

POPULAR SCIENCE

15¢

APR
20¢ IN
CANADA

MONTHLY

Diving Artillery-

By Hickman Powell—PAGE 90

Save Your Car-

How to Make It Last



DIVE BEGINS AT ABOUT 7,000 FT.

FLAPS ARE OPENED AS PLANE GOES INTO 70° TO 80° DIVE

PILOT JOCKEYS PLANE TO ADJUST HIS AIM

Lieut. R. E. Strickland initiated the author into dive bombing. As commander of the 8th Squadron, 3rd Bombardment Group, he headed the first dive-bombing squadron to be put into service by the United States Army



IF DIVE IS TOO STEEP, PLANE SPINS. THIS IS CALLED "CORKSCREWING," AND MAKES ACCURATE AIM IMPOSSIBLE

AT 1,500 FT. PILOT RELEASES BOMBS AND PULLS SHIP OUT OF DIVE

An A-24 dive bomber coming in for a landing with its landing flaps open. To brake the plane in a dive and hold its speed within the limits of human endurance and control, double flaps are used—one above and one below the wing surface as shown in the photographs at the right. Perforated with rows of holes, these metal surfaces give firm resistance to the slip stream. The drawing illustrates the part that they play in the dive and pull-out

FLAPS CLOSED



Diving Artillery

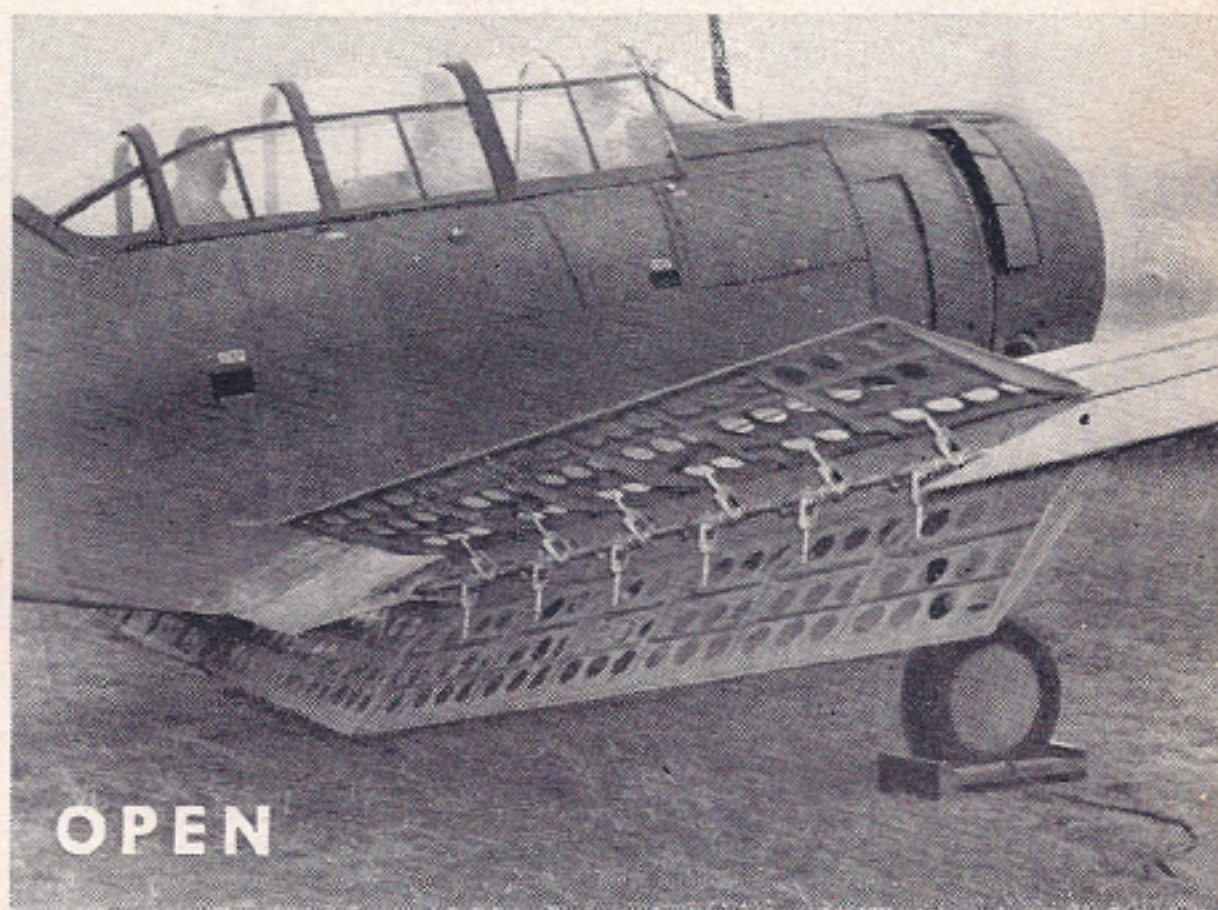
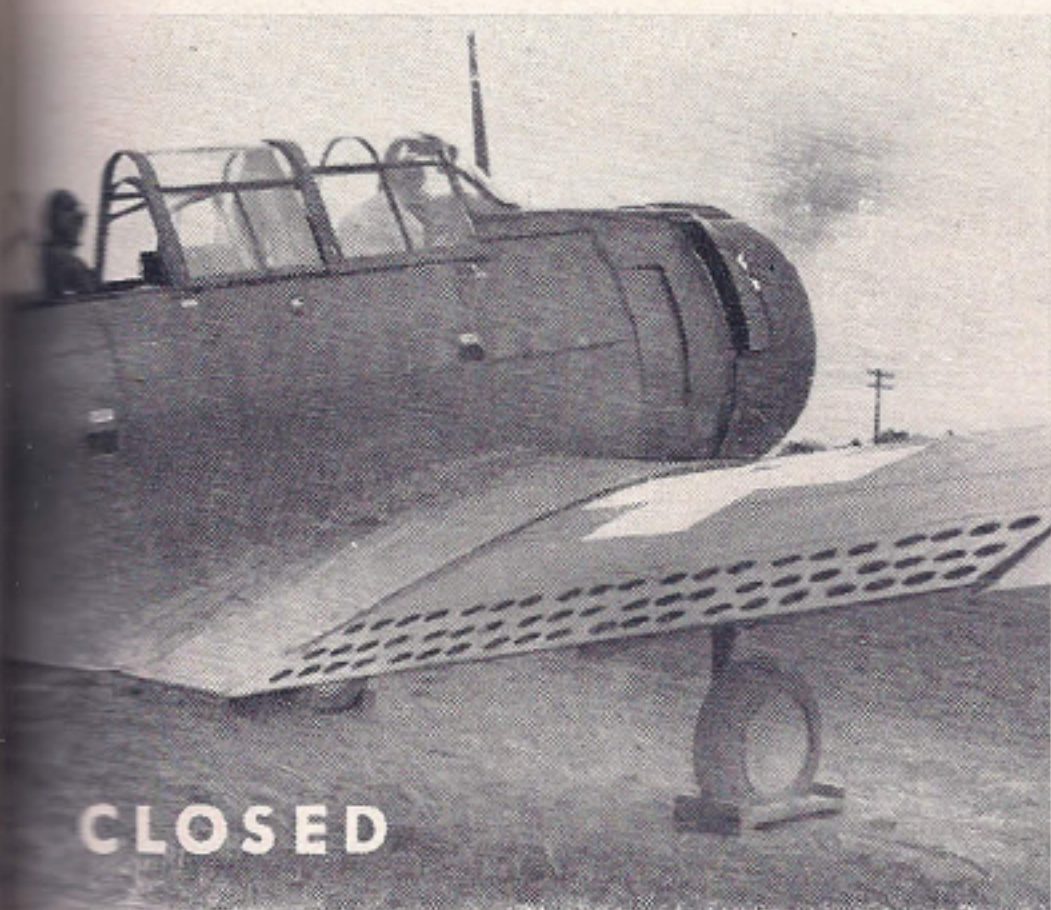
HICKMAN POWELL TELLS YOU WHAT IT IS LIKE TO RIDE A DIVE-BOMBING PLANE, AND SOMETHING ABOUT THE MEN WHO ARE READY TO BEAT THE STUKAS AT THEIR OWN GAME

