Getting DOWN

What Airmen Have Learned of the Ways of Escape from Their Greatest Peril

By General

WILLIAM MITCHELL

who commanded the A. E. F. air forces during the decisive battles of 1918, and afterward was Director of Military Aëronautics, U. S. Army. As advocate of a unified, separate Air Service, he resigned from the army in 1926 and has carried on by writing and lecturing.

Pictures by CLAYTON KNIGHT

Landing in a forest is not particularly dangerous if the forest is rather open.

GETTING down to the ground with an airplane is a more difficult undertaking than getting up with it, because so many unexpected things may happen in the air. All parts of a plane are checked over and carefully inspected before it takes off, but our present airplane engines are composed of from 2,000 to 5,000 parts, the ignition system alone containing about 1,000 parts. With so complicated a mechanism, trouble is always apt to occur.

Pilots and passengers are seldom killed in airplanes when they are in flight. It is usually when they hit the ground too hard that fatalities occur. Many things happen to airplanes that cannot be foreseen, such as breaking some part on leaving the ground, or having some derangement or accident occur to the structure of the plane while in the air. Many of these things may be counteracted by skill on the part of the pilot. Often the plane can be landed, even if a crash is inevitable, without killing any of the occupants.

There is one condition, however, in which an airplane may be placed by its pilot, which, if it occurs within 300 feet of the ground, means almost sure death for everyone in it. This is a stall.

Stalling is responsible for 90 per cent of the accidents we have in aviation. A stall is a very simple thing. It is merely losing flying speed. An airplane is much heavier than the air, and to sustain itself in flight it must cross or go over a certain number of molecules of air in a certain time so as to give itself buoyancy or sufficient support to hold it up in the air—just as a stone, when you skip it across the water, is held up by the water until it loses speed. If it is dropped directly into the water without having the necessary speed, it will sink to the bottom.

Many persons think that it is necessary for the engine of an airplane to stop to produce a stall, but this is by no means the case. If the airplane is inclined upward at an angle which makes it impossible for the engine to continue to pull the airplane through the air, it will stall. Also, if the engine is throttled to a diminished speed and put at too great an angle of ascent, the same result will occur.

Once an airplane has become stalled, all ability to control it ceases. Nothing can be done by the pilot until it regains sufficient speed so that the controls will work: its rudder, elevator, and ailerons. Some airplanes require a speed of fifty miles an hour, some sixty, and some seventy or more, to regain complete control. No engine is powerful enough to pull an airplane straight out of a stall, once the plane has come to rest in the air—in other words, lost its forward motion.

The only way the required speed can be regained is by a fall toward the earth. If the plane is within 300 feet of the ground, it will surely crash and probably kill all the occupants, because it takes a fall of about 300 feet for an airplane to obtain sufficient speed for the pilot to regain control.

SOME airplanes fall more rapidly than others, depending upon how they are built. The older types used to go right over on their noses instantly if they lost flying speed, as their weights were placed so far forward. It was called a "whip stall" by the pilots. These airplanes had gasoline tanks that were not crashproof. They almost always caught fire when they hit the ground, not only killing the occupants but burning them up as well.

Other airplanes remain on a more or less even keel and "mush" down—that is, sort of parachute themselves. These often come down on their wheels or on a wing, which takes up a great deal of the shock when they hit the earth. Good commercial planes are built on this principle.

When an airplane gets into a stall in the air, it remains entirely quiet for a moment and then begins to fall toward the earth. Frequently we cut off our engines when we are up a few thousand feet, purposely stalling the airplane so as to practice regaining control. I remember my feeling of intense surprise and interest when I made my first stall. To begin with, the sound of the engine stopped entirely when I cut it off. There was a little noise in the wires due to the forward motion, which gradually ceased. Then for an instant everything became absolutely quiet; there was no pressure of air

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supplies infrequently used. The greatest time and labor saving de- forks, stirring and measuring spoons, potato masher, eggbeaters, doughnut openers, bot- c.

ding pan, muffin and cookie pans, food chopper, rolling pin, flour sifter, etc; utensil drawers, if not housekeeper must see to it that it is of the right height. Shelves underneath the table for dishes and uten-

