws which cuts heat-treated aluminum alloy as easily as wood.

BOMBERS BY MARTIN (Continued from Preceding Page)



Jaws of metal-stretching press hold metal sheets; forms press up against them to form covering.



One of a battery of powerful presses which form out metal parts. An operator sets a die for the job. Acres of machines work around the clock.

Intricate shapes cut by power router. Sheets of aluminum alloy are sandwiched between wooden patterns acting as guide.

"Oldsters" like this make all sorts of wood patterns, forms, "mock-ups" before production.

One of thirty-odd power drop hammers in drop-hammer department smashes out a section.

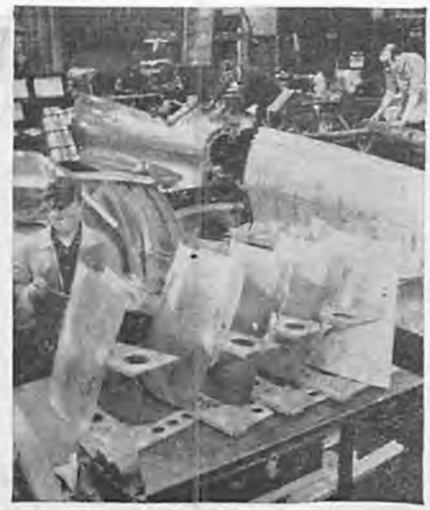
A plaster mold gets polish before being turned over to sand molds to be made into die.

Man from Mars? A melter pours metal to be transferred to sand molds for drop-hammer dies.

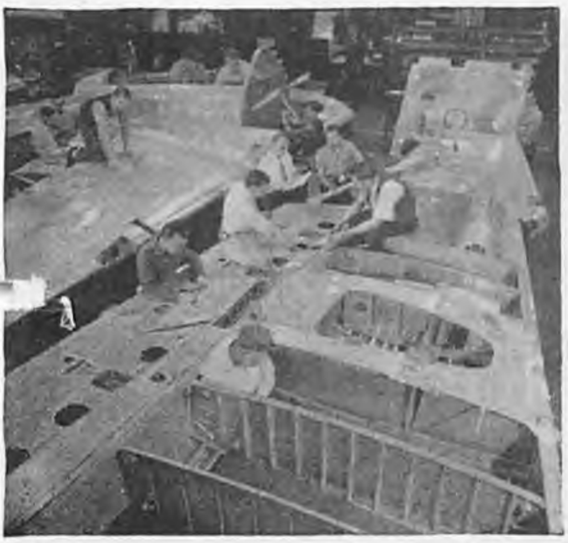
Zinc die destined for drop hammer is ground to closer dimensions and then polished.

Operator trims part. Many manufacturers encourage aviation training in local schools.

Here a rib for B-26 is formed on a fixture that permits men to work at any elevation.



Sub-assembly. Hundreds of such operations form 25,000 parts into sub-assemblies which will come together as B-26.



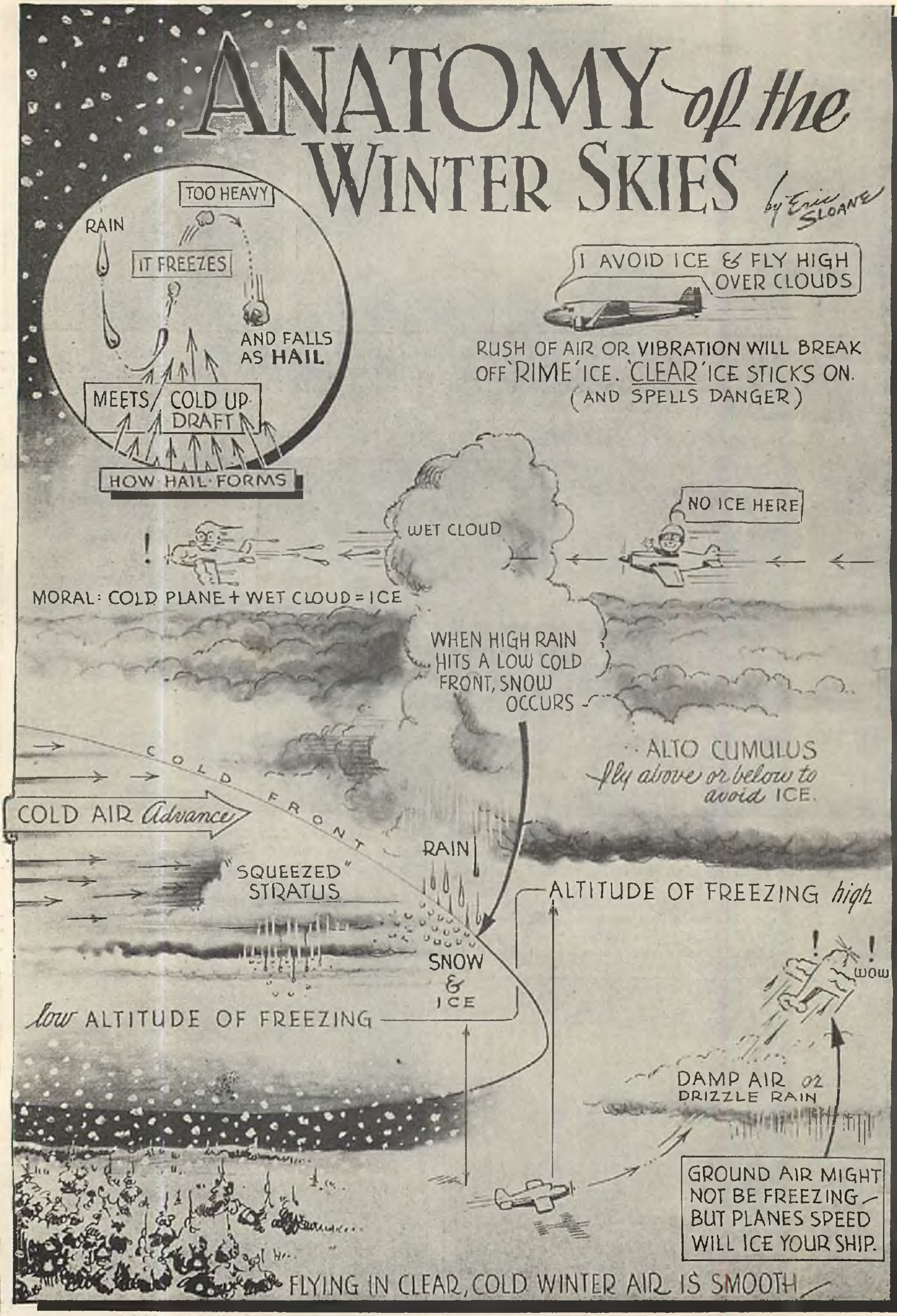
Wings for B-26 are assembled from sub-assemblies and metal skin is fitted. Installation of control wires, electric wires, and so forth, goes on from this point.

Miscellaneous equipment is fitted into the tail section of the B-26. Well in top foreground is for a power turret.

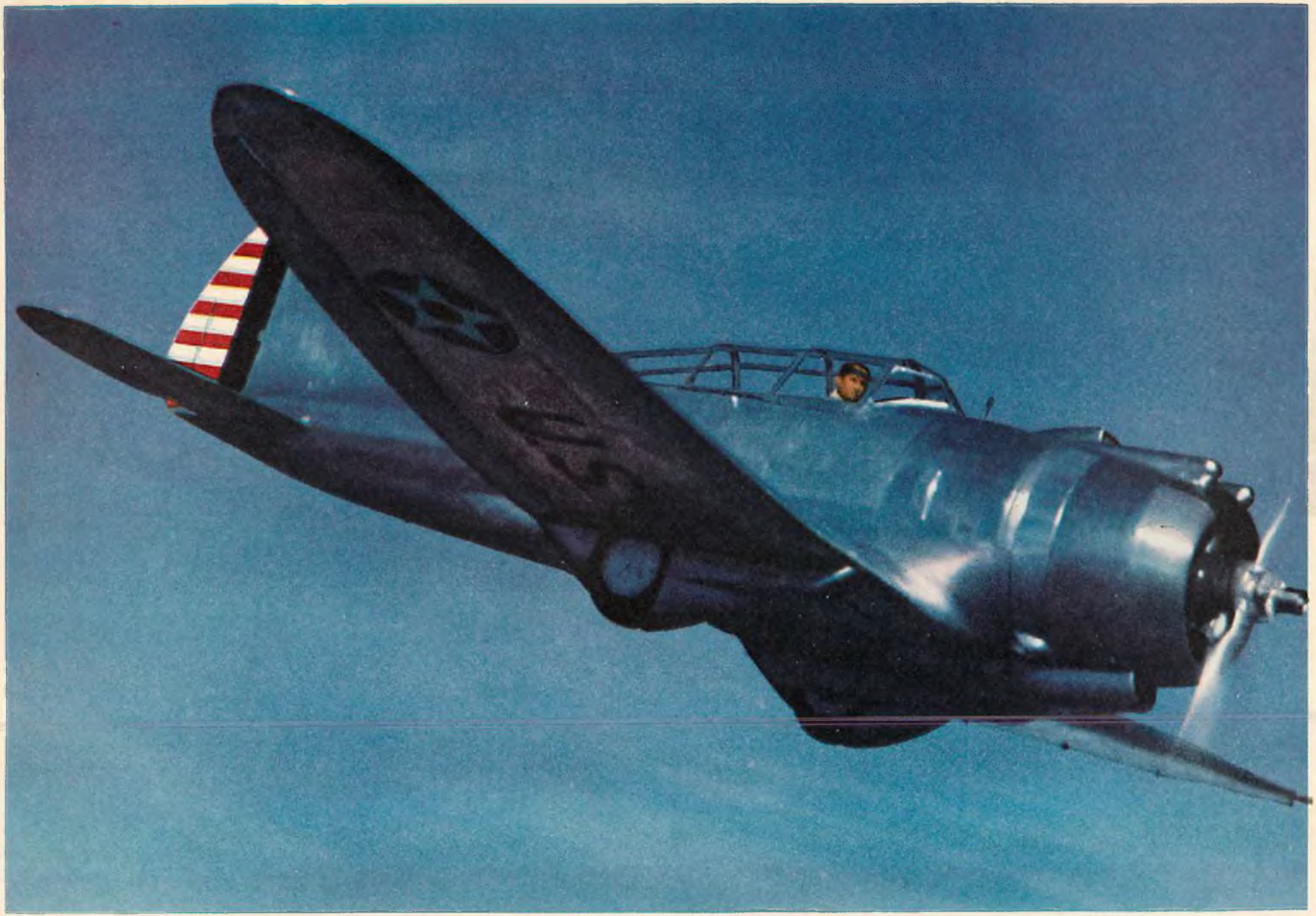
Modern Jonah emerges from the metal maw of tail turret being readied for turn on assembly line.

A line of B-26 noses moves toward final assembly. This gives idea of bomber production. The trick in mass production is to complete smaller assemblies as far as possible before bringing them together.

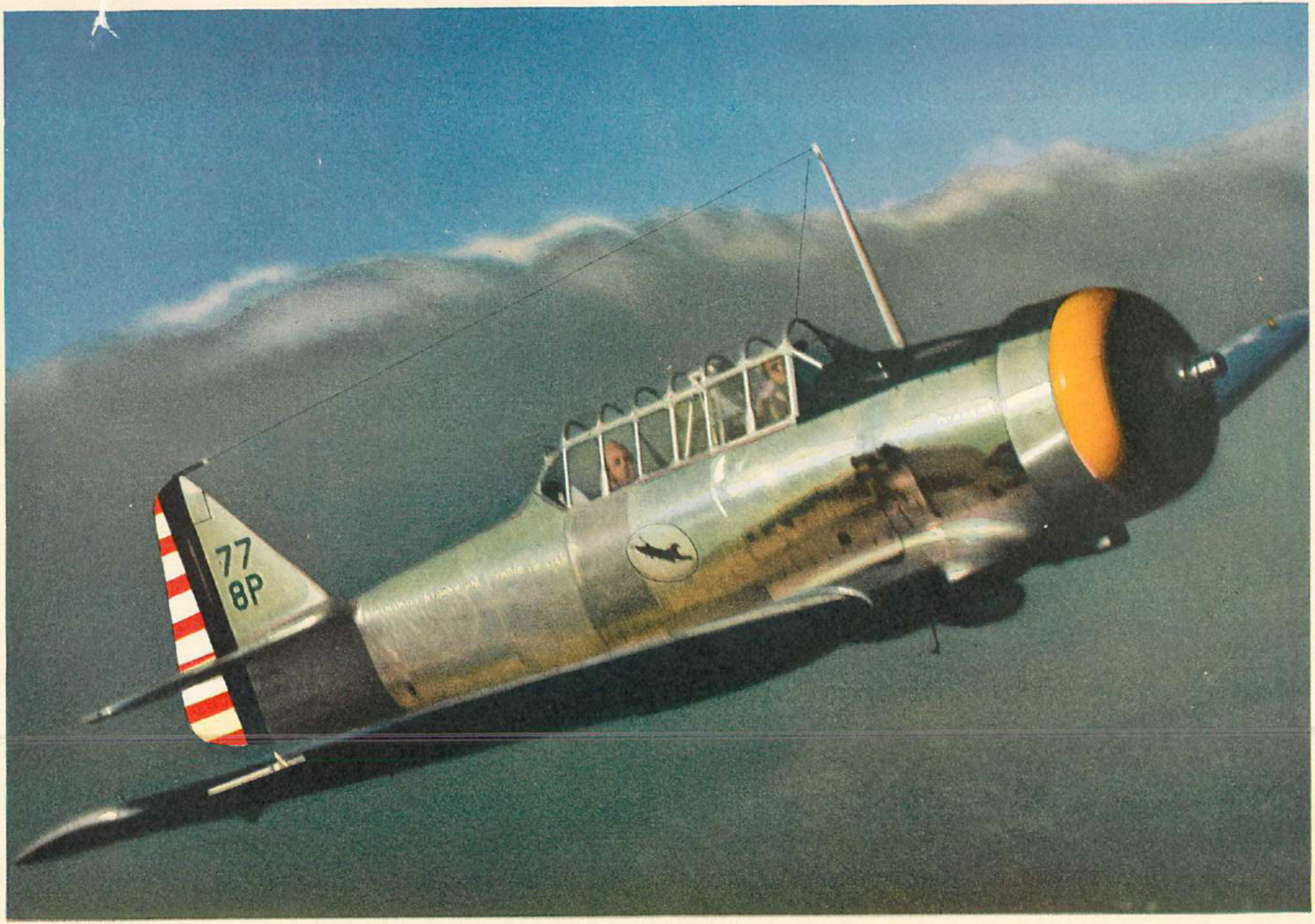
Swarm of workers put the finishing touches on a flock of B-26s. Here are installed 2,000 h. p. air-cooled engines. Martin B-26 was one of first American types bought off the drawing board.



ANATOMY of the WINTER SKIES
by Eric SLOANE
TOO HEAVY
RAIN
IT FREEZES
AND FALLS AS HAIL
MEETS COLD UP DRAFT
HOW HAIL FORMS
I AVOID ICE & FLY HIGH OVER CLOUDS
RUSH OF AIR OR VIBRATION WILL BREAK OFF 'RIME' ICE. 'CLEAR' ICE STICKS ON. (AND SPELLS DANGER)
NO ICE HERE
WET CLOUD
!
MORAL: COLD PLANE + WET CLOUD = ICE
WHEN HIGH RAIN HITS A LOW COLD FRONT, SNOW OCCURS
ALTO CUMULUS fly above or below to avoid ICE.
COLD FRONT
COLD AIR Advance
"SQUEEZED" STRATUS
RAIN
SNOW & ICE
ALTITUDE OF FREEZING high
low ALTITUDE OF FREEZING
! ! WOW
DAMP AIR OR DRIZZLE RAIN
GROUND AIR MIGHT NOT BE FREEZING— BUT PLANES SPEED WILL ICE YOUR SHIP.
FLYING IN CLEAR, COLD WINTER AIR IS SMOOTH