MOST of us probably have wondered, as we follow the war news, what it is like to be a dive bomber. Only a hero can know, of course, how it feels to hurl one's self into the cannon's mouth. But I recently undertook to find out what a dive bomber's job involves, during the training period, and I ran into a number of surprises.

A dive bomber, for instance, is a keen young fellow who eats his greens even more

religiously than Popeye the Sailor. He keeps close tab on his weight, but he eats butter in big chunks. Not only is he a perfect physical and mental specimen, but a doctor lives with him in his squadron, as alert to his least symptom as is a mother watching her first baby for a sign of sniffles.

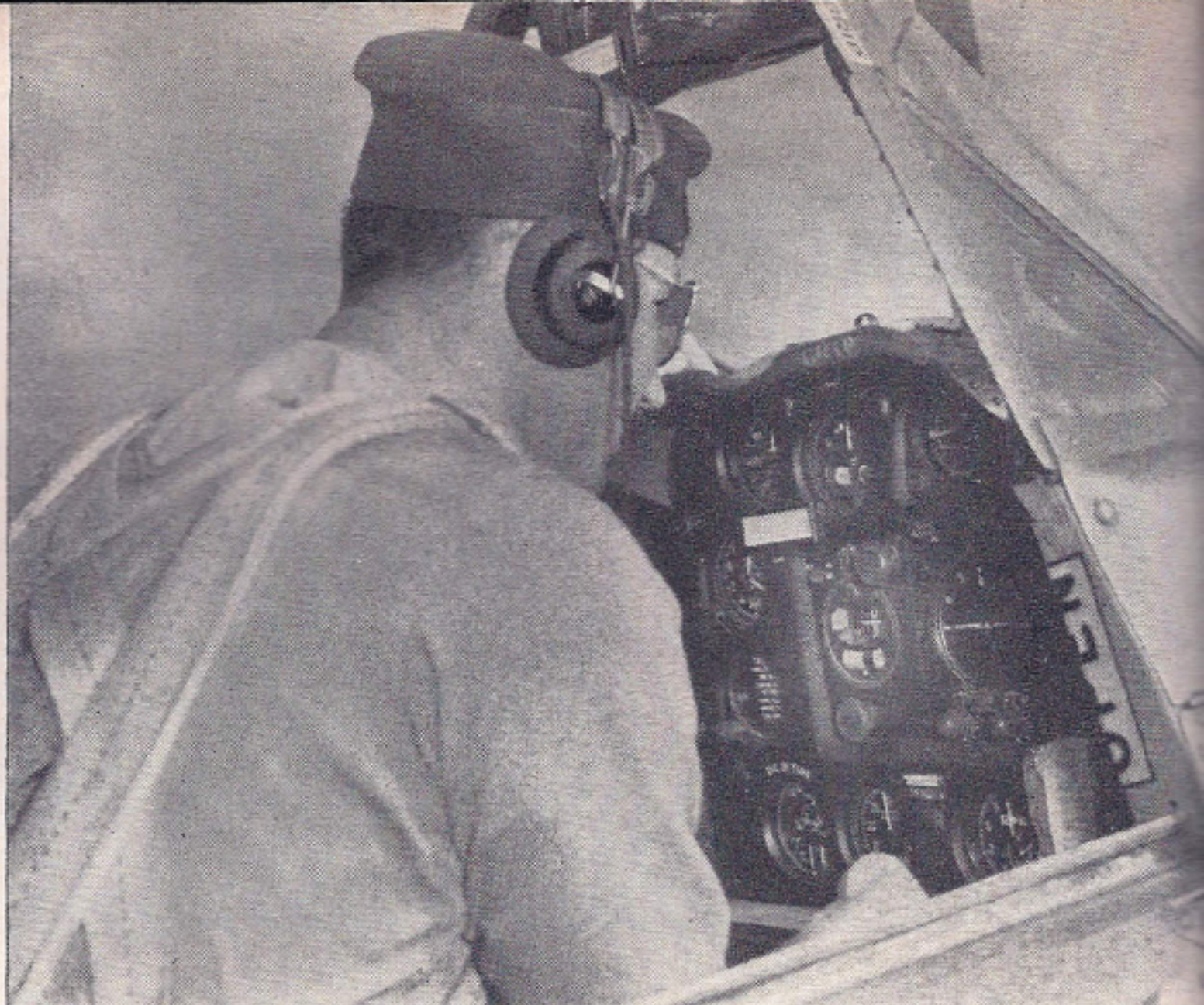
The "blacking out," the violent pull of gravity, and most of the other melodramatic terrors we have been told about diving,



AFTER DIVE, PILOT FOLLOWS
CONTOUR OF TERRAIN TO
MINIMIZE POSSIBILITY OF
ATTACK FROM ENEMY PLANES



Greatest enemy of the dive bomber — not counting Japs and Germans — is the common cold. The least cold in the head, or sore throat, swells the mouth of the Eustachian tube or clogs it with mucus — a bad thing in a dive



do not concern the dive pilot very much as he hurtles toward the ground. He is too intent on various wayward faults his plane can develop in its falconlike course. And until he meets a German or a Jap, his greatest enemy is the common cold.