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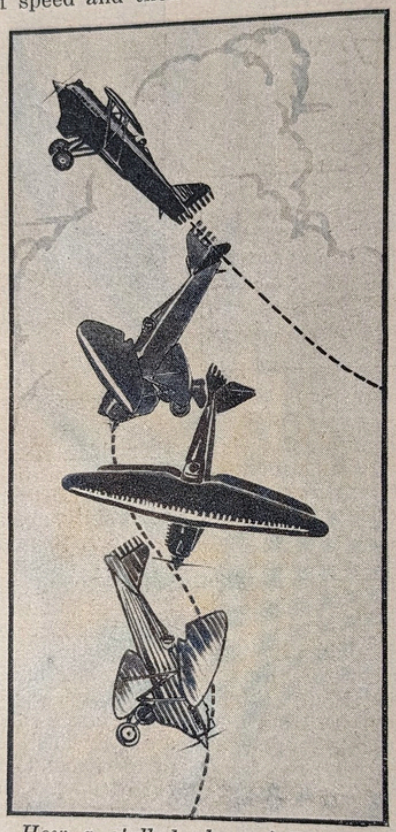
against my face. It seemed as though we were suspended in the air 5,000 feet above the ground. The feeling was one of absolute rest and tranquillity. Then slowly the airplane fell over on its left side, then on its nose, and gradually went into a spin.

This is the time when many young pilots lose their heads and try to extricate the airplane from the spin before it has sufficient speed for the controls to act. If all the controls are put on neutral, a good airplane will come out of its spin of its own accord as soon as it obtains sufficient speed, but if the control surfaces are very large and push against the air a great deal, as was the case with some of the old types, the airplane may be held in a stall for a long way. In my first stall, I let the plane fall until it had gained plenty of speed and then pulled it into a flying position.

When an airplane is stalled, a spin of some kind is nearly always the result. Either one side of the plane or one end is heavier than the other, and it begins to fall first. When that side or end has gone some distance, the air pressure on the surfaces of the airplane begins to take effect and props it up until the effect of gravity is counteracted, and then the process is reversed. Sometimes all sorts of queer gyrations are made by an airplane as it comes down, as both the pressure of the air and the force of gravity are acting on it.

If you watch the leaves fall in autumn, you will see many of them going into spins and oscillating from one side to the other. We take our airplanes sometimes and make them do the very thing the leaves do—that is, we put the plane just into the edge of a stall but not quite into one, keeping our power on all the time, then fall to the left and, when we have got a little speed, shift our controls over and fall to the right, and in this way we come almost vertically downward. Landings have been made intentionally from this sort of maneuver. It is called a "falling leaf."

A stall near the ground is more dreaded by a pilot in the air than any other thing except fire. Practice and alertness on the part of the pilot are the safeguards against it. The experienced pilot, familiar with the air, can feel a stall coming. The ailerons or controls on the tips of the wings of the airplane are the first to be affected. If he tries to incline his airplane from side to side, he will get no feel. Next his elevator becomes inoperative, and last his rudder. By that time his airplane is nearly ready to fall. A man with very sensitive reflexes can feel his airplane begin to mush, and can feel the laboring of his propeller.



How a stalled plane falls in a spin. Stalling is responsible for 90 per cent of the accidents we have in aviation.

THESE things often come with the greatest rapidity and all at once. In order to avert the stall, instant action is necessary. It has to be almost automatic and unconsciously done by the pilot.

Before we had a lot of experience in the air, we thought that a body falling through it would keep increasing in speed as it neared the surface of the earth. But we have found out that every falling body in the air has a certain terminal velocity; that is, its speed increases to a certain rate and then it can go no faster. This is on account of the pressure of the air against it, which becomes stronger and stronger the faster the body falls. For instance, the body of a man falls until it has attained a speed of about 250 miles per hour, and then it can go no faster.

Many persons used to think that the breath would be sucked out of a person's body by falling through the air rapidly, and that death would occur before the body hit the ground. But now we know this is not so, because men have jumped with parachutes and allowed themselves to fall for several thousand feet. The fall has been measured by moving-picture machines. These machines take a certain number of pictures a minute. By reckoning from the number of exposures made and the position of the body on them, the speed of descent can be told.