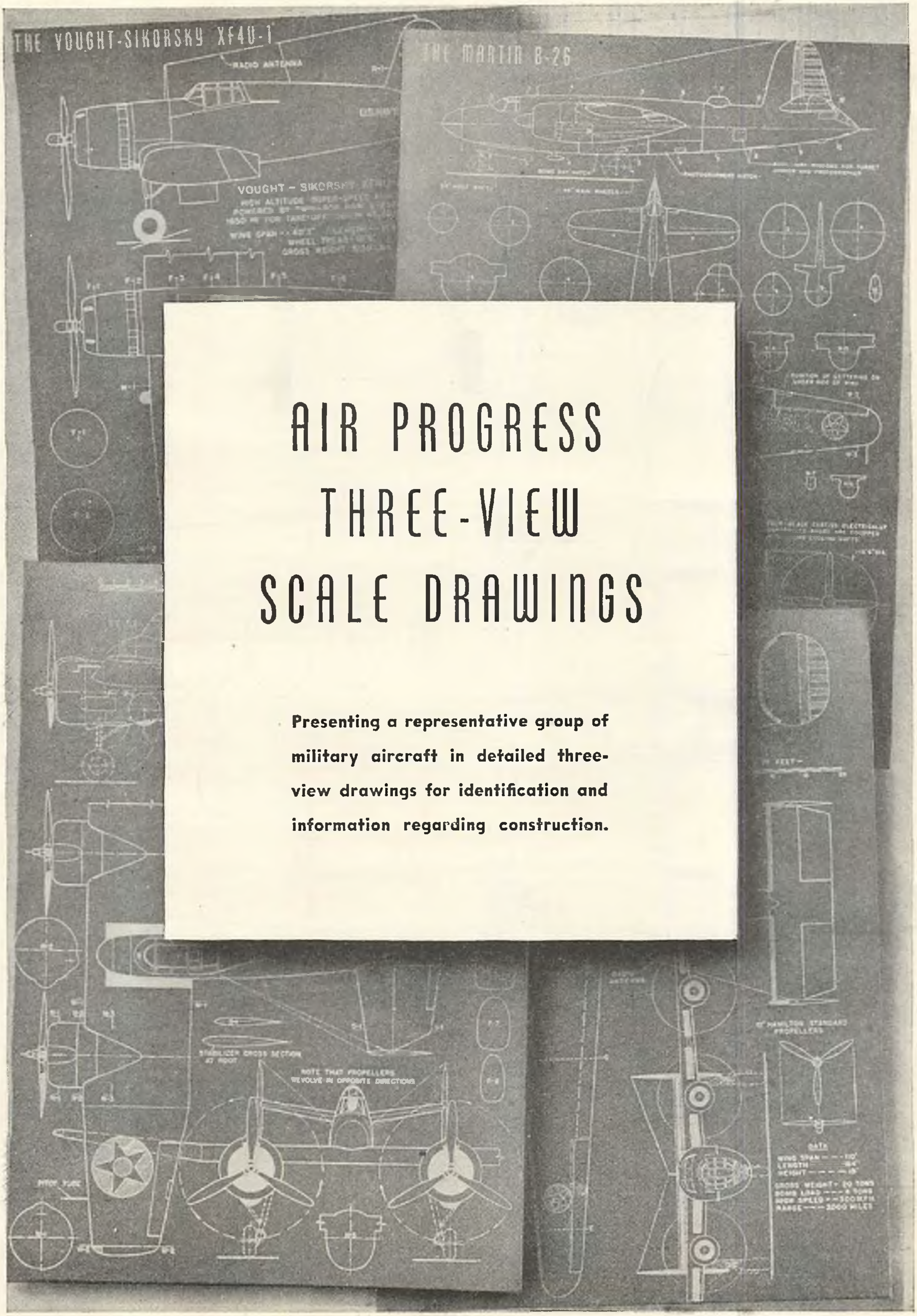
REPUBLIC AT-12



NORTH AMERICAN AT-6

VOUGHT-SIKORSKY XF4U-1

CONSOLIDATED LIBERATOR

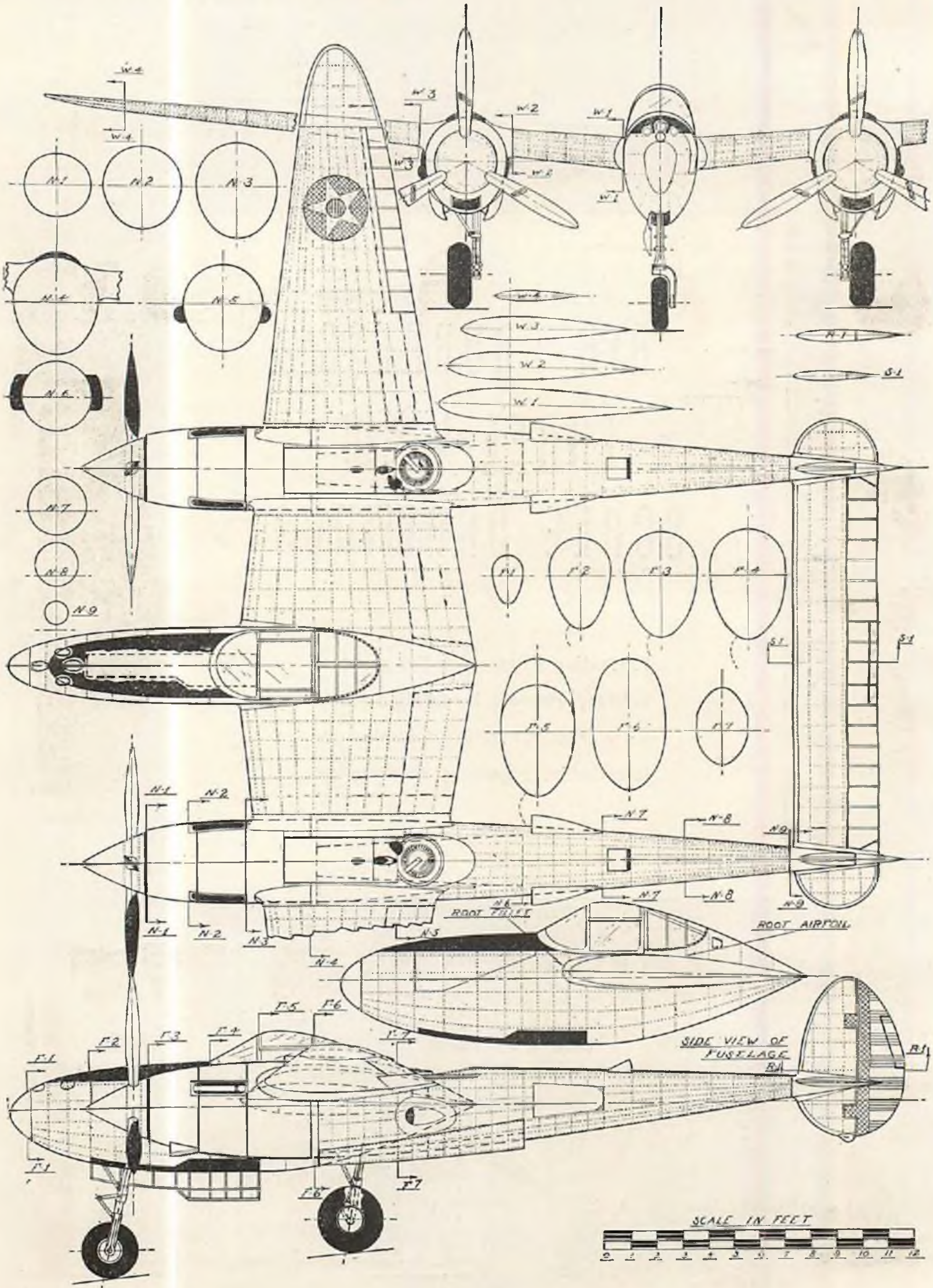


AIR PROGRESS THREE-VIEW SCALE DRAWINGS

Presenting a representative group of military aircraft in detailed three-view drawings for identification and information regarding construction.