When I arrived at the air field and presented my credentials, Lieut. R. E. Strickland was hurrying out of his tent, buttoning his flying jacket.

"You're just in time, come on," he said. "We've got a mission to bomb a motorized column."

Five minutes later, trussed into a parachute and strapped tightly into the machine-gunner's seat behind Bob Strickland, I was flying at the head of the first dive-bombing squadron to be activated by the United States Army. We were six ships, low-wing Douglas monoplanes from the 8th Squadron, 3rd Bombardment Group (Light). It had taken up its new specialty last summer. As its squadron commander, I suppose Lieutenant Strickland might be called our Army's first dive bomber.

We had flown for a half hour, high over a jigsaw, contour-plowed landscape, when an abrupt lurch of the airplane brought me up sharply to attention. Strickland was looking back at me over his shoulder. He made a quick overhand, downward motion with his hand. Now we were going to dive.

Ever since the Battle of France I had been wondering a lot of things about dive bombing. Now at last I was going to find out the answers. Hurriedly I looked over the side, trying to see our target, but my inexperienced eye was quite unable to identify it in the finely etched panorama 9,000 feet below.

The plane's lurch had been a wobbling signal for the squadron to move into string formation. They were swinging over behind us now, into echelon right.

Suddenly our plane seemed to stop in mid-air. It felt as though a speeding driver had slammed on his brakes. Indeed, that was what had happened. Our diving flaps had opened, pulled us up abruptly almost to stalling speed.

This dive-bombing plane, known as the A-24, has one point which especially distinguishes it from other military ships, and that is the trailing edge of its wings. The inner half comprises two hinged metal surfaces, about a foot and a half wide, which in normal flight are clamped close together. Now some tremendous inner leverage had swung them out, to a sharp angle from the faces of the wing, one above and one below, presenting firm resistance to the slip stream. They acted as brakes, to cut our diving speed to the point of human tolerance and control. The flaps were perforated, colander-fashion, with three rows of holes about three inches in diameter, through which the crowded air could rush. The inner surfaces were painted red and against the black-green of the plane's back they had a living look, as though they might be the distended gills of a hammerhead shark lashing in for the kill.

I got ready to hang on. I rested my forearms on a convenient metal hoop in front of me and leaned forward. I planted my feet wide apart, well away from the dual-control pedals which moved between them. Back-seat driving would hardly be appreciated now.

An important man in a bombardment group is the flight surgeon (center), here irrigating a pilot's ear. Like the trainer of a football team, he must keep a constant check on the health of his charges — with special emphasis on the vital ears, nose, and throat



In his ambulance the flight surgeon has a complete portable "doctor's office" which can be set up in a tent at any base from which the squadron operates. At right, he checks up on a "patient's" throat

We nosed over, then pulled up sharply and ran forward again for an instant. Now we nosed over again, straight downward, like a canoe going over a waterfall.