We find that falling quickly through the air produces no particular effect on the human body except on the ears, and that the sensation of it is the ordinary feeling experienced in descending rapidly in an airplane. We can actually descend faster in an airplane than we can fall, because we can stick its nose straight down, put its motor full on, and get a speed of over 350 miles per hour.

Speed affects the reflexes or sensibilities of a pilot a great deal, because he has to think so much faster than he ever has had to on the ground. Many accidents are the result of too slow thinking on the part of a pilot.

The questions are often asked: What should be done to land a plane if it has lost a wheel? Or if one has to land in a large body of water with a land plane? Or to land in a forest on top of trees? Or in mountains? Or in a fog?

WHEN these conditions arise, the greatest necessity is for coolness and common sense on the part of the pilot. An airplane should be landed, placed on the earth in just the position it occupied when the pilot and passengers boarded it—that is, with its tail and landing gear on the ground. The best landing gear we ever had was the skid, such as some of the first airplanes were provided with. Skids distribute the pressure of landing over the plane and retard its forward progress better than wheels. But they are hard to take off with when the plane is heavily loaded, so that wheels have taken their place.

The more slowly an airplane is landed, the less will be the shock of impact and the less the likelihood of smashing things up. In order to touch the ground at the slowest speed, airplanes are always landed into the wind. Against a wind blowing fifty miles an hour, an airplane with a stalling speed of fifty miles an hour can land without any forward motion whatever—just rest on the ground when it touches it. If, however, the airplane were to land *with* such a wind, its own speed and that of the wind would be added and it would be moving over the earth at a speed of 100 miles per hour. If it struck anything on the ground, such as a slight undulation, a soft spot, or any obstruction, it might be smashed all to pieces.

Strange as it may seem, water is one of the safest places on which to land with a land airplane, because when struck at slow speed it gives more of a cushion than the ground does. Of course, if a plane hits the water at very high speed, it has the same effect as hitting a solid surface. However, landing at fifty or seventy miles an hour on water, there is a cushion effect that is quite noticeable.

An airplane should be landed on the water in just the same way that it is landed on the ground—at the minimum speed and after leveling off above the water at a height of less than ten feet, then letting the airplane lose speed and settle into it. The average plane will remain in almost a horizontal position and float for many hours, buoyed up by the air in its wings and structure. Some planes whose wings and bodies are air-tight and water-tight will float indefinitely. Airplanes of the future will

guished Flying Cross. Won the Schneider Cup for America

be constructed in that way. When I did a great deal of flying over the water I kept a number of beef bladders, blown up with air and varnished, in the body of my plane, as they were the lightest and most buoyant things I could get.

I also carried a large inner tube of an airplane tire, which I could use not only as a spare in case of punctures on land, but on the water as a life preserver by blowing it up with my mouth.

A landing must not be made in water less than five or six feet deep because the wheels are likely to touch the bottom and cause the plane to turn over. I have never experienced any difficulty in landing my plane in the water in case of accident, and I have seen a great many landings made in that element. In all such forced landings I have ever witnessed, I have never seen a man killed. I have seen some planes land too rapidly in the water and turn over, throwing their occupants out, but the shock was so taken up in the water that they were not seriously hurt. Had the same thing occurred on land, they would have been killed.

When I came back from a trip to Europe in the spring of 1922, a squadron of airplanes came out to welcome us off New York harbor. I was on the steamship Aquitania, which is a large vessel and high up out of the water. A strong breeze was blowing from one side, which caused a lot of dead air—that is, eddies of air—to be formed on the opposite side of the vessel and to trail out astern.

THE older pilots, who were used to flying around ships and attacking them, kept to windward of the vessel, but one young man came very close to her on the leeward side. When just astern of her, he started to make a turn, but being in the dead air, his airplane immediately stalled and he fell straight into the water from a height of about 100 feet.

On land he would have been killed instantly, and his ship burned up, as it was one of the old DHs. Instead, as the plane hit the water, the motor broke out of its bed and fell to the bottom of the sea. The wings did not completely disappear below the surface of the water, and soon emerged and floated.

A pilot boat which was standing by close to us, which immediately went to the airplane, pulled up just to windward of it and in an instant rescued the pilot and observer. Everyone expected to see them badly hurt or dead. The pilot had a bloody nose from hitting the cowling in front of his face, but the observer was not even scratched; merely cold and wet from the icy drenching.