LOCKHEED P-38 INTERCEPTOR

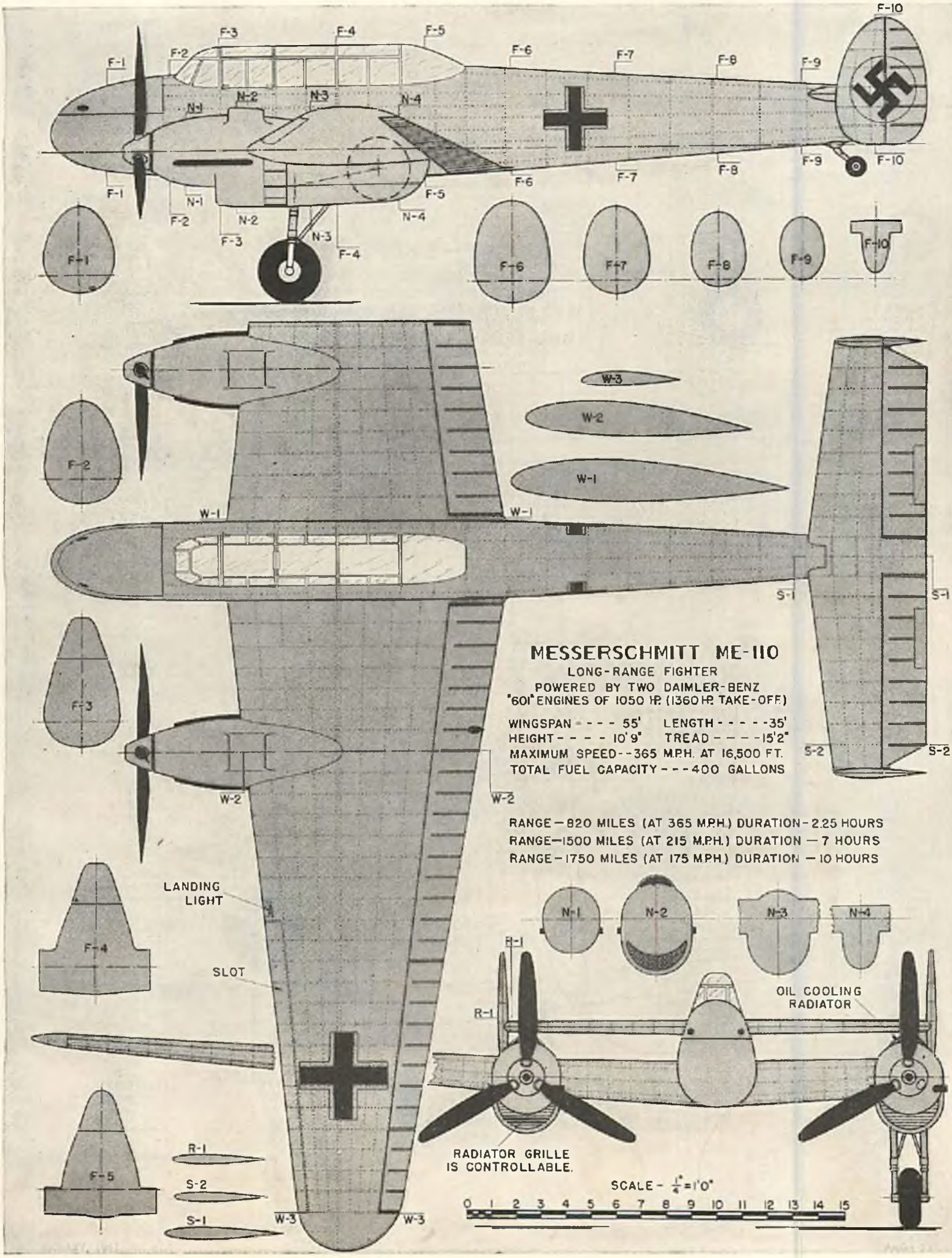
BY MARTIN DICKINSON



MESSERSCHMITT JAGUAR

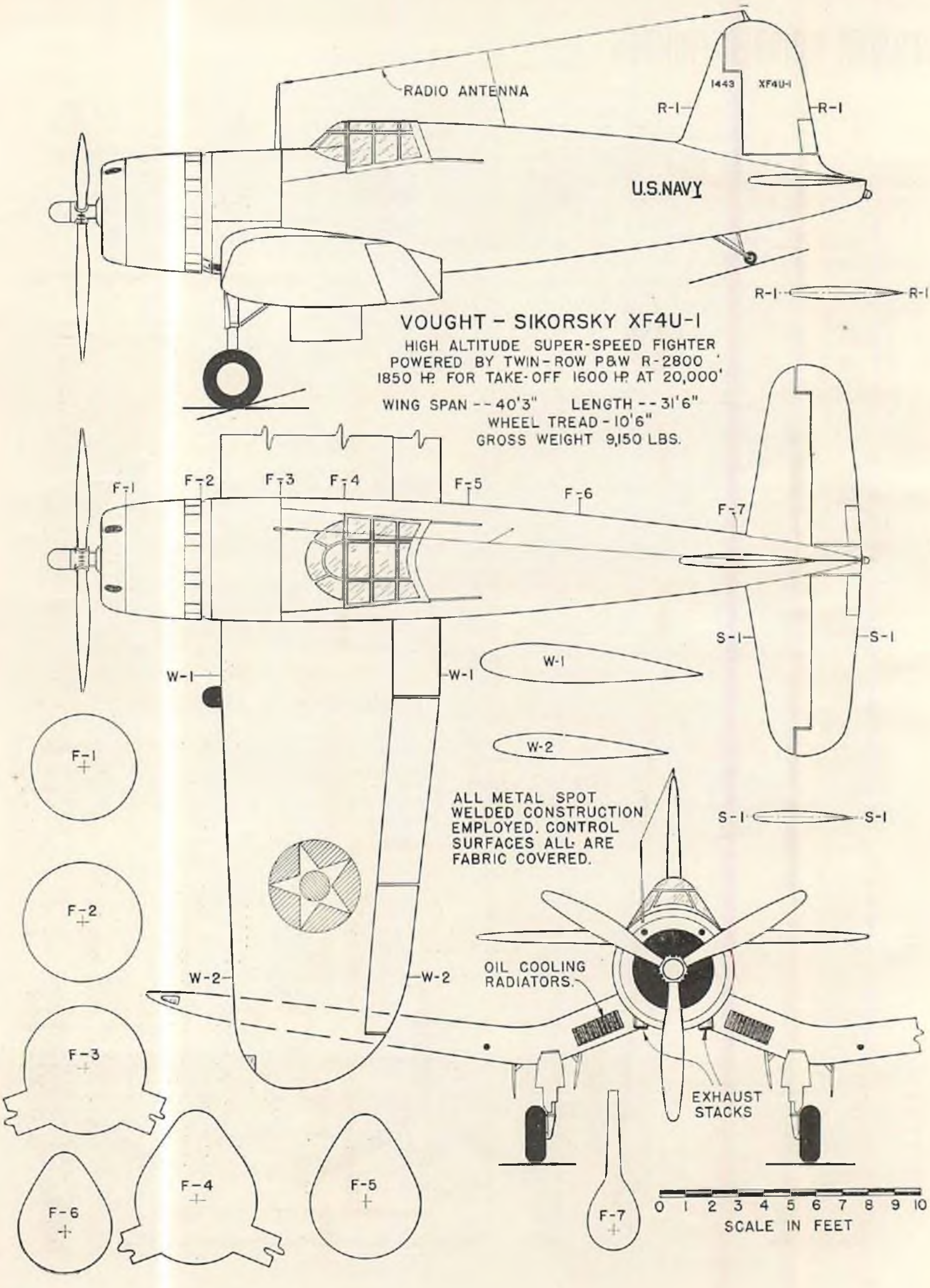
BY GEORGE ROSS

GERMAN BOMBER-FIGHTER



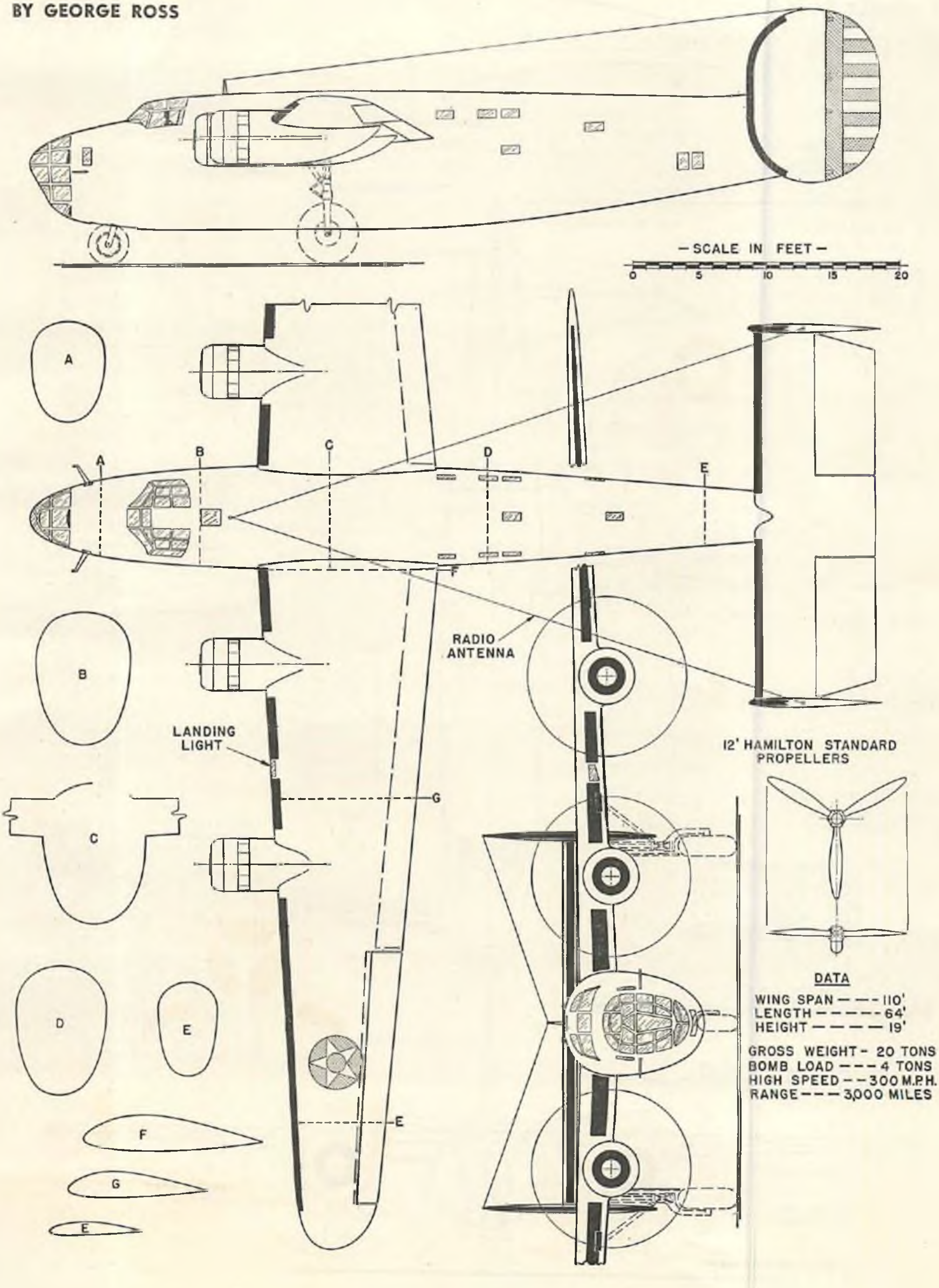
MEET THE XF4U-1 in three-view

BY GEORGE ROSS



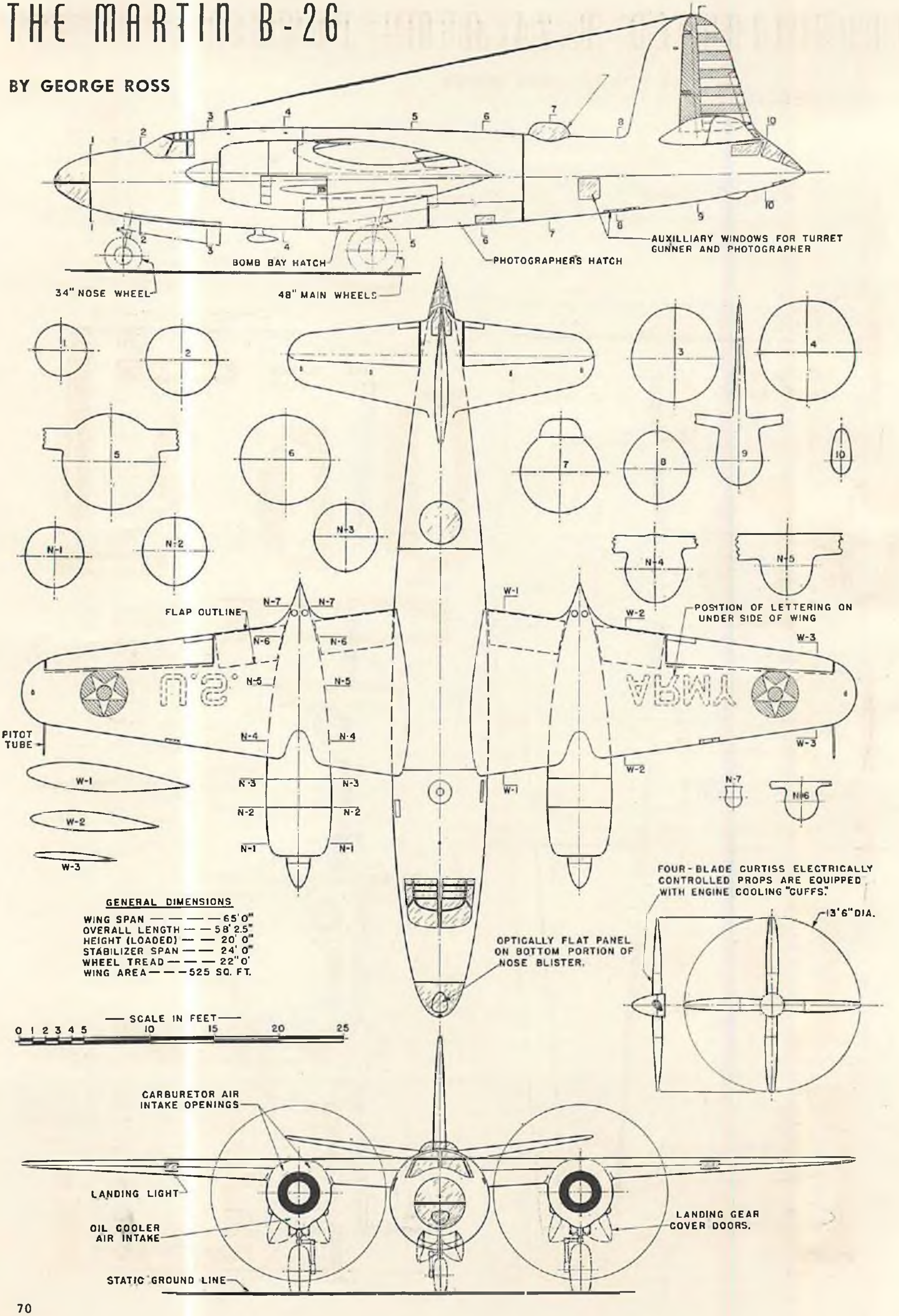
CONSOLIDATED B-24 ARMY BOMBER

BY GEORGE ROSS



THE MARTIN B-26

BY GEORGE ROSS

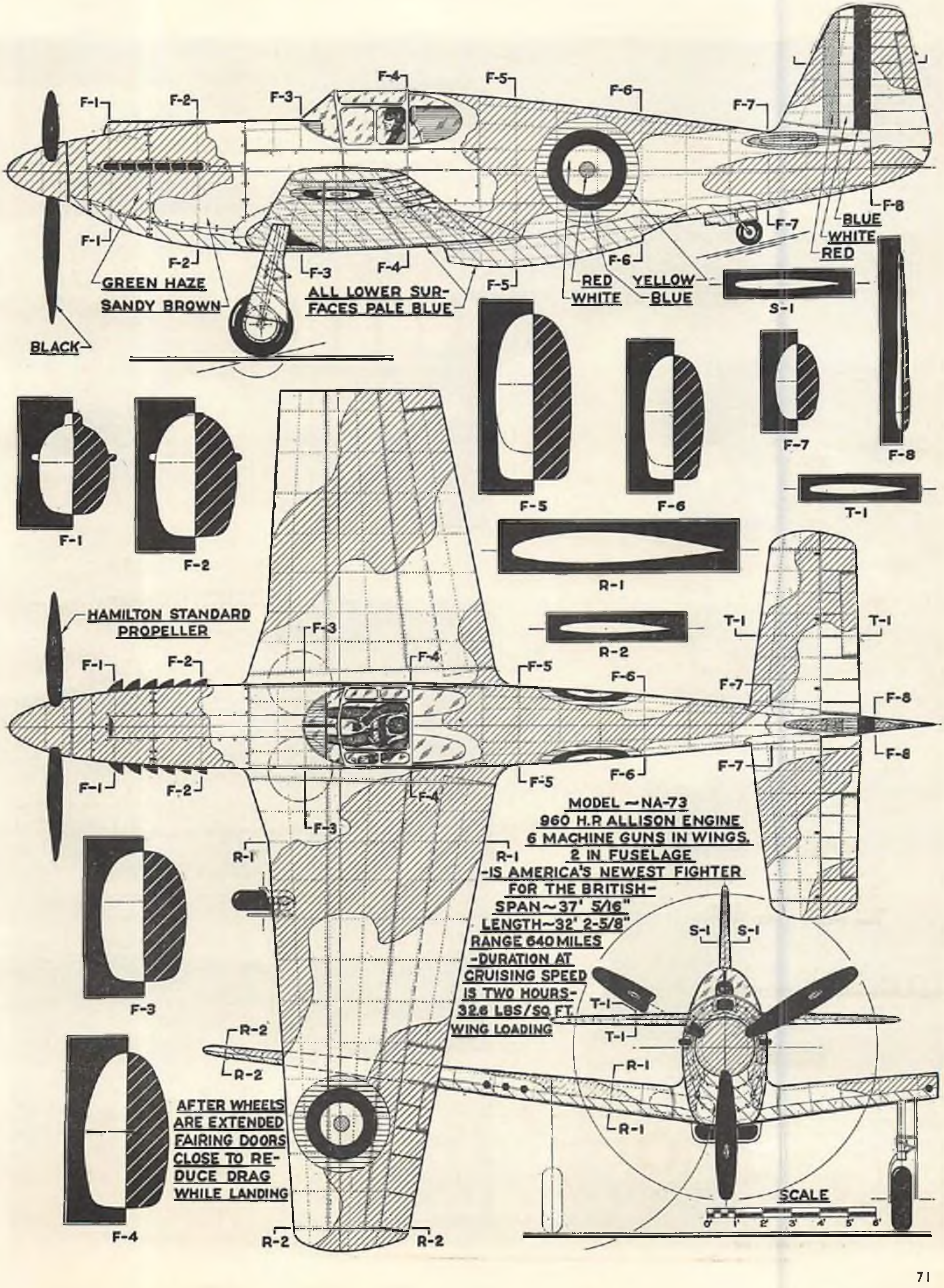


GENERAL DIMENSIONS

WING SPAN — — — — — 65'0"
OVERALL LENGTH — — 58'2.5"
HEIGHT (LOADED) — — 20'0"
STABILIZER SPAN — — 24'0"
WHEEL TREAD — — — 22"0'
WING AREA — — — 525 SQ. FT.