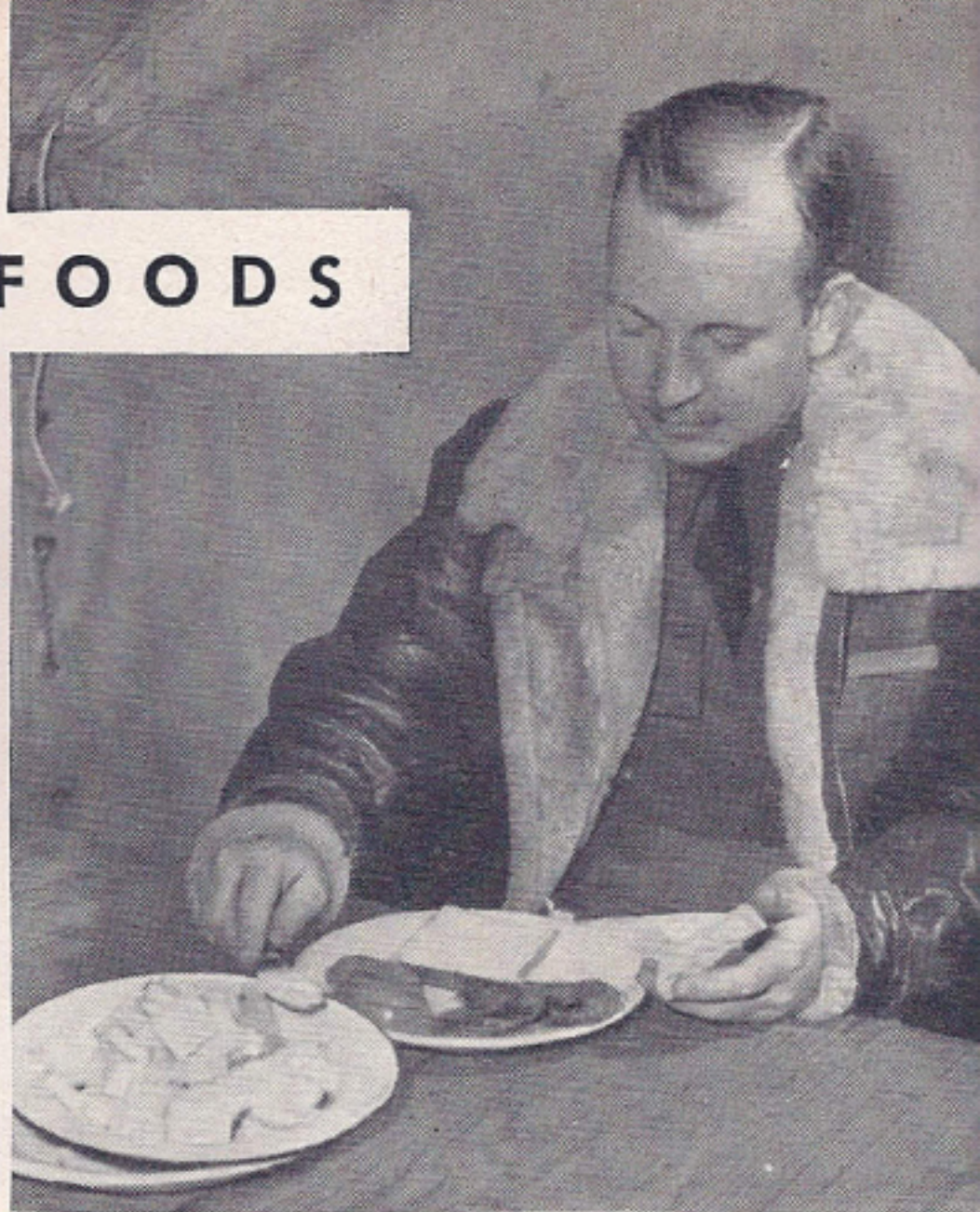
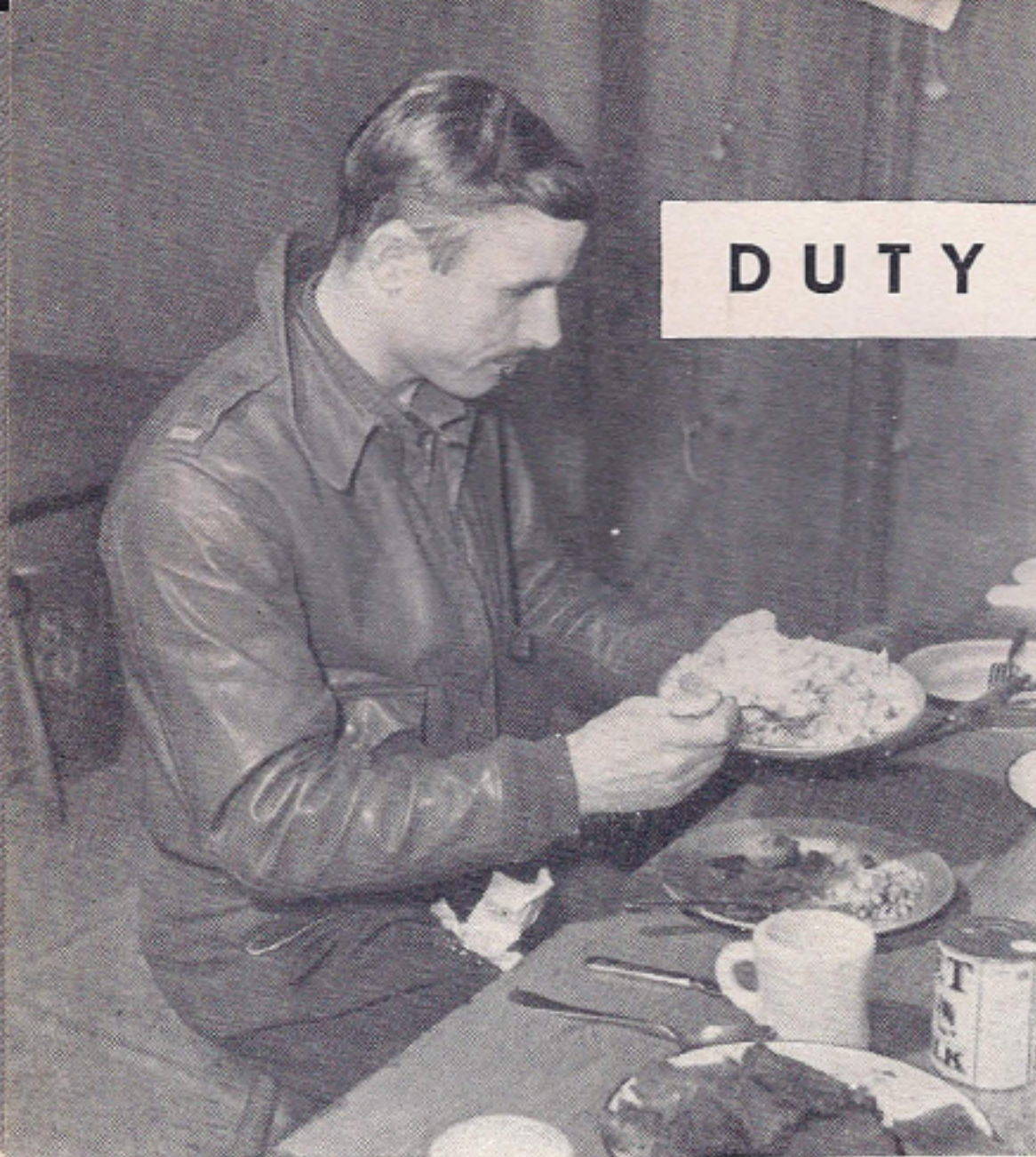
There was a confused sensation of not weighing anything. Pressure pounded in my ears, and I swallowed hard to relieve it. I was surprised not to feel that yawning unpleasantness in the abdomen which always comes when an elevator drops too fast. I glanced at the racing needle of my altimeter, and we had dived 3,000 feet before the glance was finished.

Looking ahead to see the target, I found myself staring merely at a bulkhead and Strickland's head and shoulders. We had

dropped a mile before I realized the place to look was over his head, out through the top canopy, where the sky should be. The solid earth was close looming, rushing up upon us.

Our nose began to pull up. Now everything was pushing upward against my sagging muscles. My pillowed parachute became hard. Arms and feet were straining under a suddenly terrific load. Some inexorable force was pushing my head down, downward, chin into chest. My radio headset fell off heavily, and a rushing roar engulfed me. It was about a four-G pull-out, they told me later. That is, centrifugal force and momentum had multiplied the

DUTY FOODS



Dive bombers eat their greens more religiously than Popeye the Sailor, and consume butter in big chunks. Carrots, too, provide the vitamin-rich carotene that helps adapt the eyes for night fighting

usual pull of gravity by four times. For an instant I had weighed 660 pounds.

It was over quickly. The plane was slanting downward gently and back over the side our target could be seen. It was a train of personnel carriers, armored cars parked along a roadside. Soldiers were standing up in them, unprotected, rubber-necking at the planes. Theoretically the carnage was terrific.

But it was a sight worth staring at. The second plane was just pulling out at 1,500 feet, the third was half way down, while a fourth was poised to strike. Down they came like rockets in reverse.

Just how fast they were coming I don't know. Maybe it had taken 20 seconds to dive a mile and a half. That would be about 250 miles an hour. It had seemed a lot quicker.

Flaps closed and speeding, our planes were skimming the tree tops now, pulling into formation. Hedge-hopping, grass-cutting, skipping through the dew, hardly 20 feet above the foliage. Down close to the ground was the safest place to be for an escape.

Dive bombing was invented by the U. S. Navy, back in the 1920's, and was developed secretly for some years. In 1932 somebody let the cat out of the bag, and the idea was seized by the German Luftwaffe, to be used with devastating effect in the land offensive of May, 1940.