Usually when crashes occur in the water with hydroairplanes or flying boats it is more serious than with land airplanes. This is because the landing gear of these seaplanes cannot stand as hard a shock as the wheels and landing gear on a land plane. The airplanes made to land on water require a much greater proportion of their weight to be put into the floats which constitute their landing gear than land airplanes require in their wheels; therefore they are much heavier and logier. They also expose a much greater surface to the water. When landing in high waves, or when the surface of the water is very glassy and smooth, which makes it difficult to estimate the distance to the water, a stall often occurs and into it they go, smashing their boats and pontoons and often killing part of the crew.

As I write these lines I have just finished reading of two accidents to naval seaplanes which occurred near Washington. Newspaper accounts tell how these planes were flying along and suddenly dived into the water; they were smashed to pieces and some of the crews killed, and the Navy Department was investigating. This is the usual stereotyped bureaucratic report. What occurred was that the seaplanes were stalled by their pilots and into the drink they went, breaking up everything.

Land airplanes falling into the water from the same height probably would not have killed their crews or even have been very seriously damaged. One of my officers once landed a single-seater pursuit plane in the Potomac River. It was towed ashore and hauled out on

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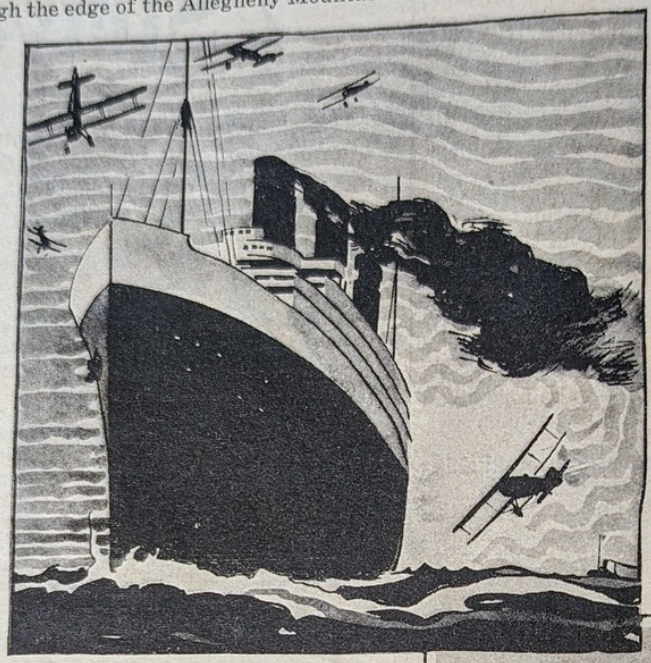
the bank; the water was let out of the wings, the engine was cleaned up a little, and then it was started and he flew off.

The last time I landed in the water was in the Ohio River opposite Moundsville, West Virginia. The river there flows through the edge of the Allegheny Mountains. The shores are precipitous, covered with timber, large boulders, and rocks. As I took off from the airdrome, the compartment in the back part of my plane opened and some of my clothing was blown out of it and stuck on the rudder and tail surfaces. I turned around and went back to the field, had my clothing picked up and the compartment carefully closed, and started out again. This time, when I reached an altitude of about 300 feet, my motor stopped suddenly, with no warning whatever.



Being in the dead air, his plane immediately stalled and he fell straight into the water.

Below me and a little to one side was the river, and all around were precipitous banks. Not a second was to be lost or the ship would be in a stall, as I was climbing, so I put her head down until I obtained a little more speed, then turned her into the wind and landed with the minimum speed in the river. The airplane rested on an even keel for a few moments, then slowly went up on its nose to an angle of 45 degrees and stayed there. Neither my mechanic in the back seat nor I in the front seat was wet.

The excitement of the people on the shore was great, so much so that they forgot all about coming out to us in a boat. I had to swim ashore and get one. When I returned the mechanic was still dry and none the worse for his experience. I took another plane and, without removing my wet clothing, flew right on to Detroit. In this case, had we attempted to land on the shores or hills, we would have demolished our plane.