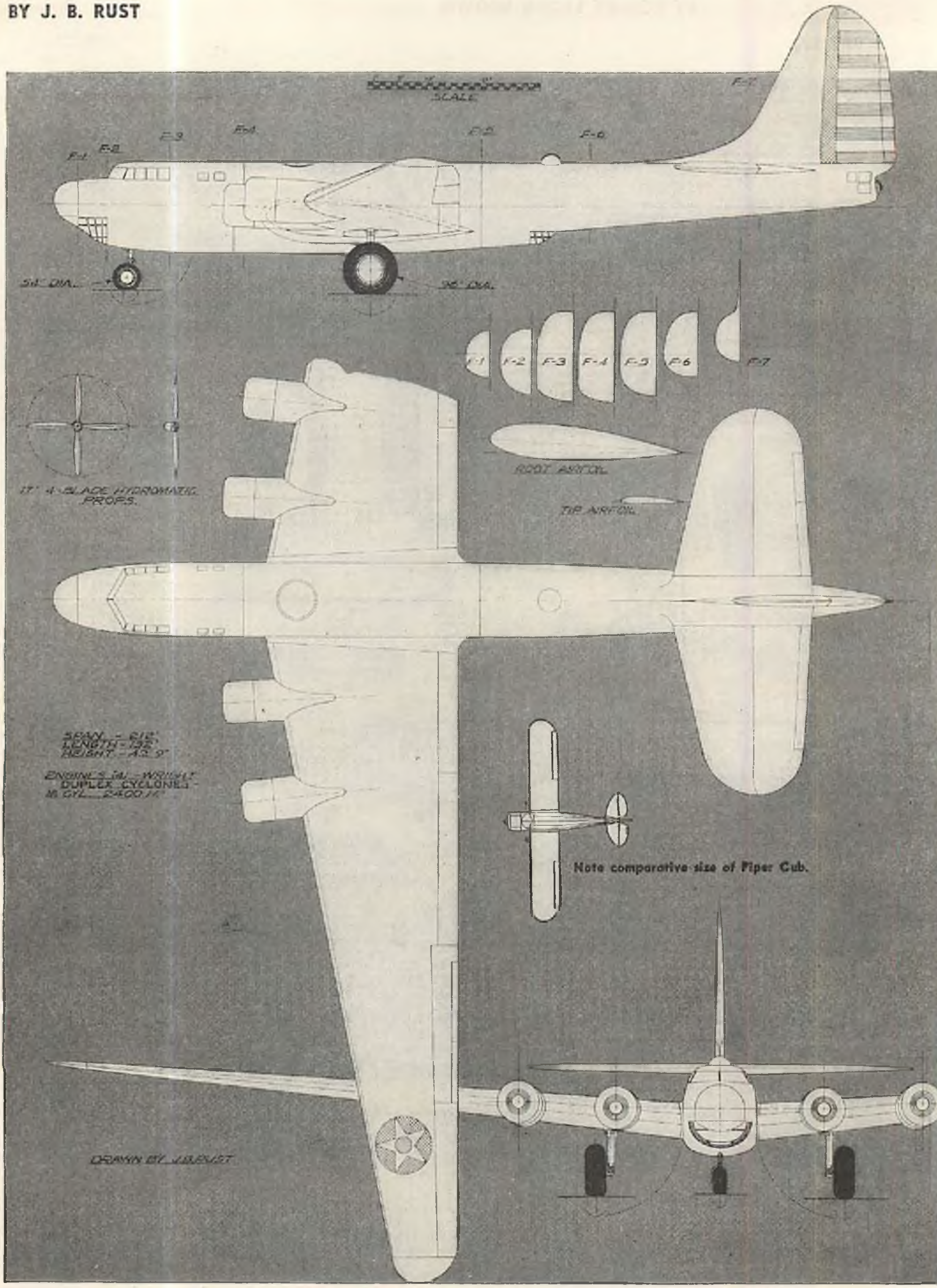
MUSTANG—North American NA-73 Fighter

BY ROBERT LLOYD BROWN

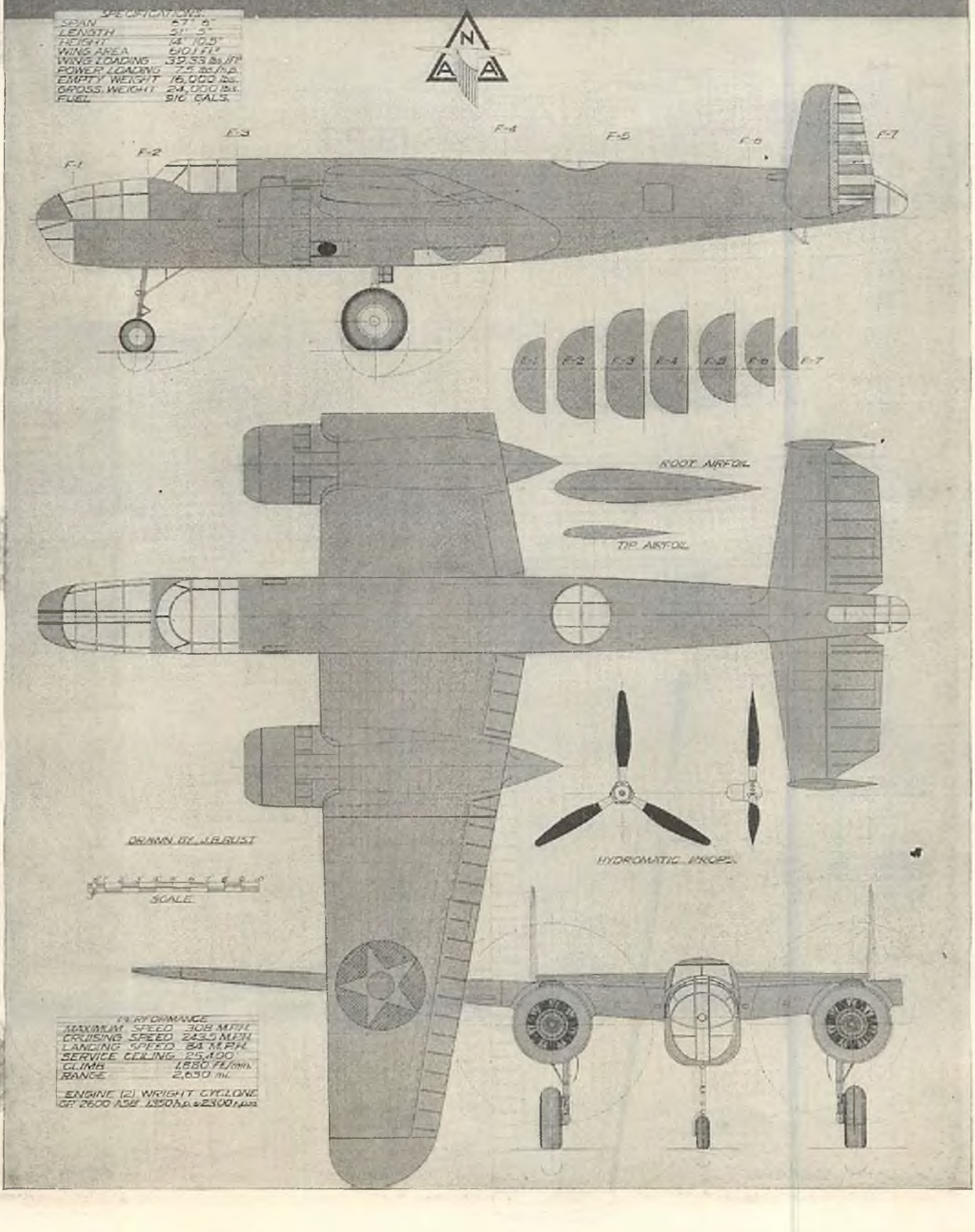


Hemisphere Defender—DOUGLAS B-19

BY J. B. RUST

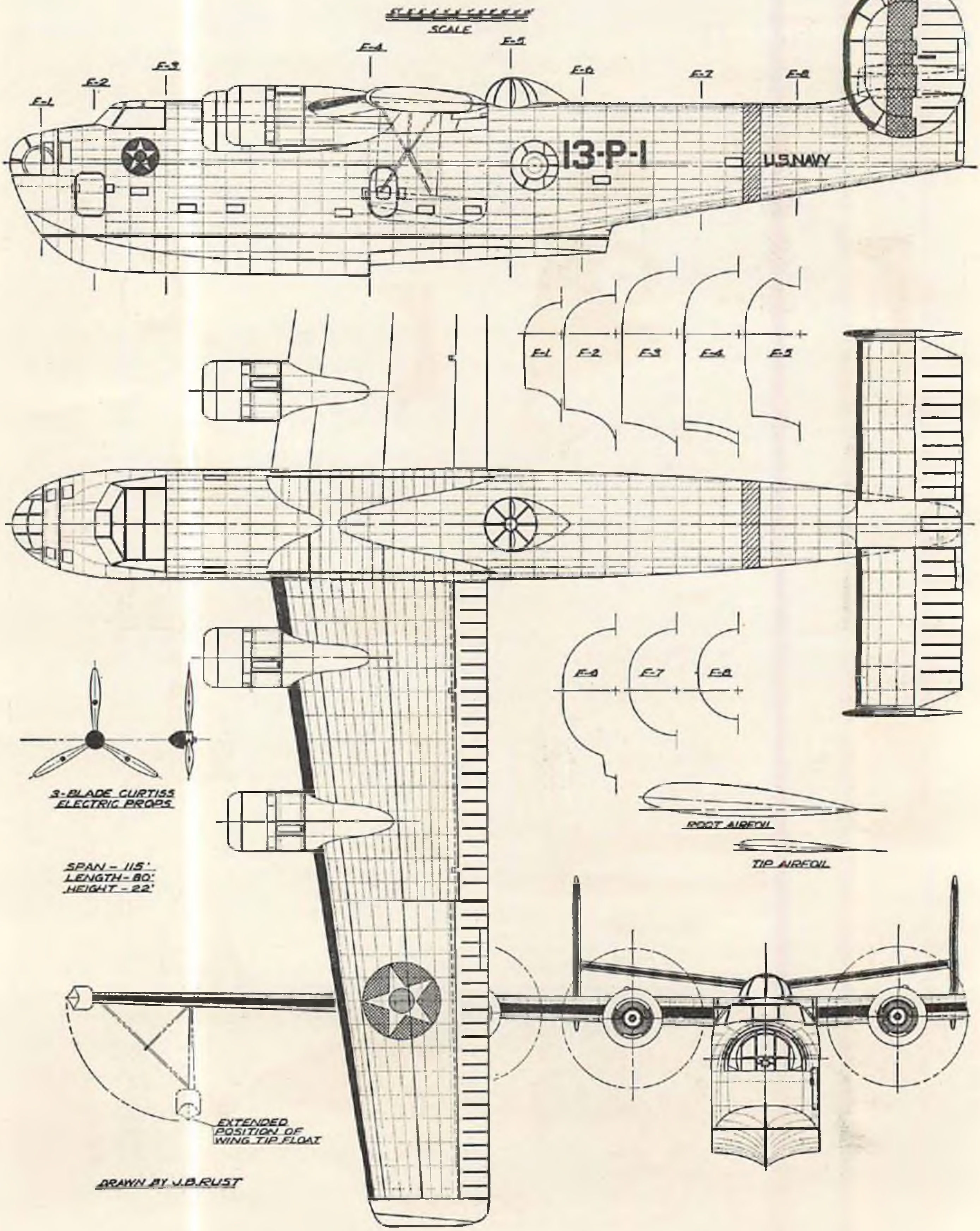


NORTH AMERICAN B-25 Army Medium Bomber



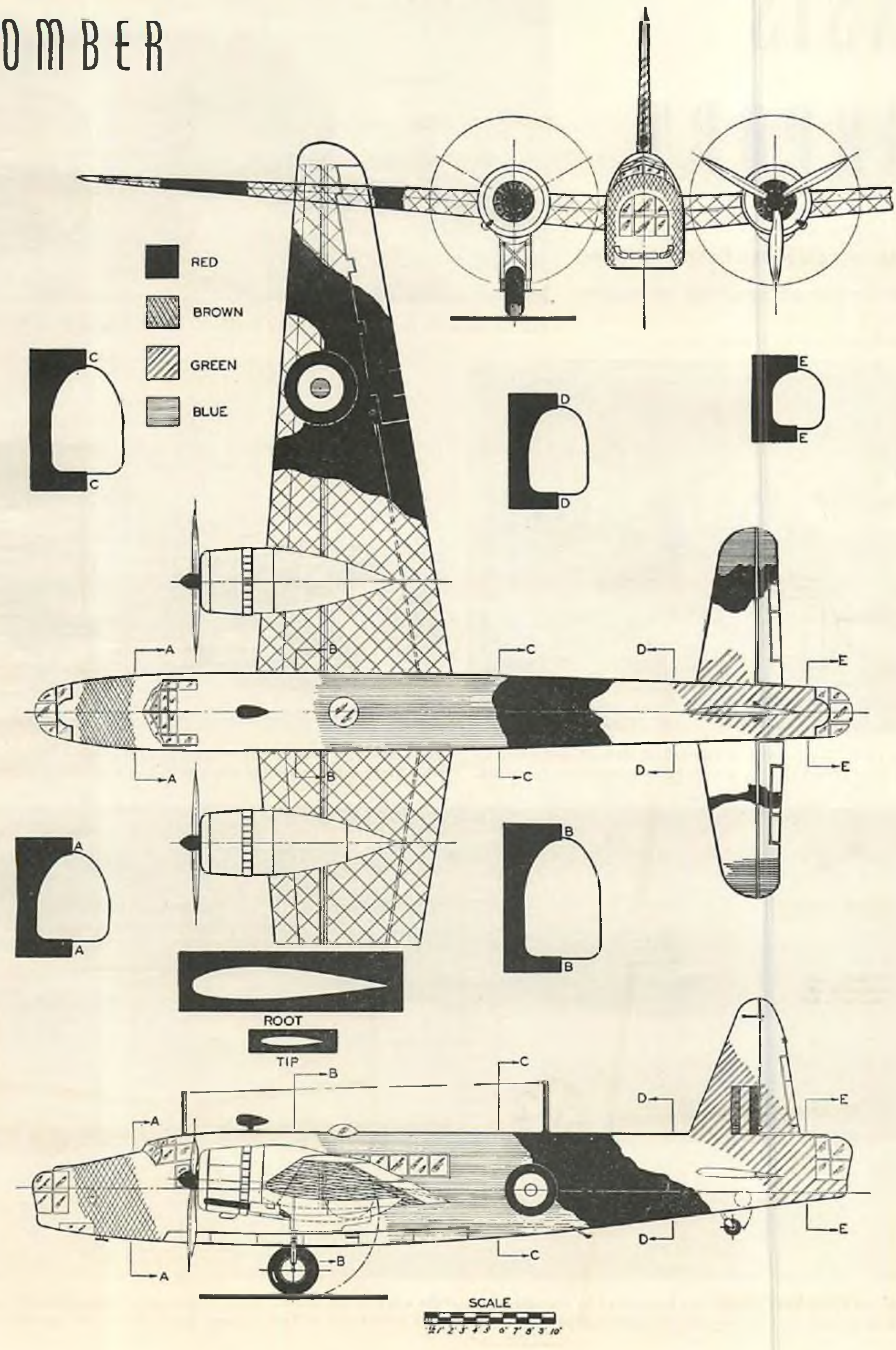
CONSOLIDATED PB2Y-2

By J. B. RUST



THE WELLINGTON BOMBER

BY ROBERT McCLARREN



OASIS AIRPORT

Unusual airport in the California desert is the mecca of hundreds of airmen.

Boulder home. To right of whitewashed boulder is stone house of Frank Critzer.

Come on in. The founder of Giant Rock Airport, and friend of many pilots, Frank Critzer, always has a welcome for sky visitors.

We'll be back. One of five visiting pilots cranks up for return trip. Many come again and again to this unusual, friendly port.

From the air Giant Rock Airport can be spotted by the white rock at the edge of the cleared area. White area at left is dried lake, another thing to look for from the air. This port is about 36 miles north and a little east of Palm Springs, Calif. If over that way drop in.

Now I lay me down to leap. With hand on ripcord, the jumper drops earthward fast.

John Jones, PULL! Jumper repeats name and word PULL, then yanks ripcord.

What, no beers? If he drops cord he buys for the crowd. Pilot 'chute is opening.

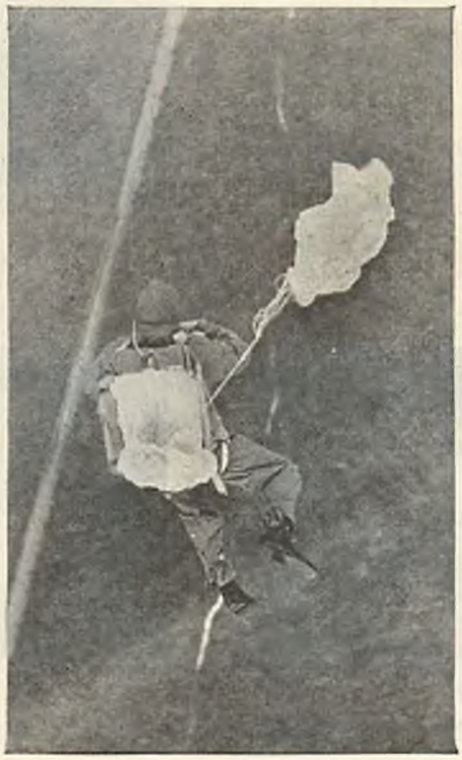
GOING DOWN!

"How'd I look? I was great, huh?" Well, you silk-sailors sure struck a lot of attitudes.

Going home headfirst. Note left hand on second 'chute ripcord just in case.

Grasping second 'chute used in training, this jumper awaits yank of first canopy's opening.

This chap puts his whole soul into jump. Opened pilot 'chute pulls out main 'chute.



Putting finishing touches on batch of Grumman midwings, part of 1,500.

Pouring molten metal into small prop mold held in vise.

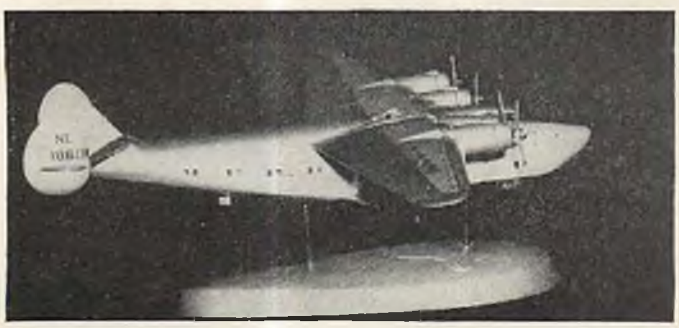
MODEL CAREER MAN

Joe Battaglia makes hobby into profitable career.

JOE BATTAGLIA has been building models for twenty-two years. Says Joe, "It started with one of Mom's best table knives and a crude attempt at carving a weather-vane propeller. That was before balsa wood. But we had gas models, believe it or not."

Even Joe himself has no idea of how many models he's built. Certainly it runs into the thousands. He recently turned out 1,500 metal Grumman midwings in three months. His largest job, a six-foot Pan American Clipper, required six months. Somehow he found time enough to have a fling at making boats, trains, liquid-powered rockets, toys and what-have-you. But Joe's outstanding success has been his precision custom-made models.

Sawing wood wing blanks for Stinson. Blanks become pattern for plaster casts from which bronze molds are made.



This Pan American Clipper was a six months' job. The plane is wood, pedestal is cast. Some Battaglia models are in museums.

Plaster is poured around model to make casts, then duplicated in bronze. White metal is cast in the bronze molds.

Your guide to aviation!

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Grumman Skyrocket

Casano Wakefield

Nomad Gas Model

Request Gas Model

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☐ Book ☐ Plans

NAME ....

ADDRESS ....

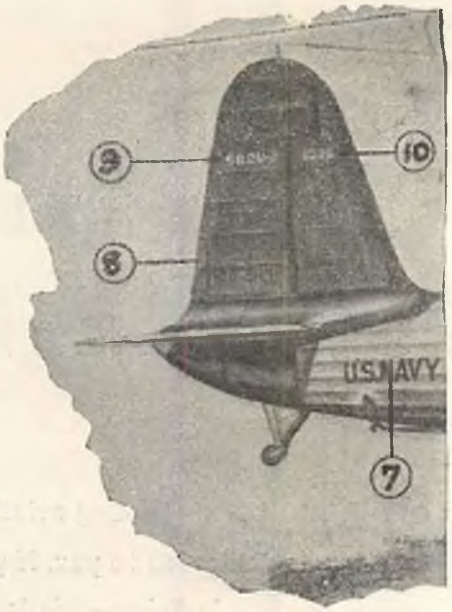
CITY .... STATE ....

This rugged Great Lakes BG-1 belongs to the marines. Note squadron insignia on plane's fin.

NAVY MARKINGS

BY WILLIAM LARKINS

Associate, U. S. Naval Institute



This navy ship, a Bellanca XRE-1, from the Anacostia base, bears markings of experimental plane.

Do you know the meaning of all the insignia, colors and numbers on naval aircraft? Test yourself with this and become an expert.

This placing of words "U. S. Navy" and marks N. R. A. B. means naval reserve air base use.

The Chief's ship. Painted all blue with silver wings and tail is true of the Command planes.

Another type of Command ship bears division markings on side. A Curtiss SOC-1 land plane.

ALTHOUGH naval aircraft markings constitute one of the most interesting phases of naval nomenclature, no one complete treatise has ever been written on the subject. Therefore this article is not presented as a complete work on naval markings, but rather as a summary of all the available data for what is undoubtedly the most complete outline available.

Carrier-based Aircraft

By means of the diagram at the right we will explain the standard markings for carrier-based aircraft. These are the normal markings, and the many other variations will be taken up later.

(1) This is the squadron number. Each carrier squadron in the navy is assigned a number, starting with two and (at present) running to eight. Squadrons One (of all types) were stationed aboard the carrier *Langley* (CV-1) which was converted into a seaplane tender in 1937; the squadrons were disorganized and have not been reorganized. Each carrier in the navy is assigned a serial number, and this is used by all the squadrons operating from it. Following are these numbers: CV-2—*Lexington;* CV-3—*Saratoga;* CV-4—*Ranger;* CV-5—*Yorktown;* CV-6—*Enterprise;* CV-7—*Wasp;* CV-8—*Hornet.*

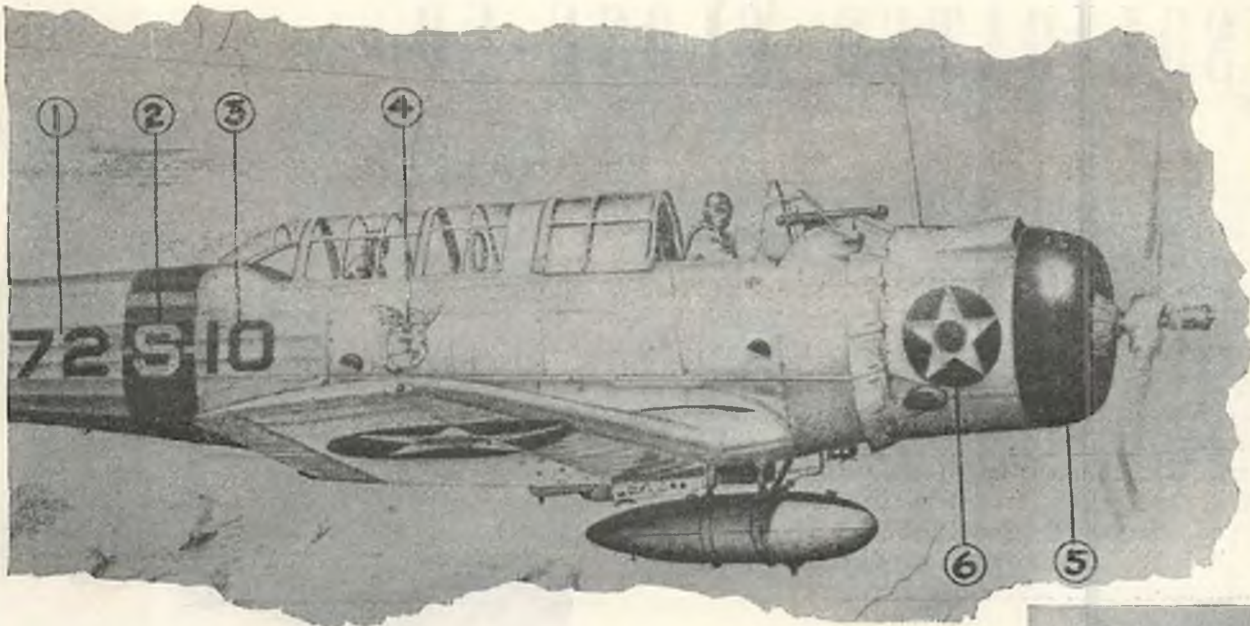
Therefore, Scouting Squadron Seven operates from the carrier *Wasp.* However, on the *Ranger* and *Wasp* (the two smallest carriers in commission) the scouting complement is divided into two sections, and the torpedo squadrons are not operated. Therefore, on CV-4 and CV-7 the scouting squadrons were doubled, and so read 41, 42, and 71, 72. Actually, this means Squadron Seven, section one and two, but because of the absence of the

This SOC-1 shows carrier insignia. "E" on side is for gunning and bombing excellency.

Another type of experimental marking is on this Vought O2U-3 fitted with special equipment.

Seldom seen, we find the squadron mark "Miscellaneous" on this Vought SU-1 two-seater.

This Command plane, blue and silver as usual, merely bears U. S. navy markings under tail.



In this drawing by H. Clark the markings on naval aircraft are indicated. (1) Squadron number. (2) Squadron mission letter and leader's band. (3) Plane's number. (4) Squadron insignia. (5) Section color. (6) Neutrality star. (7) U. S. navy mark. (8) Carrier color. (9) Model designation number. (10) Individual serial number of plane.

expected dash many people are confused by what seems to be an apparent Squadron Seventy-two.

However, on the first of January, 1941, the *Ranger's* squadrons were reorganized. The "High Hats" VB-4 became VS-41. (The outfit carrying the High Hat squadron insignia has been VF-1, VB12, VB-3, VB-4, and is now VS-41!) The former VS-41 will become VF-42 and Fighting Four will become VF-41. In other words, the *Ranger's* fighting complement will be doubled at the expense of the bombing squadron.

(2) a. This letter designates the squadron mission. In this case the S denotes a scouting squadron. The other types of missions follow: F—fighting; B—bombing; P—patrol; N—training; J—utility; T—torpedo; O—observation; M—miscellaneous; G—transport (single-engine); R—transport (multi-engine),

These missions are often combined as patrol-bombing, scout-observation, torpedo-bombing, bombing-fighting, scout-bombing and other types. Also, many planes may be manufactured under one designation and serve in another type of squadron, or one that operates in a dual capacity.

b. This colored stripe is the section leader's designation. Each squadron is composed of six sections of three planes each. The leader of each section carries a full-colored band or stripe around the fuselage of the plane, and a full-colored cowling of the same color. These sections colors are: Section 1—red; Section 2—white; Section 3—blue; Section 4—black; Section 5—green; Section 6—yellow. *(Turn to page 90)*

In large flying boats such as this PBY-1 the section stripe is placed about rear of boat's hull.

Note colored cowlings and marks; usual reserve-base method of ship identification.

This Grumman J2F-1 bears Utility Unit markings. No section stripe or cowling color needed.

This SOC-3 shows type of marking in use by catapult seaplanes launched from ship deck.