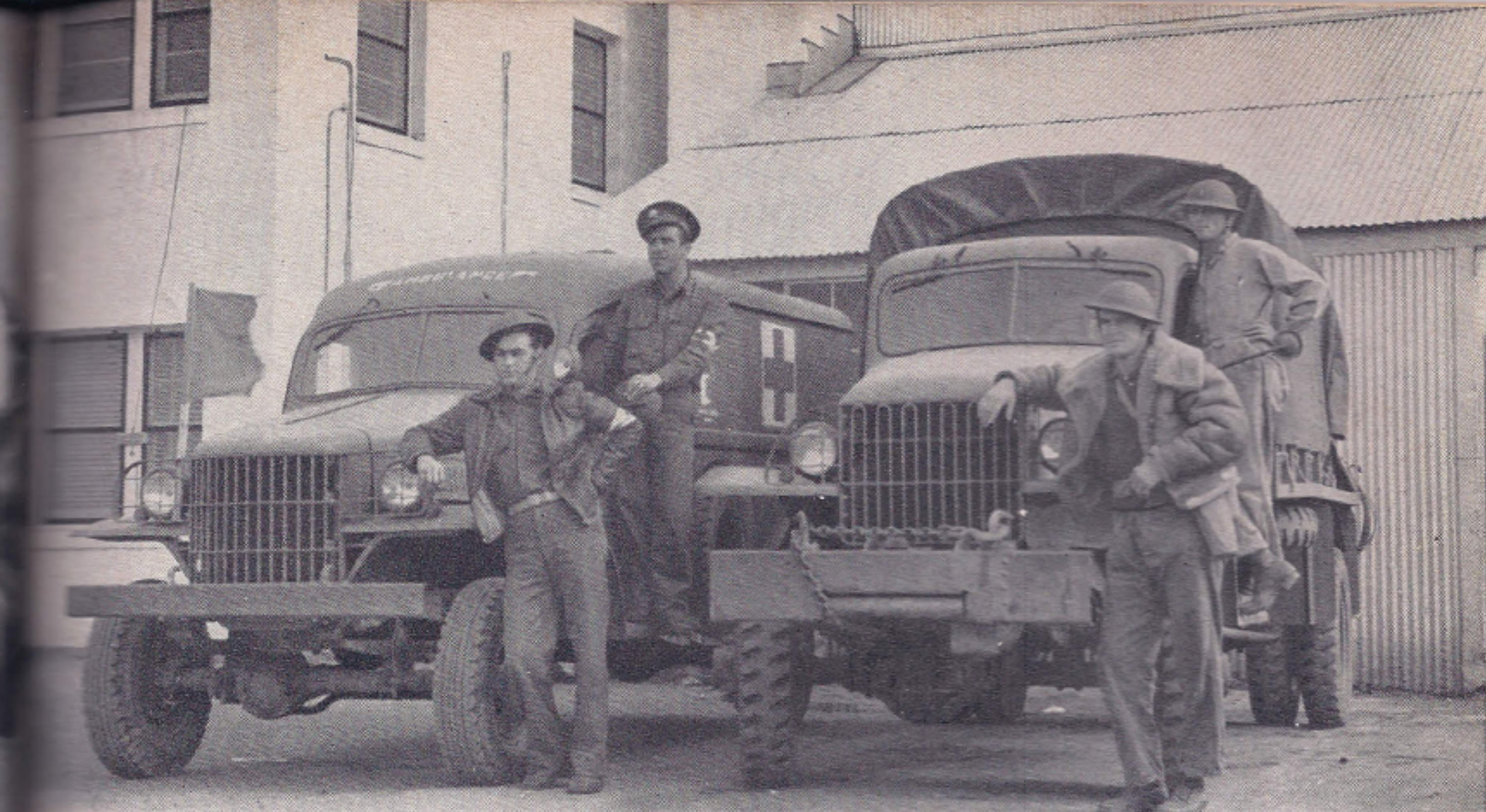
To most of us dive bombing was then a new and terrifying thought, but it was nothing new to our Army airmen and they remained convinced that for ground strafing

against troops their own method of light bombardment was better. They had developed a low-flying, twin-engine ship, now known as the A-20A (called the Boston by the R.A.F.), especially adapted to appear surprisingly over a clump of trees or a ridge of land, sprinkle a large load of cream-puffs from an altitude as low as 75 feet, and disappear while the enemy was still surprised. In another heavily armed form, known as the Havoc, this same ship has become the most effective night interceptor the British have.

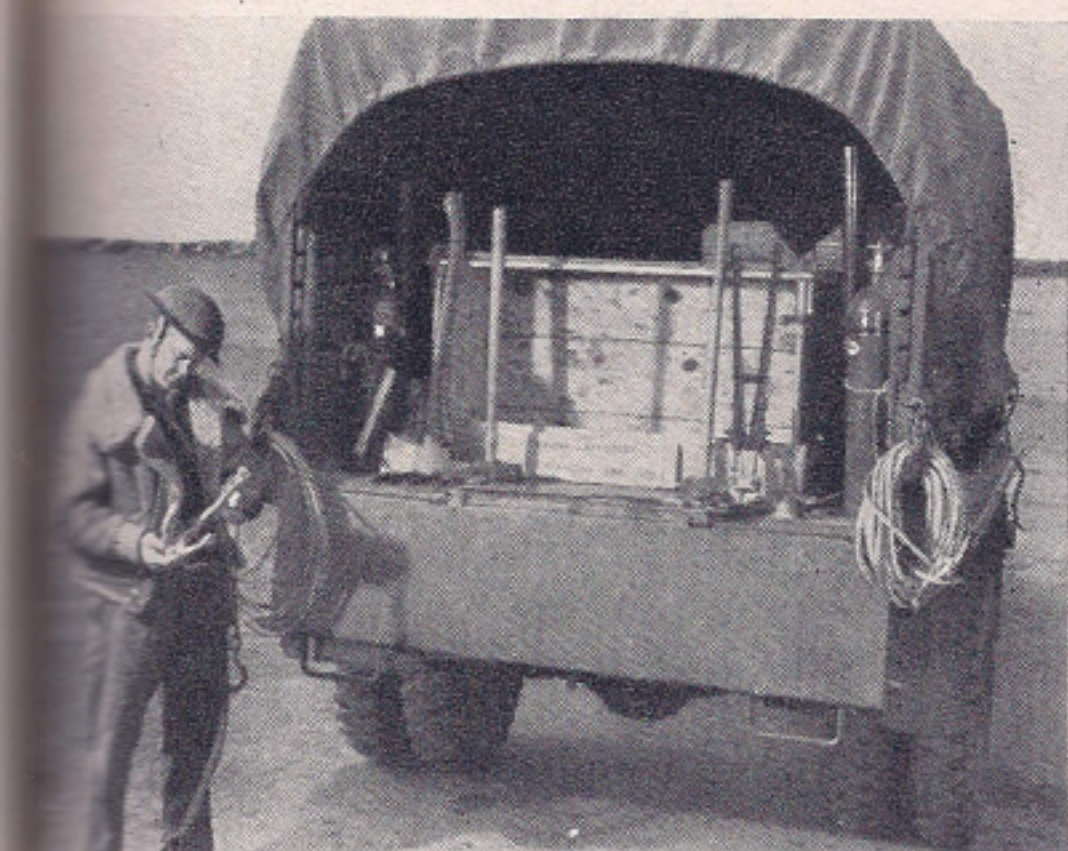
Developments supported this American judgment to a great extent. While low flying soon demonstrated its value, the German Stukas proved relatively ineffective where local air superiority had not been obtained. They had been so successful in France because no strong pursuit forces were against them. Also they were vulnerable to antiaircraft fire.