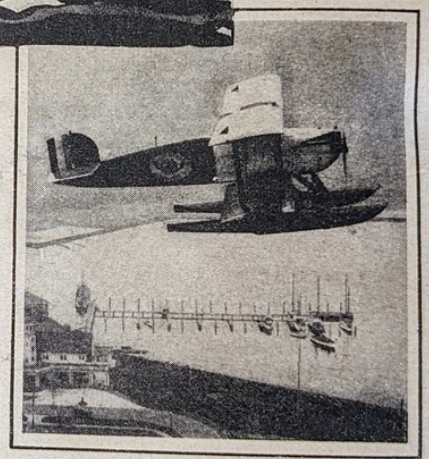
SOMETIMES on taking off one of the wheels is broken or dropped; sometimes both are lost. If a good body of water is near by, it is better to land in it under these conditions. With one wheel off, if a very slow landing is made on the ground and the airplane is inclined a little bit toward the good wheel, a normal landing can often be made. If both wheels are gone and an ordinary landing is made, either the pieces of the landing gear will be broken off and the plane will slide along on its bottom or it may turn over slowly. If fast landings are made, the airplane invariably turns over and is cracked up.

The first time I broke a wheel as I was taking off was in France during the war. A German observation plane had come over our area near Neufchâteau and was taking photographs of our newly created American encampments. I rushed to the airdrome, jumped in my Spad airplane, and did not take time to take off squarely into the wind. Instead, I took off a little sideways, which made my plane begin to swing. In an instant it was almost out of control, but I gave it all the motor I had to lift it off the ground. Just as I did so, I heard something snap and knew it was a wheel, but as I could not see them I did not know which one had broken.

After being in the air for about an hour without seeing the German again, I returned to the airdrome. As I approached, I could see three or four men running around holding wheels up in the air and others pointing up at my plane, signaling that my left wheel was broken. The ambulance was waiting to pick me up and I could see men with fire extinguishers ready to put out the flames if the airplane should catch fire, as they thought it might turn over, smash up, and burn.

I TOOK careful note of the wind, which was quite strong, from eighteen to twenty miles per hour, and came directly into it and selected a part of the field that was uphill. There I landed my plane at its minimum speed, inclined a little toward the side of my good wheel. The plane went along for about thirty feet, lost nearly all its speed, then touched on the stub of the landing gear on the other side and merely spun around. Nothing whatever was broken. The airplane had a new wheel put on it and was in commission within two hours.

Landing in a forest presents an unusual condition. Trees may be from forty to 100 feet high. Their tops are very uneven, some trees being much higher than others. If a forest is rather open, with the trees ten or twelve feet apart, and a glide can be made into it, along its side somewhere, it is not a particularly dangerous undertaking because the airplane can be directed between two trees that are from ten to twenty feet apart. This will smash off both wings, and if the central part of the plane is within ten or twenty feet of the ground it will go ahead without any serious smash, as practically all the speed will have been taken out of it.



Lester Rounds photo

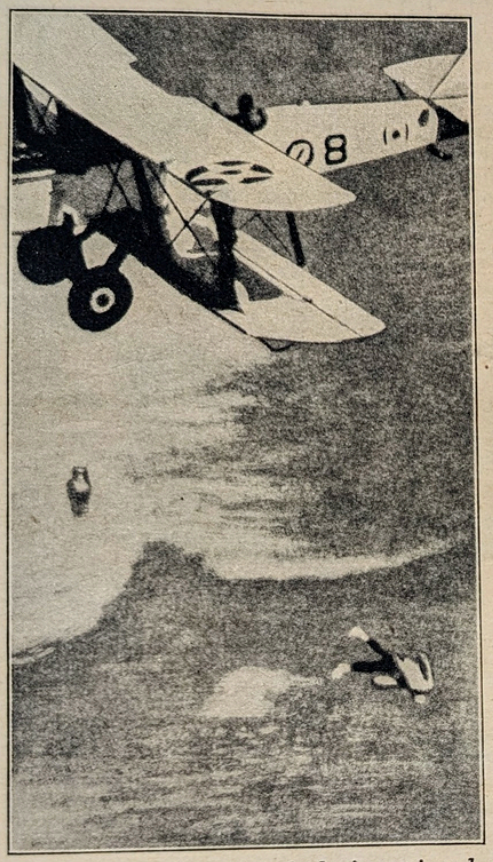
Pontoons, a seaplane's landing gear, as exemplified by the New Orleans.