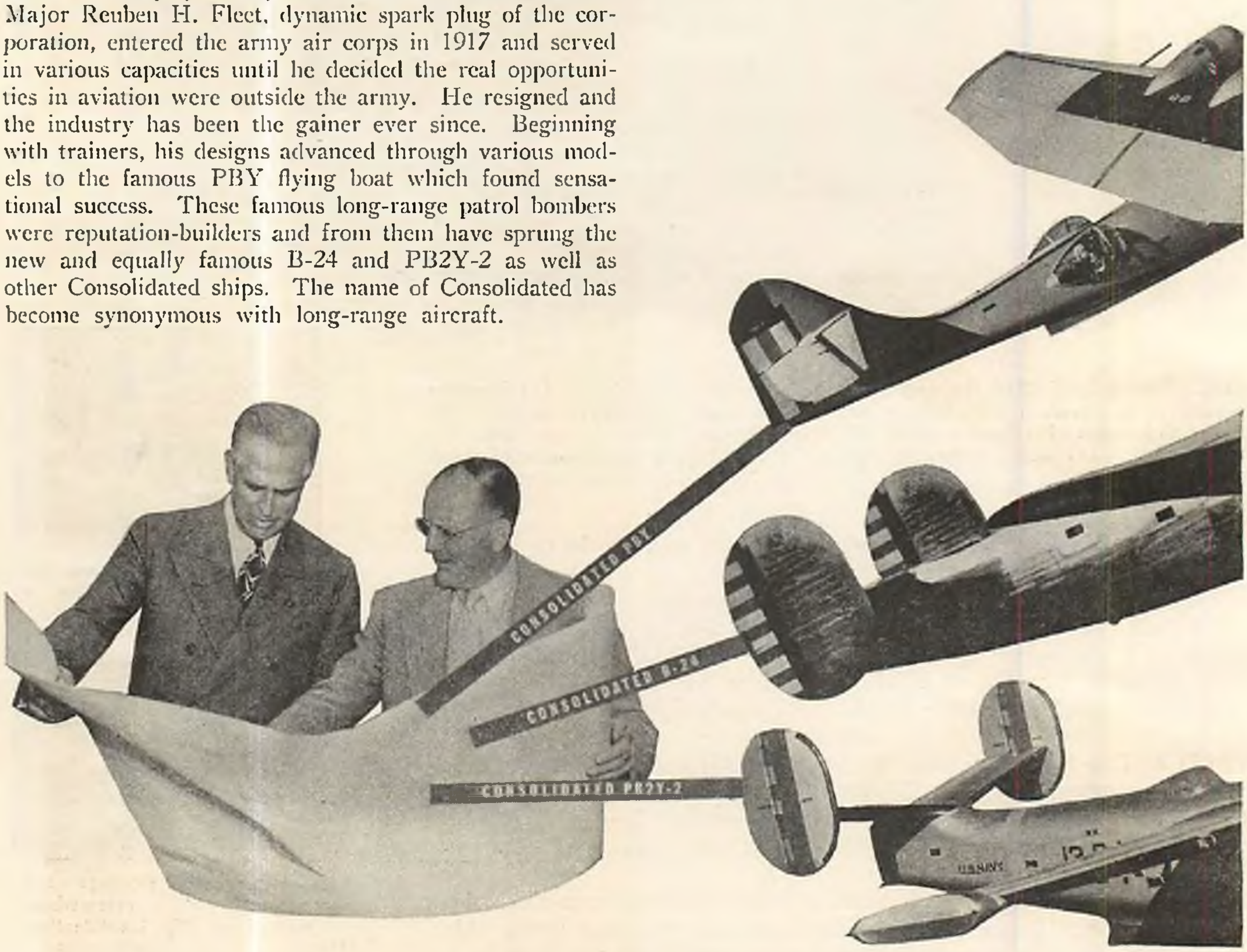
Note Command stripe on this SB2U-1, and new neutrality star on cowling, for quick spotting.

N. A. F. stands for Naval Aircraft Factory on this SU-2. The N. A. F. also builds trainers.

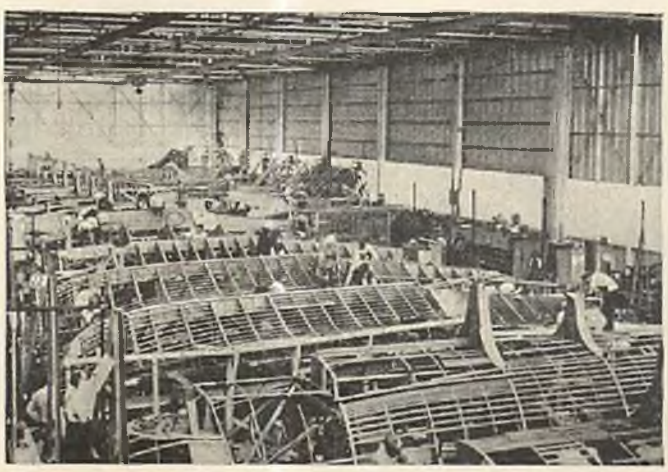
This BT-1 shows half of section V on right wing, other half is on left wing. 2 is plane number.

CONSOLIDATED CLOSE-UP

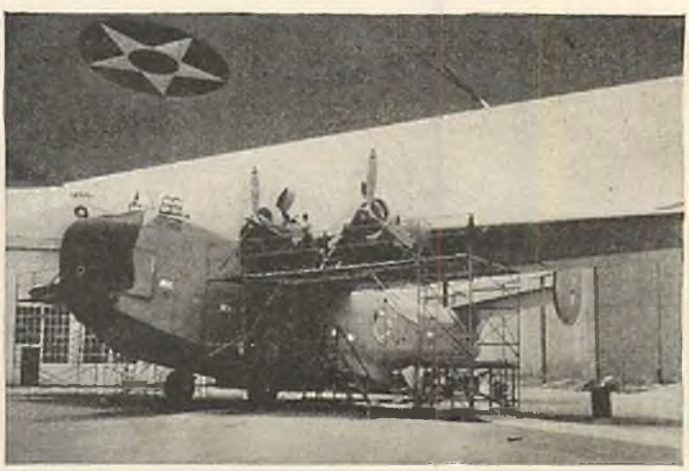
The Consolidated plant of San Diego covers many acres and employs many thousands of skilled workers. Major Reuben H. Fleet, dynamic spark plug of the corporation, entered the army air corps in 1917 and served in various capacities until he decided the real opportunities in aviation were outside the army. He resigned and the industry has been the gainer ever since. Beginning with trainers, his designs advanced through various models to the famous PBY flying boat which found sensational success. These famous long-range patrol bombers were reputation-builders and from them have sprung the new and equally famous B-24 and PB2Y-2 as well as other Consolidated ships. The name of Consolidated has become synonymous with long-range aircraft.



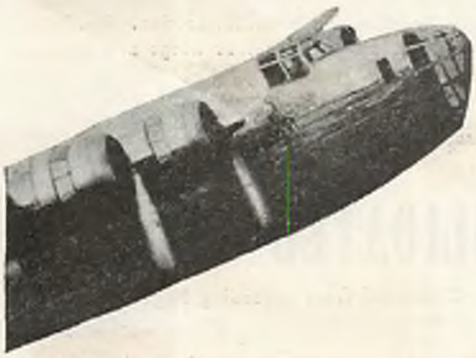
Huddle. Left, Merril C. Meigs, chief of aircraft production of the O. P. M., confers with Major Fleet on plans for future.

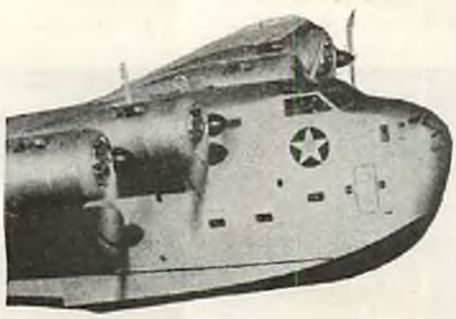


In rotatable jigs the hulls of PBY boats are being assembled and covered. Nearest hull is right side up; others are bottom up.

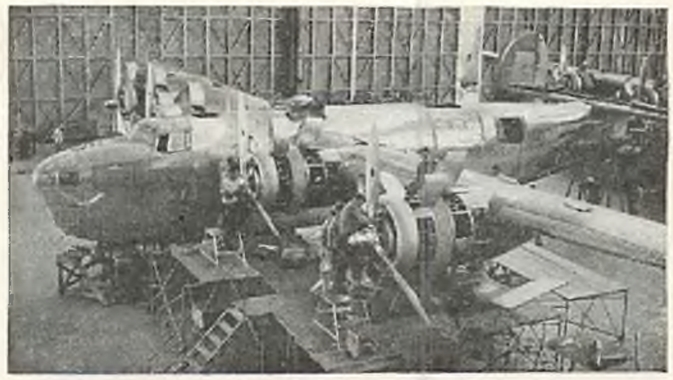


The Consolidated PB2Y-2 flying boats are given their final check inspection outside the plant to make room for those coming behind.





By day and by night B-24's come off the line. Long-range four-engine bombers being assembled by the night shift.



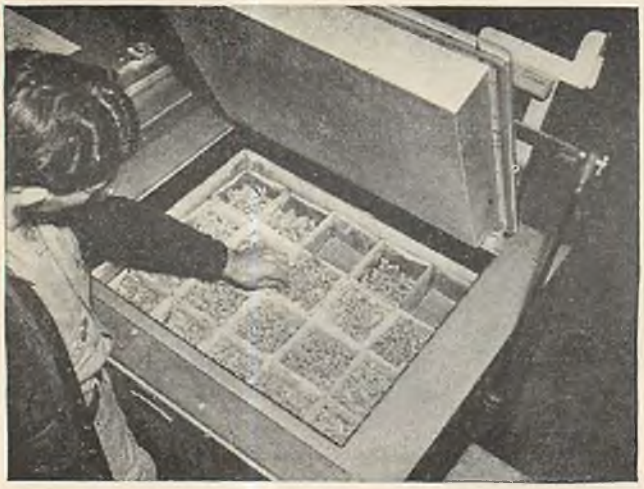
Last step in B-24 assembly is fitting of props and cowlings. after which the ship is moved outside for a final check.

With the plexiglass windows carefully protected, the final adjustments are made before the test pilot takes over his job.

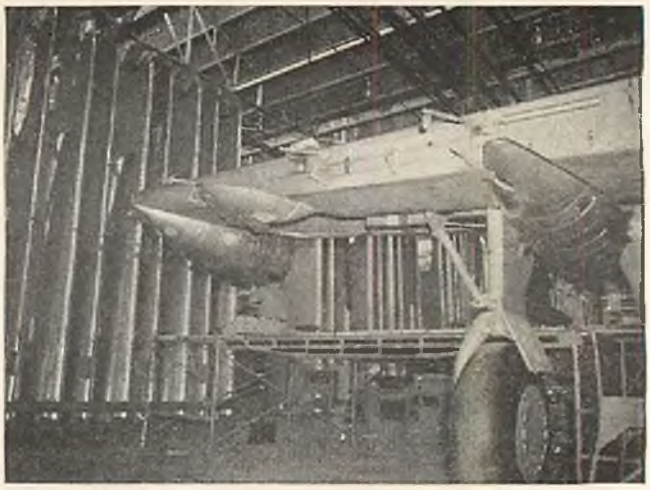
Back in the plant, more B-24 wing center sections are going together. Note nacelles under wings for 1,250 h. p. engines.

The partially finished B-24's and PBY's fill every available inch of yard. Note the tail turret location at the lower right.

Continued on Next Page



Portable ice chest keeps rivets chilled. They are kept from 0 to 25 degrees below zero until used to prevent splitting.

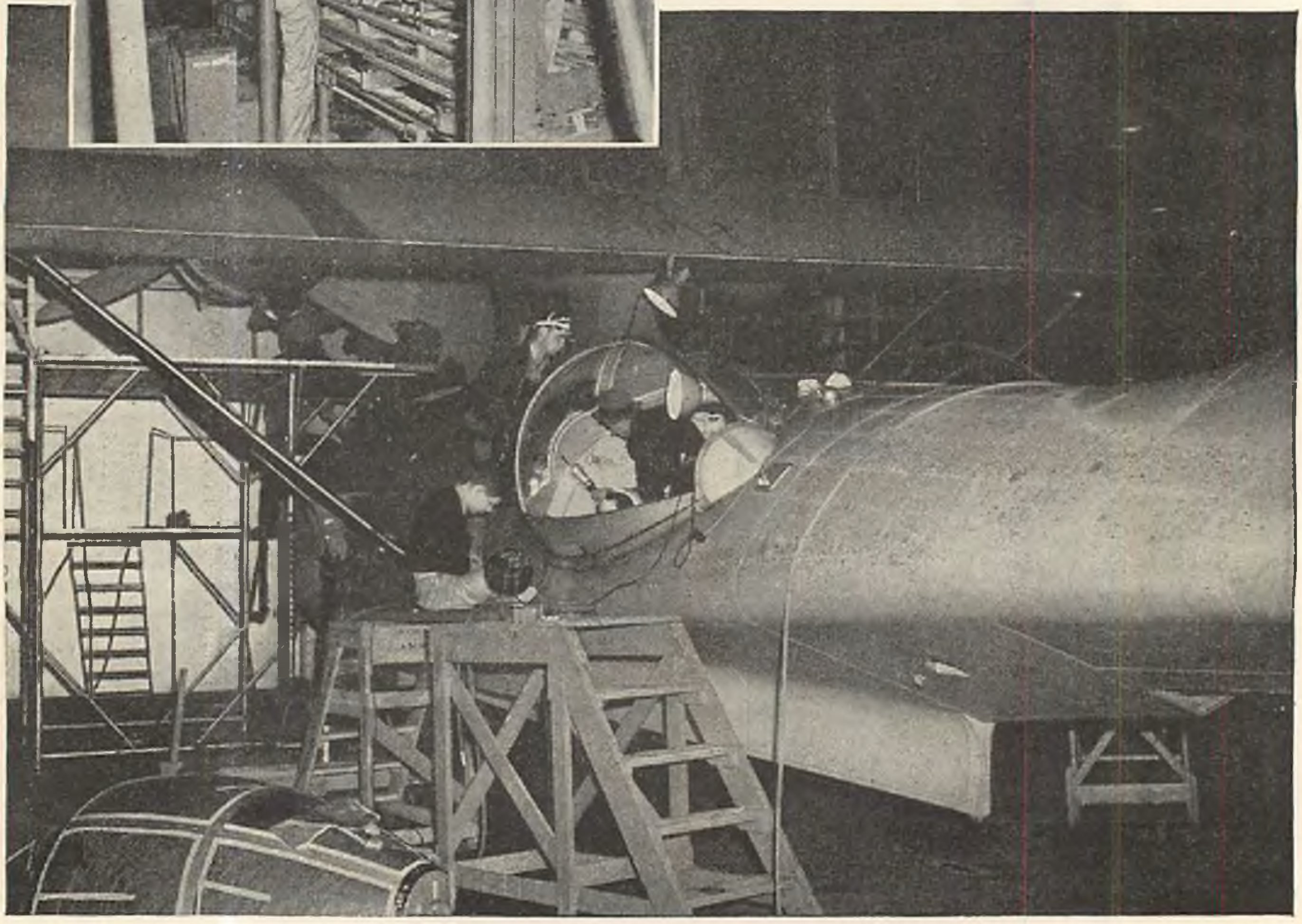


B-24 wings ready for attaching to center section. The latter, complete with wheels at right, receives wings and rolls on.

CONSOLIDATED CLOSE-UP

Continued from Preceding Page

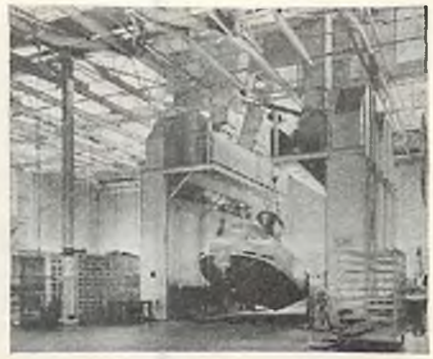
Assembling the center wing section stood on edge in its jig. Ovals with crimped edges are cut in ribs for lightness.



Opened blister. Mechanics are fitting plexiglass covering to machine-gun side blister on one of the PBY-5 patrol bombers.

This wing-section lip is set up with studs to be perfectly aligned for riveting.

PBY-5 line-up awaits wings. One of these, known as Catalina, spotted Bismarck.



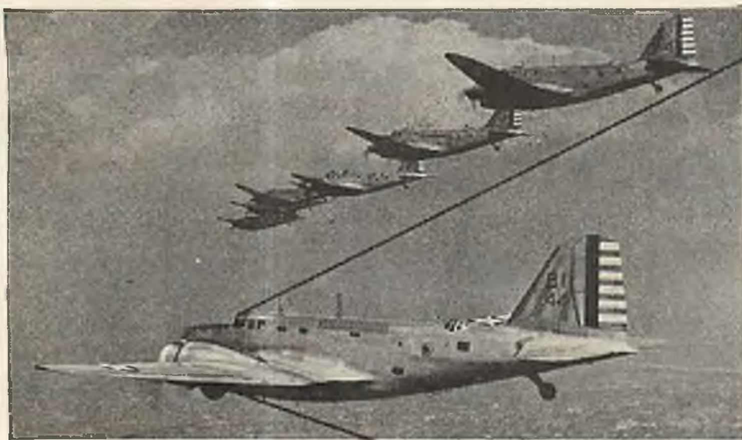
First flight is made on a crane in the paint department, where hull is sprayed.

Hundreds of thousands of dollars' worth of engines ready for Consolidated ships.

Out of the crate, the engine is checked and given inspection before installation.

These 1,250 h. p. Pratt & Whitneys are fitted with cowlings, exhaust rings, mounts.