But still diving had its definite usefulness, against moving targets, and especially for carrier-based craft against warships. Our Navy developed it to the utmost. Meanwhile the Stukas continued to prove their value in attacks on British vessels in the Mediterranean. Last year our Army began using dive-bombing squadrons, borrowed from the Navy, in all its maneuvers. A part of that development was this pioneer squadron, equipped with Navy-type planes, with which I had now been flying.

Those few seconds of diving had demonstrated a lot. For instance, without our own fighters to protect us, we would have been easy prey for enemy pursuit ships as we



Alongside the ambulance, a crash truck stands ready with its trained crew on the alert whenever planes are in the air. In case of an accident it dashes to the scene of the crash to rescue the flyers



Equipment of the crash truck includes fire-fighting and rescue tools, all arranged for quick use. The crew is drilled for perfect teamwork in emergencies



This is the first-aid kit that goes out with the rescue crew. Its contents, shown in detail below, are chosen and arranged to meet any contingency

came in and poised for the dive. And a cool machine-gunner directly below would have had a very good chance to knock us off. The Stukas have found that out. But of course if there had been more of us, diving from various directions, the odds on our side would have been improved.

Certainly there is no need to minimize the velocity and tension of such a dive as this, but a good many melo-



dramatic notions had fallen by the wayside too. For instance there was the matter of centrifugal force. From what I had heard of this kind of flying I had half expected to black out as we pulled up from the dive, but that proved to be an exaggerated notion.

The black-out is a common thing in some types of aviation. When a plane makes a sharp turn at high speed, the centrifugal force is such that the blood is drawn away from the pilot's brain and everything goes black. He becomes blind for the moment and if the strain continues he goes unconscious temporarily. A pursuit pilot expects to black out several times in an ordinary day's rat race, but a dive-bombing pilot doesn't black out unless he is in bad physical condition. It is not so bad to go unconscious in a bank at 15,000 feet, but it's a different matter altogether if you are at less than 1,500 and roaring straight for the ground.

Probably the greatest problem of flying nowadays is that machines have developed beyond the ability of human beings to endure them. This is typified by the ability of engines to operate efficiently at an altitude where humans almost instantly die without an oxygen mask and are oxygen-starved even when breathing the gas in pure form. So also an airplane's wings can stand more G's of centrifugal force than can its pilot. A healthy young man can generally stand up to about five G's for two or three seconds without blacking out. The braking flaps of the diving plane have slowed it down so that, at four G's, the black-out danger is averted and also the ship can be precisely controlled by a young man so well in tune that his reactions are almost instantaneous.

At luncheon after our bombing expedition the pilots told some of the things they had been doing during those tense seconds of the dive.

The most difficult thing was to trim ship. The whirling propeller, driving an airplane, develops torque, a twisting reaction which tends to turn the ship to the left. For normal flight the stabilizer is set permanently at an angle to counteract this. But in a dive the propeller no longer is driving the plane and the torque is abated. So the off-center stabilizer throws the ship into a skid. That is, the tail slips off to one side.

Now, the whole principle of dive bombing is that the plane itself is aimed at the target, with a telescope sight which runs parallel to the longitudinal axis of the ship. If the ship is moving in one direction and pointing in another, aim is thrown completely off.

"In a dive you're practically standing on your left rudder," said the youngster sitting next to me. "That corrects the stabilizer and stops the skid. You've got to keep the ball centered. You see, the bank indicator on your instrument board has a ball in a curved tube, and if the plane is skidding that ball rolls off center."

While thus trimming ship to avoid a skid, the pilot must also select the proper angle of dive. The sight is set to work with reasonable accuracy at an angle between 70 and 80 degrees. Remember this is degrees and not a percentage. An 80-degree dive is about 89 percent of a true vertical angle. Coming on his target, the flyer picks his moment and noses downward. Probably his angle is now a bit shallow, so he pulls up and runs forward a bit. He may perform this trial-and-error process several times in the first 1,000 feet of descent, before he attains the proper steepness and lets loose the all-out plunge.

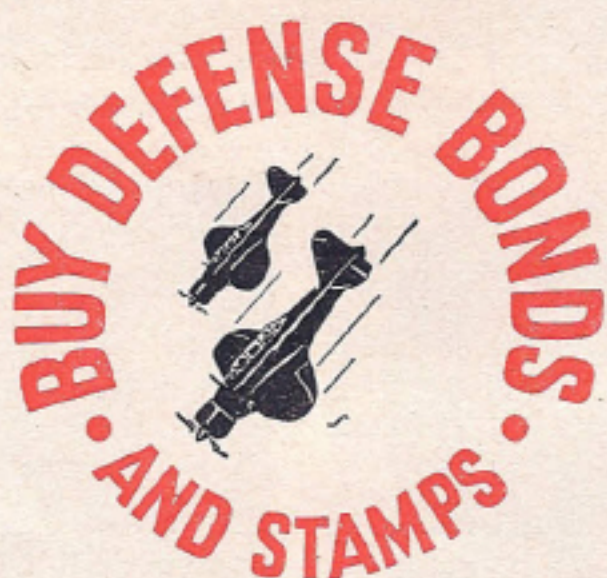
The dive is likely to begin around 70 degrees and wind up at 80. But if his angle gets much steeper the pilot is in trouble. The wings lose their hold on the atmosphere and the ship begins to rotate. Corkscrewing, they call it. The whole earth seems to whirl, and in a crazy eccentric fashion, for the pilot's sight is of course not at the axis of his rotation. Aim is lost, and in pulling out of the dive the pilot has also lost his sense of direction, which may be embarrassing in a battle.

Diving is easier into the wind than with it, because a tail wind may carry the plane into too steep an angle. It may even carry the ship beyond the target, so the wing load is reversed. But a good pilot has to learn to dive from any direction.

Having trimmed ship and got the proper angle, the pilot's next job is to look through his sight and hold his cross hairs right on the target until, at about 1,500 feet, he is ready to release the three bombs suspended under his wings and fuselage. One hazard developing at this moment, sometimes called target fascination, is that the pilot finds himself glued so fast to the target he can hardly force himself to pull off. Those reporting this difficulty, however, have always been able to master it.

In lunching with these pilots, I noticed how much colorful food there was on the table. Servings of butter were several times the usual size, and it was very yellow butter. There were raw carrots, green vegetables, lots of salad.

"I don't like (Continued on page 220)



NEW...FREE SEE BELOW

CASCAMITE WATER PLANS

William F. Crosby, world-known designer, draws new water sports projects to be built with Cascamite Resin Glue

No. 201 SKIPPY—a safe kids' boat 6' x 3'6", makes a fine dinghy.

No. 202 WATER SKIS—7'6". Length can be varied. Loads of fun.

No. 203 AQUAPLANE—70" x 26". Built-up construction. Canvas covered.

No. 204 WAIKIKI SURFBOARD—11'3" x 1'11". Light, strong, easy to build.

No. 205 KAYAK—16 ft. Length can be varied. Inexpensive to build.

No. 206 "PRAM"—A car top boat. Plywood. No frames necessary.

No. 207 "FISHERMAN"—12 ft. flat bottom plywood skiff for rowing or outboard.

No. 208 "PLOVER"—14 ft. centerboard sailing skiff. Plywood or planking.

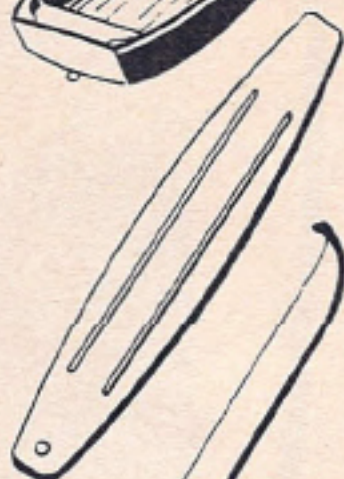
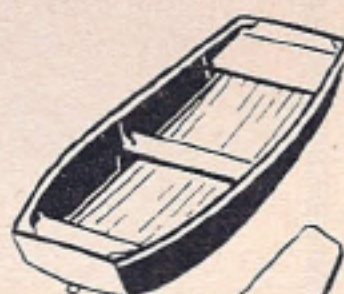
No. 209 "SKEETER" ICE-BOAT — Class E. front steerer for one or two persons.

No. 210 OUTBOARD RUNABOUT AND FISHING BOAT — 15½ ft. Vee-bottom.

No. 211 HOLLOW MASTS AND BOOMS. Complete directions for 7 different built-up hollow masts and 4 booms.

No. 212 DECOY (by J. H. Walton). Life-like, colorful, durable. Hen or male mallard.

HOW TO GET FREE PLANS... Fill in and check the number of the plan you want—on a Casco or Cascamite package coupon (25c or larger size). Pictures and descriptions of all water projects included in free booklet offered below.



CASCO POWDERED RESIN GLUE
For all outdoor projects
10c to 85c
At Hardware, Paint, and
Lumber Dealers

MAIL COUPON TODAY

CASEIN COMPANY OF AMERICA, Dept. PS-442
350 Madison Avenue, New York, N. Y.

Please send Water Projects folder.

Name _____

Address _____

City _____ State _____

Save 2¢—stick coupon on penny post card

Diving Artillery

(Continued from page 96)

this stuff worth a hoot, but Doc says eat it, and so I do," said the flyer across the table, attacking a large plate of salad greens. "We call it duty food."

"Doc" was the squadron flight surgeon, one of the most important men in this or any other military-aviation outfit. He was filling his flyers full of vitamins, especially vitamin A, which is found in the carotene of butterfat, carrots, and greens. Carotene has some mysterious chemical connection with the adaptation of the eyes for night vision; and these pilots were flying by night as well as by day.

Dive bombing, as military flying goes, is a simple operation; but, even more than some other types of piloting, it requires split-second reaction. The dietary care was but one example of the strict regimen which it was necessary for the pilots to follow in order to maintain efficient operation.

The flight surgeon's job, as applied to this or any other squadron, is another story. But with the diving outfit there is one aspect of his work which has to have special emphasis. That is the watch he must keep on the upper respiratory organs of the flyers. The change of atmospheric pressure in an 8,000-foot dive is so violent and sudden that anything wrong with the nose or throat is likely to give the pilot great trouble with his ears.

I had an example of this myself, the second time I tried a dive, forgetting that I had a slight nasal irritation. Watching the ground rushing up at us, I also forgot to swallow and thus ventilate my middle ear. Half way down, there came a sudden sharp jab of pain in my left ear, which increased with each foot of dive until by the time we reached the ground the pressure on the eardrum was agonizing. It was a half hour before the pain was relieved, three weeks before that ear felt normal again.

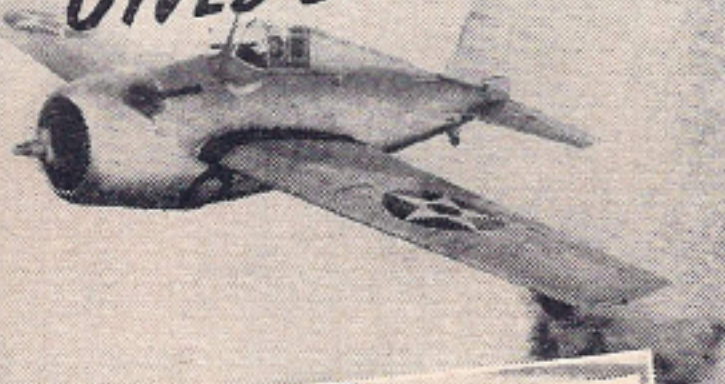
They explained to me what had happened. The eardrum separates the outer and inner ears. The outer ear is connected directly to the atmosphere, but the inner ear is thus connected only by the small Eustachian tube, which runs into the throat at the nasal pharynx. The pressure in these two chambers should be equal. When we climb in an airplane, atmospheric pressure decreases, and the compressed air in the inner ear easily escapes through the Eustachian tube. But when the process is reversed, the air has a much harder time getting back. Swallowing helps it. That's the reason for the