Awaiting wings, these PBY-5's fill every available foot of the huge plant. Note PBY-5 wing sections and PB2Y-2 in background.

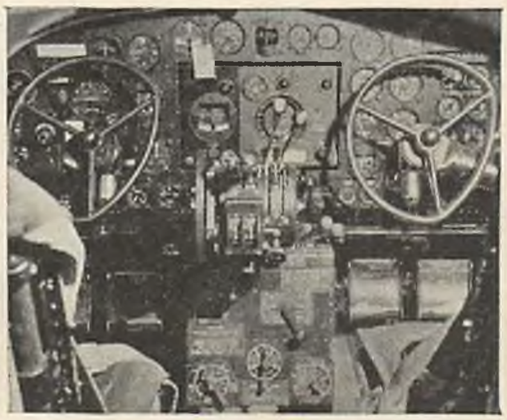


INSIDE THE "EGG" CRATE

What's it like aboard a U. S. Army B-18A bomber? Here are the quarters, both living and working.

All present. Before take-off, flight engineer checks 40 items, crew. Captain receives list from engineer.

Roof trapdoor aids poor visibility for directing taxiing bomber.

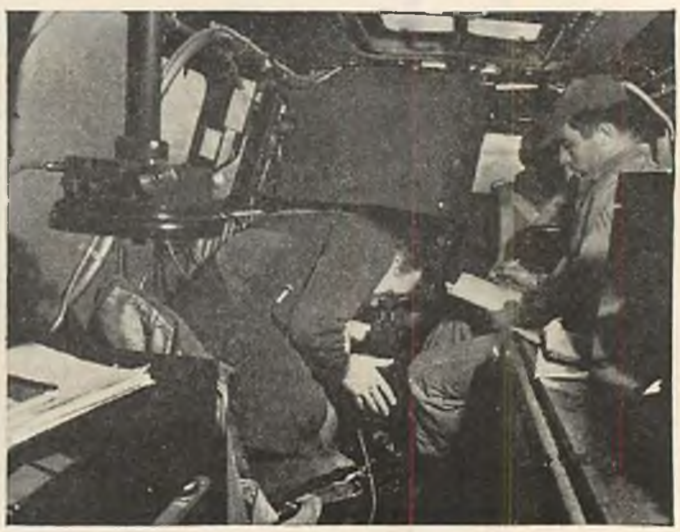


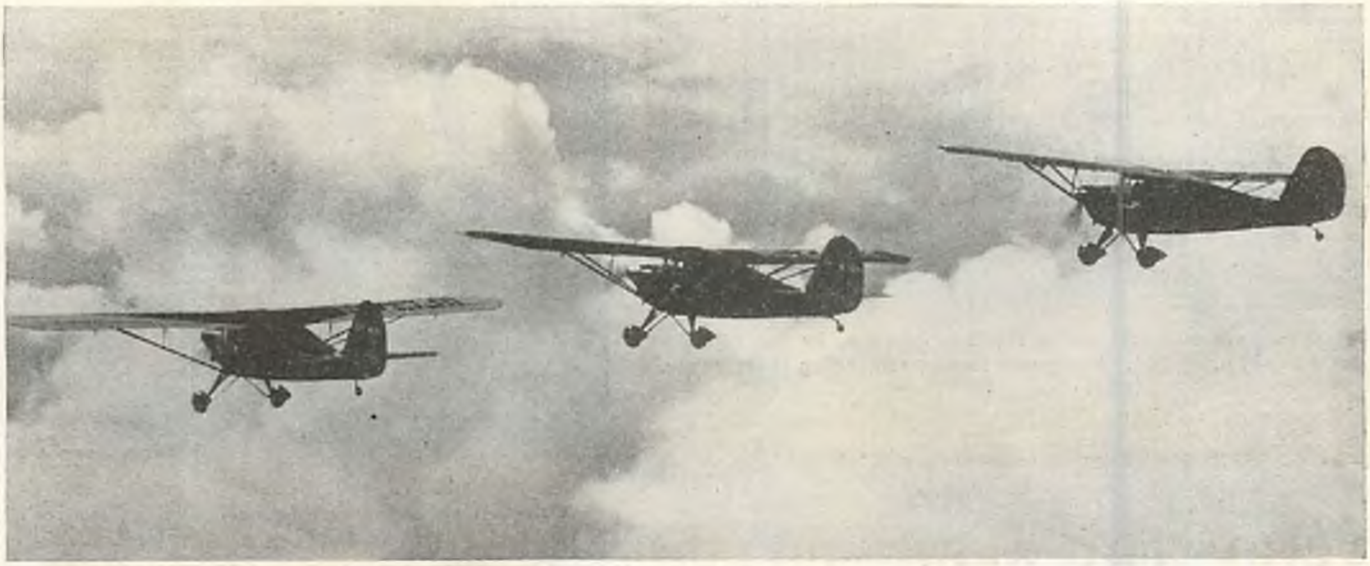
Instrument board contains automatic pilot unit in center and about 40 other dials and switches.

Crew member takes time out. Below floor is bomb bay. Exhaust-driven heating unit right.

Radioman contacts home field by code. Drum above right hand is antenna reel. Wheel at right is for revolving loop antenna.

Getting the drift of things. Navigator peers through drift sight to calculate drift of plane from true course due to cross wind.

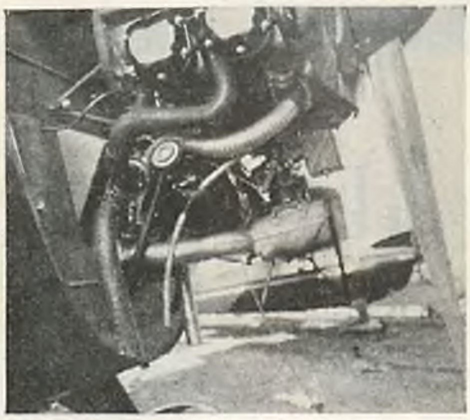




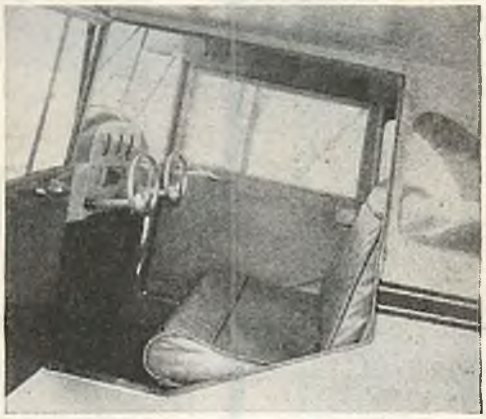
AERONCA'S SUPER CHIEF

Times change, and so do aviation styles. Aeronca's latest Super Chief embodies many features and innovations developed over many years of successful manufacture of popular light planes.

Super Chief presented by Aeronca bids fair to step up light-plane interest.

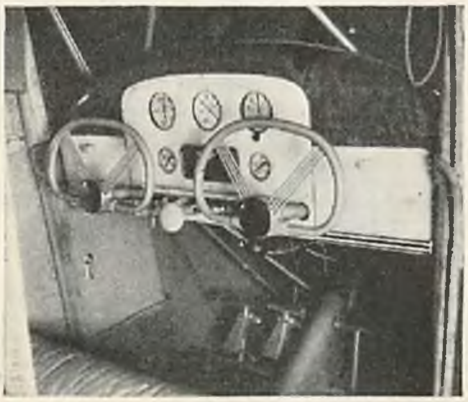


Super Chief with the engine cowling removed to show installation of Continental engine.



The cabin features a wide seat, plenty of leg room, good visibility, and ample baggage space.

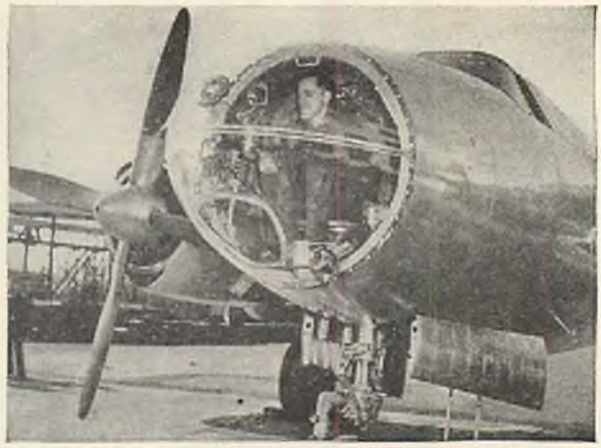
Auto-type cowling may be raised for inspection as easily as that of a car.



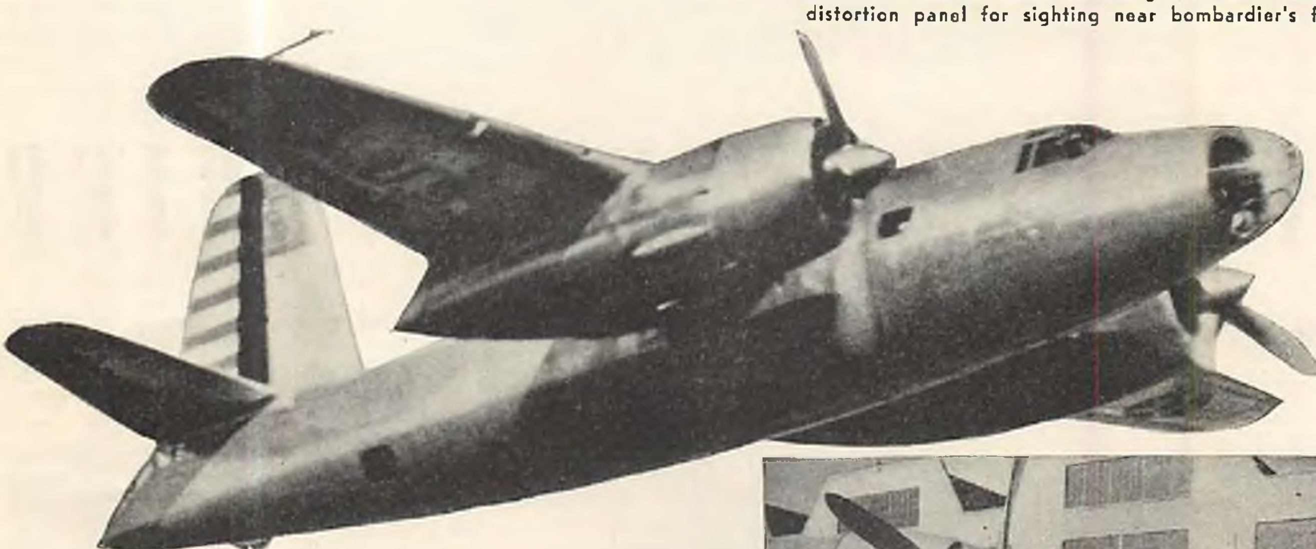
Smart looking. The instrument panel has visibility and style. Note glove compartment.

First of a long line. Flown over 352,000 miles, the first Aeronca, now retired, can still take it.

Clipped-wing thunderbolt hurtles skyward, driven by its two 18-cylinder, 1,850-h. p. engines. Has power turrets, self-sealing tanks, armor.



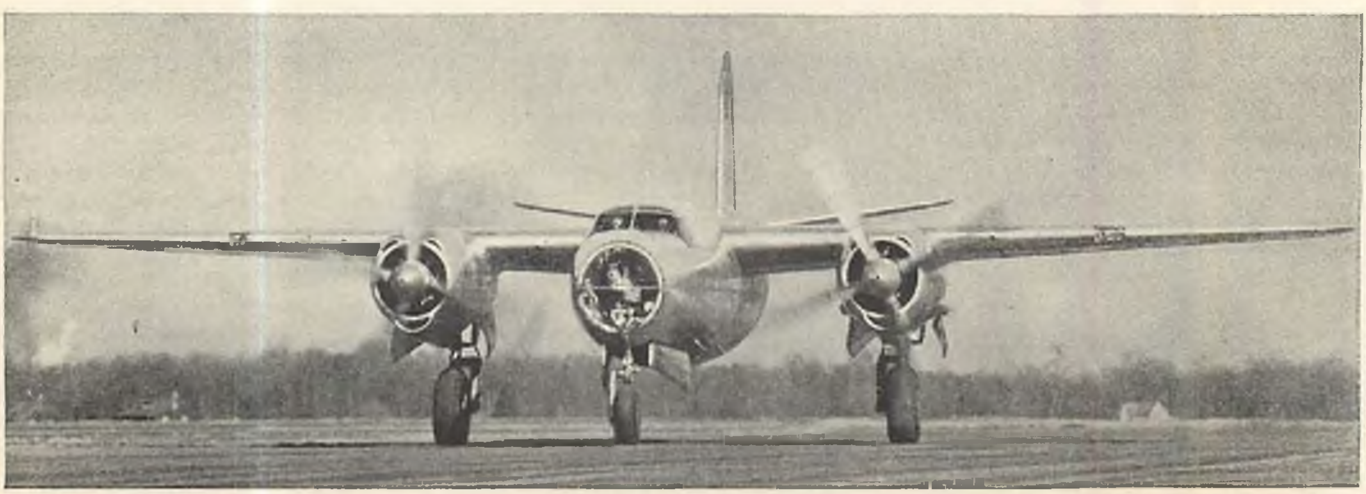
Nose for trouble. Note flexible gun mount, flat anti-distortion panel for sighting near bombardier's feet.



TOUGH GUY

Applying the lessons of the European war, Martin's B-26 bomber for the air corps is fast, heavily gunned, armored. The contract calls for 1,150 of them.

Glenn Martin and army officers inspect "cuffed" four-blade props that pull B-26 at speed of 340-360 m. p. h.



Best defense is a good offense. B-26's 12 guns offer hot reception to interceptors fast enough to catch it. Ship has five-man crew.

Stratosphere Bombing

(Continued from page 9)

from which to launch an effective attack. At temperatures of minus thirty to fifty degrees Fahrenheit, fighting-plane pilots are handicapped by cumbersome clothing and machine-gun operation is slowed up due to congealing of lubricants.

Daylight air raids in Europe largely have failed because of losses inflicted by pursuits at levels of 16,000 to 20,000 feet. Far above that altitude the bomber with pressurized cabin would have the distinct advantage. It is difficult to see aircraft during clear weather when flying above 30,000 feet, even with the aid of binoculars.

After dark, raids by these stratobombers will be undetectable until their lethal loads begin to find their marks, advising those below of their presence. High-altitude bombing, brought about by the necessity of outwitting balloon barages, searchlights and antiaircraft guns, is to be expected from those belligerents believing in the indiscriminate bombing of areas rather than the selective bombing of definite objectives. The former will find high-altitude approaches to the arena of bombing of great advantage because of smooth air and accurate celestial navigation, the latter due to the absence of any overcast to obscure the stars or sun. A gradual descent with silenced engines from a great height will prove impossible to detect by warning devices until the bombers have released their loads miles before reaching their objective and altered course to confound possible lucky warning and antiaircraft crews able to detect their approach.

Night raids by bombers at 40,000 feet will be above the range of searchlights, today's antiaircraft guns and all but the best mechanical "ears" or sound detectors.

Although it is true these stratobombers will not go unchallenged, they will be at an advantage over attempted interception. At night such interception may be discounted as almost entirely out of the question. Interceptors would be unable to climb to their location in time to contact them. Defense patrols at this altitude would be impractical. The inadequacy of a fighting plane's fuel and oxygen capacity would prevent maintenance of patrols at these levels. Relays could be maintained, to be sure, but time, fuel and oxygen consumed in reaching and descending from such patrols would cut down patrol durations severely, as well as make the cost prohibitive.

During the daytime the same complications hold good, with the one disadvantage that the invading stratosphere bombers may be seen. However, unless the interceptor is at a greater height than the invader, daylight interception is rarely possible for even a slight advantage in altitude on the part of the bomber may turn the trick due to the time required for the enemy fighter to reach an attacking level.

Let us consider the case of the invading stratobomber which faces an interceptor at an even higher altitude. The interceptor pilot is at once handicapped by the marginal performance of his plane, guns, oxygen and instruments, during the diving attack. It is no small comfort for him to realize that if he fails and passes below and behind the invader it will be useless for him to attempt to correct his dive, effect a pull-out in the thin air of the stratosphere, regain an advantageous altitude for another attack and once more overtake the bomber. It is a case of now or never, with the odds all in favor of "never."

The crew of the bomber, on the other hand, have much in their favor. Their plane is steady, they are not handicapped by heavy clothing and smothering oxygen masks and their connecting tubes. They have been free to move about, keeping their limbs active. The gunners fire from a steady platform, concentrating their fire on the diving interceptor, from the many gunner stations of the huge bomber. Surely the stratosphere bombing plane will be a flying fortress able to withstand all but the strongest assault by enemy aircraft.

Actual investigation of power-plant operation and flight problems incident to the use of cruising altitudes of 20,000 feet and above were undertaken by TWA early in 1935. The army air corps in 1937 experimented with a special Lockheed Electra having a supercharged cabin. These tests completely proved the feasibility, comfort and safety of high-altitude flying in pressurized cabins.

Another important advantage in high-altitude flying is the increase in speed. The speed picks up one percent per 1,000 feet. Suppose a bomber has a sea-level speed of 300 miles an hour. At 30,000 feet that speed would be increased to 390 miles an hour. Of course, this increase of speed at the rate of one percent per 1,000 feet cannot go on indefinitely. Naturally, as the speed of sound is approached the airplane's efficiency is lost through the design of the present airfoil section and the propeller blades, which lose their efficiency when the speed of sound, roughly 740 miles an hour, is approached.

Now that advantages have been pointed out, let us look at some of the complications to be expected in designing a stratosphere ship for military purposes.