(Continued on page 222)

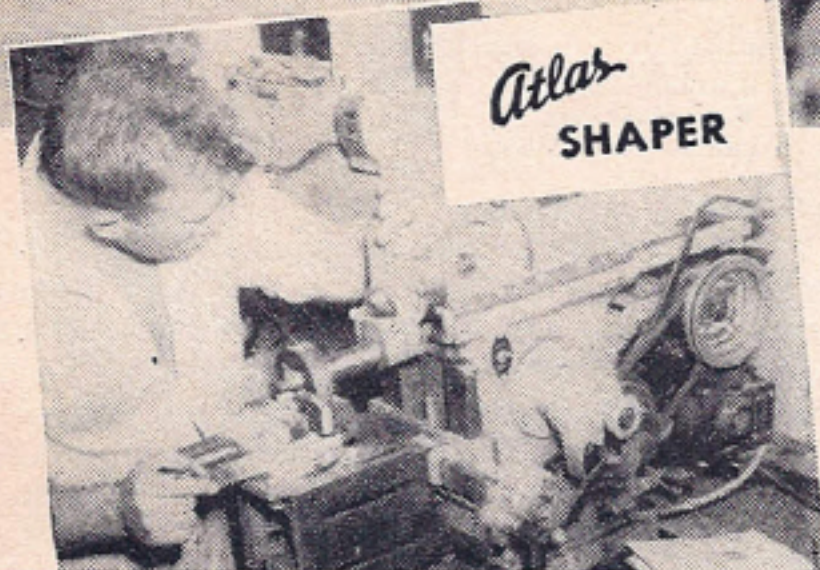
How *Atlas* **SERVES THE NATION**

Off. U. S.
Navy Photo

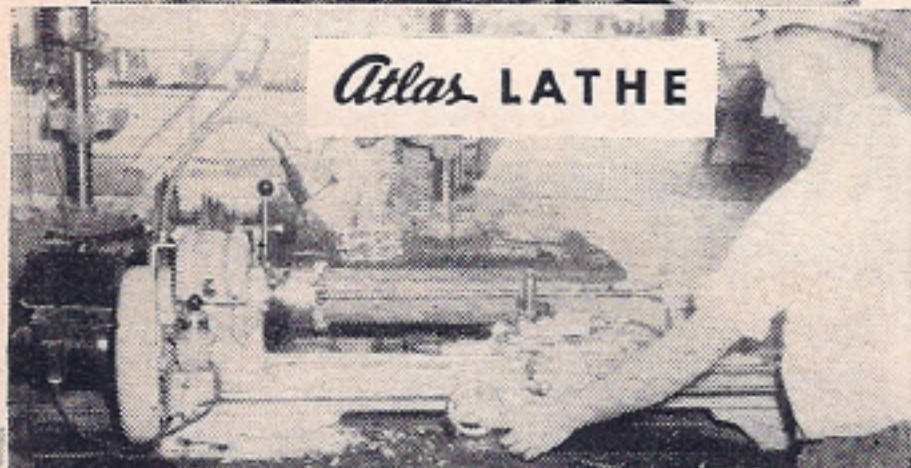
GRUMMAN
"GIVES 'EM THE GUN"



Atlas
SHAPER



Atlas **LATHE**



Atlas
MILLING MACHINE

Grumman's chunky little carrier fighter, XF4F-3, has already proved itself dynamite to the "Rising (?) Sons" of Japan. Compactness makes it ideal for naval use. Performance and fire power — 50 caliber machine guns and fragmentation bombs — make it deadly in the air.

Aircraft Specialties Company, Long Island,

are important sub-contractors for the Grumman Aircraft Engineering Corporation. And at Aircraft, we're proud to report that Atlas Equipment, as shown above, is saving time on many machining operations.



ATLAS PRESS CO.

455 NORTH PITCHER STREET
KALAMAZOO, MICH.

**LATHES • DRILL PRESSES • SHAPERS
ARBOR PRESSES • MILLING MACHINES**

Diving Artillery

(Continued from page 220)

chewing gum they give you in an airliner. When descent is gradual, there is usually no special problem.

But in a diving descent, the pressure increases very suddenly, by more than one third within a few seconds. At 9,000 feet the barometric pressure is 21.38 inches of mercury, while at 1,000 feet it is up to 28.86 inches. Under this sudden change the soft mouth of the Eustachian tube is likely to collapse, like a rubber tube which is sucked. Then the increasing pressure seals it against the entrance of air and the eardrum has to absorb the pressure by bulging inward.

The least cold in the head or sore throat, by swelling the opening of the tube or clogging it, exaggerates these difficulties. In addition, any throat infection is likely to be carried into the ear by the inrush of air. At the least sign of such trouble, the flight surgeon puts the dive bomber down for duty not involving flying.

This 8th Bombardment Squadron is a venerable outfit, with traditions going back to World War days. It had a great deal to do with developing the Army's technique of low-level attack bombing. But except for the commander, its veterans were transferred when it took up its new specialty. These dive bombers were youngsters fresh out of flying school, hot with enthusiasm for the development of what was for the Army a new type of flying.

They had learned it quickly, for as military flying goes it is a very simple thing. It involves none of the intricate teamwork between pilot and bombardier in using a bomb sight, none of the elaborate corrections required by level-flight marksmanship. Dive bombing is basically just another maneuver in the flying of an airplane, and after a few principles are explained to the flyer, the rest is practice. Of course there are tricks to it, just as there are tricks about making a basketball go through the hoop, but those are within the realm of military secrecy.

Up to now we have heard of dive bombing mainly during the German offensives in Europe. The next time it breaks into the news may well be when the American Fleet engages the Japanese. All our naval pilots are dive bombers, along with their other skills, and the art is one of our main naval weapons. With our war now centering in the Malay Archipelago, a combination of sea and air campaigning, dive bombing may well assume an importance greater than has ever been anticipated.



JO KOTULA, artist of this month's cover, has been drawing airplanes for the last 16 years. While he is not limited to aeronautical subjects, he likes them best. Although now a resident of New Jersey, he has spent most of his 31 years in the Midwest and in Texas. His hobby, as might be expected, is airplanes, and he has been flying his own Taylorcraft for more than five years.