Although the pressurizing of the various personnel positions is a comparatively simple matter for commercial purposes, it at once involves new and bewildering problems when combat is considered. It will probably be necessary to have an air lock between the pressurized space where the crew will be located during the long cruising periods and the combat stations aft in the tail. These combat statons in the tail will probably be impossible to pressurize. Therefore, oxygen-breathing facilities will have to be made available in these spaces so that as the gunners leave the pressurized air lock they will have to put on oxygen masks. Inasmuch as probability of attack from ahead is extremely remote, only machine-gun protection against aircraft approaching from the side or rear will be necessary.

It has been proven, however, that a drop in air pressure is much more easily withstood by the human body than an equally rapid increase in pressure, which fact will lessen the importance of bullet holes through the pressurized compartments, provided an emergency supply of oxygen is available. Naturally, such holes will have to be sealed as soon as practical by some sort of reinforced rubber patches, which ought to be comparatively simple. It is even possible that the slashing effect of cannon shells contacting the bomber may be sealed with a form of sponge rubber mat in patch form. The greater pressure within the sealed compartment will be an advantage in keeping the patch and sealing medium in place.

Sufficient reserve of pressure supply, whether supplied by power-driven units or pressure tanks, must be adequate to maintain the approximate desired working pressure even during the repair of combat damage.

The flight crew, bombardier and engineer compartments only will be supercharged. The bomb bay must be at atmospheric pressure. Arrangements must be made for the movement of crew members out of the pressure compartment to reach battle stations. They will first step into an air lock where the pressure may be released independent of the main pressurized compartment.

Let's examine the problems of the combat crew—the bombardier and the gunners. First, we'll check off the various high-altitude effects upon the gunner and his equipment. Machine guns, due to rarefied air, will heat up more quickly than those operated at more nearly normal levels. On the other hand, their mechanism will be slowed through the cold acting upon lubrication mediums in them. Bullets will have greater ranges, which will necessitate readjustment or redesign of sights. Explosive shells, on the other hand, will lose some of their effectiveness due to thinner air about the explosion point. Trajectories will have to be recalculated, while tracer bullets may have to be completely redesigned to burn effectively in rarefied air found where stratosphere bombers will operate.

Next we'll consider the bombardier and his problems. A bomb dropped from an altitude of 30,000 feet reaches terminal velocity very quickly due to the low density of the atmosphere. The higher terminal velocity cuts down the time the bomb is exposed to the air currents, thus helping to offset the disadvantage of the higher altitude from which it is released. Passing through so many air currents will naturally affect accuracy to some extent. In connection with wind strata, there is no way to tell what the wind strata are at lower levels through which the bomb must pass, as different wind strata are encountered at varying altitudes.

It is undoubtedly true that new bomb sights will have to be developed to compensate for the higher altitude, and new systems devised to check the wind directions and velocities at varying levels below the bomber for correction of sighting calibrations. It is possible that test bombs will have to be dropped, their flight checked through instruments to determine this all-important data.

Although "area bombing" from the substratosphere is feasible, it is beyond conception that accuracy such as is now possible from normal bombing altitudes will ever be possible from the stratosphere, for so many factors enter into the behavior of the bomb once it is released for a free fall of upward of eight miles.

As optimistic as one may be, there is always the possibility of any aircraft on military missions being disabled through combat injuries. Should such injuries cause the oxygen system to fail completely, rendering the crew helpless, the ship would undoubtedly fall with great speed. It is possible that the crew would revive before a dangerously low altitude was reached, although the success of a pull-out after such a descent would be problematical and dependent upon many factors such as plane design, bomb load, and the technique employed in making the pull-out.

The personnel must be considered in case of emergencies necessitating the abandonment of the bomber, should it become totally disabled. An individual supply of oxygen must be included in each parachute equipment sufficient for several minutes' use during a parachute descent from the stratosphere. Here, too, we encounter the painful and even disastrous results of too rapid a descent from the rarefied air of say 40,000 feet, or even greater heights, to the normal sea-level pressure. As adaptable as it is, the human body can stand but a certain amount of internal pressure without painful results. This subject of personnel escape will be in itself an important item in stratosphere bombing.

Although four-engine bombers with supercharged control spaces probably would be capable of flights from Europe to North America and back without refueling, such undertakings would be of highly questionable military value. A half dozen such craft might be developed for the moral effect on an enemy, but to be effective it would be necessary for the bombers to attack in groups of hundreds. The cost of such an operation would be prohibitive.

Stratosphere bombers will likely make their appearance in the present theaters of war, although used for comparatively short operation areas. Already, as has been stated, British planes have encountered German aircraft operating experimentally at the 37,000-foot level, and while no data is available as to their mission or purpose it indicates that Germany is experimenting with and anticipating the advent of bombing operations in the higher altitudes.

To be expected with equal likelihood will be adequate "remedies" for the stratobomber. These undoubtedly will consist of new and deadlier combinations of guns, range finders, ammunition, and the inevitable "secret weapon of defense" so popular in current communiques from aboard.

All in all, the lot of the stratobomber may not be the happy one now envisioned by even its most enthusiastic champions. Time and the historians of the future will tell the tale.

Navy Markings

(Continued from page 81)

(3) The individual aircraft number. This runs from one to eighteen in the bombing, scouting, and torpedo squadrons. Each fighting unit is assigned one VSB auxiliary, and this plane is No. 19. Patrol squadrons are composed of either six or twelve planes per squadron.

(4) The squadron insignia. This design is usually placed under or near the cockpits, but may be found in various positions throughout the many different branches of the service. The two best known are perhaps the "High Hat" and "Felix the Cat" insignia.

(5) The section color as placed on the cowling. The leaders of each section, bearing full cowls, are planes No. 1-4-7-10-13-18. Planes No. 2-5-8-11-14-17 have the top half of their cowls painted with their respective colors. The remainder have the lower half painted. Plane No. 19 in the fighting squadron does not have the cowling painted.

This section color is also painted in a V on the top portion of the upper wing, with the apex of the V toward the nose of the plane. When on the upper section of a biplane, the number of the plane is placed on the inside of the V.

(6) The Neutrality Star, an innovation in use since the beginning of World War II. All planes on the East coast and in the Philippines carry these Neutrality Stars on the nose.

(7) The name U. S. Navy is placed on all naval aircraft starting directly beneath the elevators. Some of the older aircraft have this on the side of the fuselage on a line parallel with the elevators. The name U. S. marines is placed in the same position, but the U. S. coast guard has its own system of markings.

(8) Each carrier in commission is designated a color and this is painted on the entire tail surface of all planes operating from it. The top and bottom of the elevators are painted, also. These colors are: *Lexington*—yellow; *Saratoga*—white; *Ranger*—green;

(Turn to page 92)

THE BELL AIRACOBRA "*Cannon on Wings*"

AMERICA'S ANSWER TO *Ground Monsters*

Crawling along in their tracks of terror come the invader's flame-breathing armored beetles. But America's defense can pierce their skins of steel—with the cannon carried in the nose of the U. S. Army Air Corps' Airacobra. The armor-shattering shells of the Airacobra's 37 mm. anti-tank cannon stop tanks which easily go through machine gun fire unharmed. Because the Airacobra is *the world's only single-engine fighter with such a cannon,* it provides an advanced weapon for stronger defense in conjunction with America's many other splendid fighting units. Picture the advantage of artillery whirling through the air at Aviation's fastest speeds, under the control of single pilots, with devastating accuracy. Slower land forces are at the mercy of their speed and maneuverability, and their fire power is available in places a thousand miles apart in a matter of hours. Now a noteworthy milestone in Aviation's progress, the Airacobra is a symbol of Bell Aircraft's future destiny.

BELL AIRCRAFT CORPORATION

Bell Aircraft Ordnance Division BUFFALO AND NIAGARA FALLS, N. Y.

Making Aviation History

BELL AIRCRAFT

Navy Markings

(Continued from page 90)

Yorktown—red; *Enterprise*—blue; *Wasp*—black; *Hornet*—not as yet assigned.

(9) The model designation attached to each type of aircraft. These are built up in series. For example, observe the fighting planes manufactured by the Grumman Aircraft Corp. for the navy.

The first Grumman fighter was the XFF-1. The X denotes that this plane is still in the experimental stage and is being tested by the navy. The first F stands for fighter, the type of plane. The second F is the call letter designated to the Grumman factory by the navy. Every plane that is sold to the navy by the Grumman people will carry the letter F in its model number. (Examples—F4F-3, JRF-1, J2F-4.) The one stands for the first model of that type built.

The second plane was the XFF-2. This shows that a minor change was made in the original design, but not enough to change the entire plane type. The third plane was the XF2F-1. This plane was vastly different from the FF-2, and so the plane type has ben converted from one (not written) to two, and the model of that type has reverted back to one, as it is the first model of that type built.

The next plane was still different, and so was called the XF3F-1. Next came the F3F-2, which only constituted a change in the power plant. This type was further modified into the F3F-3, but the next type was a monoplane, so the type has advanced still another notch and becomes XF4F-1. This type has been altered four times, so that the current model is the F4F-4. Still another type appeared, this one with two engines instead of one, and so is called the XF5F-1.

The manufacturer's symbols in use at the present time are as follows: A—Brewster; B—Boeing; C—Curtiss; D—Douglas; E—Bellanca; F—Grumman; G—Great Lakes; H—Hall-Aluminum; J—North American; K—Kinner; L—Bell; M—Martin; N—Naval Aircraft Factory; O—Lockheed; P—Pitcairn Autogiro; Q—Stinson; R—Ford; S—Sikorsky and Stearman; T—Northrop; U—Vought-Sikorsky (formerly Vought); W—Waco; Y—Consolidated; Z—Pennsylvania Autogiro.

(10) The individual serial number of each plane. There are four figures and the number of the plane may range from 0001 to 9999.

One or two stripes are placed horizontally on the left side of the vertical stabilizer on all carrier-based monoplanes. This is a visual aid to the landing officer on the deck of the carrier as he is flagging the planes in for a landing.

A small turtle with wings may be seen in the top of the rudder on many carrier planes, and this denotes a "Shellback," or one who has flown over the equator and undergone the ritual on the carrier after returning.

The next largest division of naval aircraft is that of ship-borne catapult planes. These may be found in both the battleship and cruiser divisions of the U. S. fleet.

Battleship Aircraft

These planes operate for the most part on single floats but change to wheels at shore bases when the fleet is not at sea. The main differences between battleship markings and those of regular carrier planes lie in the marking of the plane and the name of the ship it is from. The ship's name is placed to the rear of the plane number. These planes have solidly colored tail units, but the colors are of a different designation than carrier aircraft. The following is a list of the five battleship squadrons: VO-1—red (Observation Squadron One); VO-2—white; VO-3—blue; VO-4—black; VO-5—green.

Cruiser Aircraft

Cruiser-borne planes may be distinguished by a horizontally striped tail and by the letter C before the squadron mission letter. (S as all cruiser squadrons are scouting squadrons.) Thus, all planes operating from cruisers have the two letters CS on the side of the plane, with the name of the cruiser written beneath the CS. Both the rudder and vertical fin, and the elevators, are striped with a wide colored band. This color is determined by the cruiser squadron to which the plane is attached.

Experimental Aircraft

This type of plane is painted all aluminum and has the word Anacostia (naval experimental station) on the side of the plane. The model number of the plane usually has the prefix X before it. As a rule, only one experimental model of each type is manufactured, but the navy has ordered two planes of the new Grumman XTBF-1 type.

Training Aircraft

Primary training planes are painted all yellow and, as a rule, do not carry any squadron markings whatsoever. They do carry an individual plane number, however.

Advanced training planes are painted the regulation silver fuselage, with the upper portion of the wing being orange-yellow. These carry squadron markings.

Reserve Aircraft

The navy operates reserve air bases throughout the country and these reserve squadrons have their own system of markings. Two types are in use at the present time. The first is the reserve plane which has a striped red, white, and blue rudder. The second is the type bearing a full-colored tail unit. Both types use individual plane numbers, but not squadron markings. The section coloring is retained, however.

The letters N. R. A. B. stand for naval reserve air base and are used by a few bases at the present time. When this is used, the name U. S. navy is placed directly beneath the N. R. A. B.

Patrol Aircraft

The patrol section constitutes the only branch of the navy which has the squadron mission letter and the sectional stripes separated. On patrol planes, the squadron designations are painted on the nose of the plane, while the section stripe (on the leader) is painted on the rear portion of the fuselage.

Each patrol squadron has its own tail markings and some utilize elaborate checkerboard designs. These colors have not been released by the navy department, so cannot be fully explained or listed.

Command Aircraft

This is divided into two types. The first type is painted all blue with a silver tail. (A few in service are painted half silver and half blue, with silver tail units.) A rectangular metal holder is placed on the side of the plane to hold the card denoting the rank of the officer using the plane.

Each carrier has a command plane attached and these have a diagonal stripe across the fuselage, the same color as the carrier's color. "Air Group Commander, U. S. N.," and the name of the carrier are placed on the side of the plane.

Specially Marked Aircraft

(a) There are various experimental districts allotted by the navy, and planes operating under these districts are marked by large numbers and letters on the side of the fuselage. An example of this would be 2XdI6. This means that this is the sixth plane from the second experimental district. District scouting units are being organized at the present time and aircraft operating in these districts will be marked with an S instead of an X.

(b) I. N. A. on the side of the fuselage stands for inspector of naval aircraft.

(c) N. A. S. means naval air station and is usually followed by the name of the station that the plane is from, such as Alameda or Norfolk.

(d) N. P. G. Dalgren denotes a plane from the Naval Proving Grounds.

(e) N. A. F. Philadelphia denotes a plane from the Naval Aircraft Factory.

Marine Aircraft

Marine planes use the same system of squadron markings as the navy, but place the letter M in front of the squadron mission letter on all of their planes.

Marine planes have striped red, white, and blue rudders, and the name U. S. Marines is placed under the elevators as usual. Some of the older marine planes have this on the side of the fuselage.

The squadron insignia is placed on the vertical stabilizer and their marine insignia under the cockpit.

Many other specially marked planes are in use by the navy and marines, but a complete listing of them is unavailable and for the most part only temporary, as the markings change very rapidly. But this constant change is what makes a study of naval markings interesting and educational.

You Try Dive Bombing

(Continued from page 12)

you must get hits—you must sink, destroy, or wipe out the target.

With that thought in mind, you immediately realize that in order to get hits the entire squadron will dive low, lower than it has ever bombed before. Procuring a map of the terrain, the elevation of the target is noted. Bearings of nearest land or friendly airports are jotted down. Air-line distance, course to fly, course to return, and a fair idea of terrain is obtained—the latter to determine the most likely avenue of retreat, at the same time the best place to bail out if a forced landing results.

If there is any information relative to wind, this is obtained also. Unfortunately, the enemy guards his weather closely and little data leaks out. At the time the dive is made it will be necessary to check wind by means of telltale smoke of previous explosions.

The heaviest demolition bombs are mounted on the bomb racks—perhaps incendiary bombs on some planes. The racks are so arranged that either bomb or both may be dropped. The bombs themselves are equipped with a device that will permit them to explode upon contact, but if this device is not set by the pilot before he releases the bomb, it will not explode. The reason, obviously, is to prevent damage to one's own troops by accidental release of the bomb. However, it gives the pilot just one more thing to think about.

The take-off is slow; each plane lumbers along the ground carrying its gross load limits of gas, pilot and bombs. After take-off the usual attention to small detail must be given: propeller-pitch setting, fuel selector valve, wheels, carburetor temperature, manifold pressure, oil pressure and temperature, cowling flaps, carburetor mixture, head temperature—and the many other important items in addition to one's navigation. The other poor devils on your wing and in your formation may or may not have instruments, depending upon whether war-time conditions have permitted their installation. In Germany, four out of five planes have no instruments but a stick and a throttle—they are built to follow a leader.

At 12,000 feet you level off on your course and commence to check drift and ground speed. The attack must be a surprise attack, and if done correctly it will be. At last the objective is sighted, and thus far all is well. You look around at the men in the formation, and wonder which of them will be with you that evening; a low attack is always costly. Motioning them to close in for the dive, you begin preparing the airplane for the descent.

First, the bomb is armed, the release lever set for both bombs to drop. This obviates the necessity for a second dive, which not being a surprise dive would be extremely costly. The squadrons which follow you will take the brunt of the artillery and anti-aircraft fire.

Second, the airplane is made ready to dive. The engine is of course costly and the prop is set in high pitch to prevent the 400-mile-an-hour drop from turning the engine over excessively. The flaps—diving flaps, if the plane is so equipped—are set, in order that the diving speed may be reduced. With flaps the speeds may be less than 200—without them as high as 500. The mixture control is set full rich, carburetor heat on, the fuel selector on main suction. The machine guns are loaded, the electric firing apparatus checked. In the midst of this bewildering routine you keep an eye on the target below, trying to maneuver your squadron so that the dive will be made downwind, precisely in line with the target, and neither too steep nor too shallow.

Now you raise the right hand and wiggle the ailerons—the conventional signal which means "right echelon." The left-wing man in each section moves over behind the right-wing man, and now the entire squadron is strung out behind in a line that is stepped up to the right. Looking down, you see it is time to dive; you point downward, stir the stick, and peel off from the formation. The show is on.

With the throttle just cracked slightly to permit a steady flow of gas through the carburetor, which prevents torching, you nose over slightly. In your ears a pressure begins to build up, a roar of wind and motor commences. With increased speed you find more left-rudder pressure is necessary to keep the plane from skidding. Straight ahead of you—really, below you, but in front of the nose—is the target. Your dive was well coordinated; had the target been slightly to one side or behind, it would have been impossible to regain it. A poor entry usually means a poor dive.

In the sights the target commences to grow. The flaps are keeping the speed down admirably, which permits a better aim and gives the pilot more time to think. The wind direction changes several times on the way down, which increases the complexity of the problem and must be coped with by gentle pressures on the controls. No pressure on the ailerons is permitted in dives—it pulls the wings off.

Halfway down you wonder if the bombs were armed—they will not explode unless they have been. Your left hand reaches for the bomb release handle. You do not want to go down too low because of anti-aircraft fire and also because the airplane will "mush" at high-diving speeds, which means that it may go downward even though the stick is hauled back because of the terrific downward momentum.

The altimeter revolves like the hand on a clock whose works are mixed up. It is registering altitude, but is behind schedule nearly 800 feet. It is also indicating pressure altitude which does not allow for the height of the target above sea level. Better to pull out when you think it is time, rather than watch the altimeter. This calls for rare judgment and timing.

The target is rushing up to meet you. It grows in the sight: the larger it is the lower you are; the farther you dive the greater the chances for accuracy, and because this objective has a high military value you decide to go a bit lower. The seconds tick by as you wait nervously, and the plane is rushing earthward at about 300 feet per second, depending upon the airplane and its diving flaps. With some apprehension you remember that pilots who have been flying very long at high altitudes have notoriously poor judgment—for every four shot down in combat, six are killed through their own errors and incorrect decisions.

The target is now a large comfortable object in the sight. It is time to pull out. With an easy movement you pull the bomb release and simultaneously pull back on the stick with an easy, slow movement. The ground keeps coming up as the plane pulls out, until you can see men running out from shelters to man the guns. Your dive has carried you extremely low.

In order not to hit the ground, more pressure is put on the elevators. The result is an increased pull-out which in turn increases the centrifugal force. The blood is pulled downward, away from the brain, and a momentary blackness ensues. You are conscious but are unable to see a thing. In the meantime there is so much to be done: the propeller, the flaps, the stabilizer tabs, the cowling flaps, the carburetor heat—but the downward pull keeps the gray veil in front of your eyes. In common parlance, you have *blacked out*.

At last, after what has seemed minutes, you see again. The plane fortunately is still flying, and you take the corrective measures necessary. The squadron starts to join up—at least, what is left of them. Three of the eighteen are gone—how, you don't know. But the objective was properly bombed, as a glance below reveals nothing except smoke and fire rising from the objective.

Beware The Quickie Course!

(Continued from page 15)

plants, as taught today in both the decent and quickie schools, falls usually into two divisions: sheet-metal work and fuselage welding. Sheet-metal work is sometimes subdivided into riveting and assembly. In engine factories, production mechanics embrace the trade of machinist and its branches, drawing from a reserve of experienced workers and offering little chance for the quickie operator.

Sheet metal. Silvery, gleaming plates of it, to be laid out from blueprints, cut, shaped, riveted, assembled, like constructing a great jig-saw puzzle that grows under your touch until it becomes a proud, mighty airplane that skims at last from the runway—your handiwork! That's the magnet, seconded by the welding torch's glow, that the quickie operator uses as bait.

He sends his high-pressure salesman—a glib fellow with the heart and conscience of a hyena—into your town. An ad appears in your newspaper: "Help wanted—men for aviation industry—" The salesman interviews you in his office—a hotel lobby. You come out with your ears ringing with the rivet knocks of opportunity and your eyes dazzled with sheet metal. Down into the old sock for that nest egg, or into your savings account—or your dad's, or your uncle's, or good old Joe's, your bosom pal. Onto a bus for Los Angeles, center for many big aircraft plants and also for some forty-five aviation schools, a lot of which should have quotation marks around them. Into a school building that suspiciously resembles a refitted chicken house.

There are plenty of other fellows like you there—too darned many, for you consult your "instructor" only rarely, and you almost have to fight to get to use the rivet gun. Your instructor turns out to be a recent graduate of the school or a gent with a little vague experience in an aircraft plant. The "dormitory" you are living in is pretty foul; in fact, the health department closes it down, but your school obligingly opens up another that's almost as good. At last comes your diploma, which you are shocked to find gets only a weary rejection from the personnel interviewer at Vultheed. But maybe at Rylas—You realize finally that you are permanently unemployed, in the estimation of the personnel directors, without further expensive schooling; you are out several hundred bucks already and in debt at home and to your quickie, which is getting nasty about those last two payments they "financed" you on.

Extreme case, this? Sure, but true. A congressional committee investigating migratory labor has heard complaints from West-coast employment men about the Los Angeles situation. And you can get rooked just as neatly at home, as far as your future in aviation is concerned, if a quickie operator happens to be located in your own city. You're not safe anywhere.

On the other hand, there's one place where you're just about as safe as your fondest dreams could envision: in a *good* school. Aviation can't get nearly enough suitable men today. One or two big companies have actually set up their own short-term schools to feed men into their plants as fast as they can be graduated. The government has started courses to try to meet the demand. Men trained in reputable commercial schools are sought for. The writer of this article has heard a quoted statement from the superintendent of a New York plane plant that to hire a man trained in a certain well-known California school, he would gladly pay his fare East.

What are the shortcomings of the quickie school that leave its graduates jobless when there are such wide-open opportunities? They are hasty, incompetent instruction given on inadequate equipment.

Knowing little or nothing of aircraft work, the student is unable to judge what is missing from his course or how badly he is being trained. Counting on this lack of knowledge, the quickie operator sells the student on the latter's desire to get a job surely and quickly and cheaply.

No quickie operator and very few genuine schools can get the student a job *surely*. The most you can count on is a reputable school's record of successful placement—and that can be plenty high.

You cannot, unfortunately, always spot the quickie school so readily by the selling argument that it trains you *quickly* and *cheaply*. Reputable schools are now also giving intensive short-term courses in production mechanics at reasonable rates.

How, then, can you avoid the pitfall of the quickie? Here are six rules for choosing a production training course which should keep you from danger:

1. Ask if the school will "guarantee" a job without condition. If it does, be suspicious.

2. Check on its educational status. Government approval does not extend to short-term production courses in any institution, but a school whose regular long-term licensed-mechanic courses have received government approval is pretty sure to be a school you can depend on for thoroughness and high standards in any other courses they may teach. Federal approval, incidentally, costs the school nothing. Some good schools, however, do without government approval for one reason or another, so do not immediately rule them off your list on that account. Investigate their local standing. A letter to any State department of education will bring you information about local requirements. If in doubt as to any school's standing, write to the Administrator of Civil Aeronautics, Washington, D. C., or Federal Trade Commission, Washington, D. C. Or even contact the Better Business Bureau, if there is a branch in your vicinity.

3. Visit the school, if distance does not prevent, to inspect its layout and equipment. Since you may understand little of the machinery, try to bring along somebody who knows. A wide variety of wood and metal-working machines are needed for instruction in modern factory methods. Band saws, routers, emery wheels, sanders, drill presses, arbor presses, foot shears, bending brakes, crimping machines, beading machines, rollers, shapers, as well as heat-treating furnaces and several types of riveting guns comprise just some of the minimum equipment for a good sheet-metal course. Ten or fifteen thousand dollars is a skimpy investment for such equipment. Add rent and salaries, and you will realize why a low tuition fee should make you wary.

4. Get the expert opinions of others. Your best bet is the employment department of the aircraft plant where you hope to utilize your training. Tell them you are going to apply for a job later, you are about to prepare yourself for that job, and you crave their frank, off-the-record opinion of the schools you are considering. Talk to graduates of the schools, if you can find some, about their success or failure in getting employment.

5. Read the contract before you sign up. Preferably, take it home with you and give it serious study. There should be a clear statement of the terms of payment, and provision for reasonable refunds if you withdraw or are dropped before completion of the course. There should be a total refund if you are drafted for military service before finishing.

6. Shop around. Consider as many schools as possible. Keep a score card and award comparative grades for educational status, employment record, equipment, hours of instruction, et cetera.

Strict attention to these rules should get you safely past the quickie pitfall. Now let's look at the prospects for genuine training that lie before you.

Take stock first of your own fitness. You must not only be a citizen of the United States to get a job in a plane plant these days; you must *prove* your citizenship. That means, usually, a birth certificate. If for any reason you cannot produce a birth certificate, you'd better get busy on the question of your citizenship right away. Otherwise your school training is going to be wasted. It is also sad but true that racial discrimination still exists in the hiring of aircraft workers. Check up on this beforehand if you think you are likely to encounter prejudice.

Age, like education, is no longer important. Youngsters and not-so-youngsters are welcome. Maturity, however, is being recognized as valuable, and men of thirty to forty-eight actually have an advantage today, for their broader experience makes them desirable for promotion to lead men, heading groups of ten or so workers.

Physical handicaps probably won't disqualify you. Get advice from an employment manager. With the exception of riveters—sometimes favored when they are young and nimble and not taller than five feet five or six nor fatter than 130 so that they can squeeze into tight places—production workers can have any kind of physique.

You've decided you're all set? All right, let's consider courses.

The production training available to you can be long or short. The best courses are still the commercial schools' long complete airplane-mechanic courses of usually eight to twelve months that prepare you for a government rating and teach you practically everything about the output and upkeep of airplanes. Such a course is well worth the cost of approximately $500. There will still be plenty of jobs for you when you come from the course about a year from now, and your broad knowledge will give you a foothold in aviation from which you can climb high while other less-trained men are standing still or being laid off.

The short courses of a few months for specialized work such as sheet metal and welding are available at three sources: the factory school, the government-sponsored Emergency Training Program's public classes and the commercial aviation schools.

The factory school is a fairly recent development. Job candidates are selected by the aircraft plant and sent at its own expense to an affiliated school where each man is trained for a specific job within the plant. Republic is using this system to acquire 8,000 workers from five-to-twelve-week courses at the Faust School near New York. The candidates are being chosen only from the two surrounding counties. Lockheed has a training-school and apprenticeship program under way on the coast.

The free "refresher" courses of the Emergency Training Program are being given with government support by public schools all over the country. So far they have been limited to WPA workers and unemployed who have had at least a little previous aircraft or engine experience, but there is the possibility that with the intensified national defense effort, beginner students may be admitted. For local information, write to the Director, Emergency Training Program, at your city or State board of education.

The commercial schools' short courses remain the leading route into aviation for the average man. Schools carrying government approval and other technical schools with sound reputations are giving excellent sheet-metal and welding courses, together or separately, of from five to twenty-four weeks, totaling 200 to 690 hours, varying with the schools' different plans of instruction. Those course lengths are for day classes; night classes take usually from two to three times as long. Prices range from about $100 for simple riveting to well above $300 for more extensive courses. Such prices are not high, when the student considers that they are conveniently payable in installments, and that they represent an investment which, in all likelihood, he will soon earn back.

For the convenience of the prospective student, we list below the schools teaching aircraft and engine mechanics and production mechanics currently approved by the C. A. A. While compiled from sources available at time of going to press, this list is not to be considered complete, due in large part to the fact that new schools are daily being granted approval as they qualify.

Aero Industries Technical Institute, 5245 West San Fernando Road, Los Angeles, Calif.

The Aeronautical University, Curtiss-Wright Building, 1338 South Michigan Avenue, Chicago, Ill.

American Aeronautical Institute, 2425 McGee Trafficway, Kansas City, Mo.

Aviation Institute of New York, 24-13 Bridge Plaza North, Long Island City, N. Y.

Billings Senior High School, Airport

and Grand Avenue, Billings, Mont.
Boeing School of Aeronautics, Oakland Airport, Oakland, Calif.
Boyer Technical School, 1120-24 Carnegie, Cleveland, Ohio.
Brayton Flying Service, Inc., Lambert Field, Robertson, Mo.
California Flyers School of Aeronautics, Los Angeles Municipal Airport, Inglewood, Calif.
California State Polytechnic School, San Luis Obispo, Calif.
Cape Cod School of Aeronautics, Box 592, Hyannis, Mass.
Casey Jones School of Aeronautics, 1100 Raymond Boulevard, Newark, N. J.
Cleveland Flying Service, Municipal Airport, Cleveland, Ohio.
Commercial Aircraft Co., Swan Island Airport, Portland, Ore.
Curtiss-Wright Technical Institute of Aeronautics, Grand Central Terminal, Glendale, Calif.
Dallas Aviation School, Love Field, Dallas, Texas.
Essex County Boys Vocational School, 209 Franklin Street, Bloomfield, N. J.
General Airmotive Corporation, Municipal Airport, Cleveland, Ohio.
Lewis Holy Name School of Aeronautics, Lockport, Ill.
Lincoln Airplane and Flying School, 2415 O Street, Lincoln, Neb.
Luscombe School of Aeronautics, Mercer Airport, West Trenton, N. J.
Missouri Aviation Institute & Frye Aircraft Co., 334 Richards Road, Kansas City, Mo.
Municipal Flying Service, Floyd Bennett Field, Brooklyn, N. Y.
National School of Aeronautics, Inc., 2558 McGee, Kansas City, Mo.
New England Aircraft School, 29 Brookline Avenue, Boston, Mass.
New York State Aviation School, Utica, N. Y.
Parks Air College, Inc., Parks Airport, East St. Louis, Ill.
Pittsburgh Institute of Aeronautics, Pittsburgh-Bettis Airport, Homestead, Pa.
Rising Sun Aircraft School, 191 West Roosevelt Blvd., Philadelphia, Pa.
Roosevelt Aviation School, Roosevelt Field, Mineola, L. I.
Ryan School of Aeronautics, Lindbergh Field, San Diego, Calif.
Sansom Technical Trade School, Inc., 157 Charter Oak Avenue, Hartford, Conn.
Spartan School of Aeronautics, Municipal Airport, P. O. Box 2551, Tulsa, Okla.
State Trade School, 28 Providence Street, Putnam, Conn.
Stewart Technical School, 253-5-7 West Sixty-fourth Street, New York, N. Y.
Stinson School of Aviation, Inc., 21-25 Forty-fourth Avenue or 27-01 Bridge Plaza North, Long Island City, N. Y.
Swallow Airplane Co., Inc., 917 East Lincoln, Wichita, Kans.
Sweeney Aviation Schools, Inc., Fairfax Airport, Kansas City, Mo.

Prone Pilots

(Continued from page 11)

total area of the fuselage exposed to the air stream rather than to the cross section itself. This friction is naturally diminished by the proportional reduction of the total fuselage area through chiseling down the cross section. The other component consists of the paradoxical interference arising from the conflicting flow patterns of the fuselage and the wings. Obviously, the smaller the fuselage the less effective is this resistance.

Now, before considering definite advantages of the prone-pilot position, especially in the military field, let's go back to the simple explanation of the principle of centrifugal force in upright and horizontal flying to see how it works out in practice. Have you ever spiraled tightly for thirty minutes? If so, you have experienced anything from a slight dizziness to a severe case of nausea as well as vomiting. Here's what happens: the centrifugal force increases the weight of all parts of the body. Your pants press harder on the seat, your arms feel heavier, and your blood becomes weightier. The blood being heavier, the heart cannot pump the brain with sufficient blood.

It is this same reduction of blood supply to the brain which causes dive-bomb pilots (and sometimes fighter pilots in dog-fight maneuvers) to black-out. The only difference between dizziness due to spiraling and blacking out due to pulling out of a dive is simply the magnitude and duration of the reactions. In an airplane flying at forty miles an hour, a pilot's blood during a turn in twenty seconds weighs one and five tenths its normal weight, whereas a dive-bomber pilot's at a pull-out weighs eight times as much as in level flight.

Recently a glider was built in Germany to verify the results of research made on the effects of acceleration upon the blacking out of dive-bomber men. In this glider the pilot was laid out prone, with a chin rest to support his head. His chest was padded with his parachute pack. The pilot was also made to lie on his back. Curiously, in the former posture there was less labor involved in respiration, though greater weight was exerted on the thorax; this is ascribed to the fact that in the on-the-back position the diaphragm does not move as it does in the face-downward posture. It was also ascertained from these tests that the prone flying position is no more tiring than that of sitting upright, and that the field of vision is sufficient for all normal flying.

Naturally, the reduced frontal area of the prone-pilot ship will be a great advantage to pilots engaged in dive bombing and torpedo bombing. Not only will the smaller frontal area present a much smaller target to defenders below, but the prone position will enable the pilot to pull out at a much lower altitude, thereby increasing his chances for an accurate hit with bomb or torpedo.

It has been suggested that in the case of dive bombers or the rocket-zooming fighters, the pilots' seats could be made adjustable. They would be equipped with an automatic flattening-out gadget which would permit the pilot to adopt a reclining position in accordance with the particular angle of the dive or pull-out. Those who strongly advocate the prone posture say that the upright seating serves no useful purpose in the speedy lighter ships, because in combat they are pointed at the enemy, anyway.

Today we are hearing more and more of armored fighter planes. With the present cost of training pilots around $25,000, it is no wonder that the various air forces are trying to protect the pilots, at least in a small way. It is unfortunate for the pilots that a modern pursuit ship does not lend itself to good armoring. There are too many control cables, structural members and other gadgets which must be compensated for when designing the armor. This difficulty cannot be overcome except by such a radical departure as placing the pilot in a steel tube made of armor plate. It is a well-known principle of armor engineering that the armor is more effective if curved to deflect the bullets. Also, the more curved the more effective is the armor. A pilot would certainly feel safer if he were lying in a steel tube than if he had a few squares of steel placed around him.

Then there's the matter of bailing out. Even after the pilot has left the ordinary ship he still has to anticipate a battle with the tail surfaces. With the present disposition of pilot and crew, it is impossible to make their departure from the plane any less hazardous. Now suppose a ship could be designed which would permit the crew to drop out much as bombs are dropped from a bomber. Such a pilot-dropping plane would of necessity be one featuring the prone pilot. You can easily imagine how easy would be the parting of the ways for the pilot and his ship if it were merely necessary for the pilot to pull a lever and immediately drop through a trapdoor opening at the bottom of the fuselage. The method would make bailing out as easy and as safe as falling off a log.

The ease, safety and speed with which a pilot could leave a prone-pilot pursuit ship suggests that our present parachute troopships are designed too much along conventional lines. It does not take a great deal of imagination to see how much more effective a parachute troop attack would be if the troops could be released simultaneously and at such a low altitude that they would not long be a target for ground crews.

Keep your eye on the prone pilot!

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