I made a landing of this kind once on Long Island. Having motor trouble, I attempted to get into a small field and slipped sideways to lose speed. When I got down below the trees I reached dead air, as the wind that had been against me ceased. I saw I would have to go into the forest or stall. I was in a small airplane, alone. I merely directed it between two trees that were about eight feet apart and moved the plane from side to side, "fishtailing" it, as much as I could, to stop its forward motion. When I hit the trees I broke the wing beams in the leading edge of the plane and no harm resulted. I have seen landings made in a somewhat similar manner in several other instances.

Landings have been made in dense forests without killing the passengers or crew. In such cases, the airplanes have been brought in with minimum speed and practically stalled at the time they hit the tops of the trees. The cushion effect of the wings hitting the limbs of trees and letting the airplane come down gradually was sufficient to save the occupants.

Of course, in any of these instances, if the airplane is flying at a high rate of speed and hits an obstruction, it will turn over and spin around and surely kill its occupants. I have had it happen that men hit trees with loads of bombs, when an explosion would occur and blow everything to atoms, not leaving anything of the plane or the crew to pick up.

What should be done by the pilot when a forced landing must be made in mountains? Again, every advantage has to be taken of the circumstances. If there are any fields or clear spaces the airplane can be directed with considerable speed to their lowest point, then turned uphill when within a few feet of the ground. In this way the airplane will lose speed more rapidly than if it were flying on the level, and much more so than if it were flying downhill. To attempt a landing in the mountains downhill is a very dangerous undertaking. If the only clear space presenting itself is the bed of a stream, then a landing should be made with the slowest speed wherever the stream bed looks smoothest. Sometimes it may be better to land between two trees, as described when landing in a forest.



Nowadays, when everybody is equipped with a parachute, most pilots jump out when their engines stop.

IF a landing has to be made into the face of a cliff or vertical cañon, or the sheer side of a mountain, the airplane should be directed straight toward it at its minimum speed and, just before the instant of impact, swung sharply to one side so the crash will be taken out on the end of a wing. In this way the shock will be deadened and the danger of fire minimized, as the airplane will not hit on its nose. I have seen one instance of this kind occur, both the pilot and observer escaping without serious injury. Had they flown straight into the cliff they would have been killed.

Always landings must be made with the minimum speed when the airplane touches the ground, and it is the ability to judge the difference between stalling speed and the minimum safe flying speed that makes a good pilot. A man may be an excellent pilot in the air but a very poor one near the ground, both in taking off and in landing.

Just after we returned to the United States from the European war, most of the flying men were quite dubious about safe flying across the Allegheny or Rocky mountains. They feared it would be impossible to land with safety in this rough country. I therefore took a single-seater airplane, an SE5, that contained only enough gas for one and three-quarter hours' flying. With me I took three of the best pilots in the United States, in two-seater DH airplanes, the only ones available at that time. These carried sufficient gas for about three hours' flying.

I STARTED from Washington, D. C., across the Allegheny Mountains, for Dayton, Ohio. Encountering a heavy head wind as I left the capital, I began to run out of gas when over the Blue Ridge Mountains and determined on landing. I had arranged a signal with Colonel Hartney that he would take command of the three airplanes when I decided to land. So rough was the country that it took me twenty minutes to find a place to go down. It was on a hillside covered with large rocks. I landed and spread a cloth, which I had carried for the purpose, on the ground to indicate where the other planes should place their wheels upon coming down.

Each pilot was an expert in his own method of landing. Colonel Hartney approached the landing point first, sideslipping—that is, letting the airplane lose altitude by tilting it up on its side and letting it slide, keeping perfect control all the way.

A sideslip to a landing is one of the best methods of bringing an airplane in, as there is little chance for stalling if the pilot knows his business.

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Colonel Hartney landed exactly on the mark. Next to come in was Lieutenant Logan, one of the greatest pilots that have ever lived. He glided with considerable speed for the mark and when approaching it swung his airplane from side to side, fishtailing—that is, presenting the flat side of the plane's body to the air so as to kill his speed. Lieutenant Logan also landed exactly on the mark.

The third to land was Major Ocker. He made a very flat slow glide, keeping himself in the air with his engine—that is, as he would approach stalling speed he would give the airplane a little more engine and pull it out, and then repeat the process. He also landed with minimum speed on the cloth.

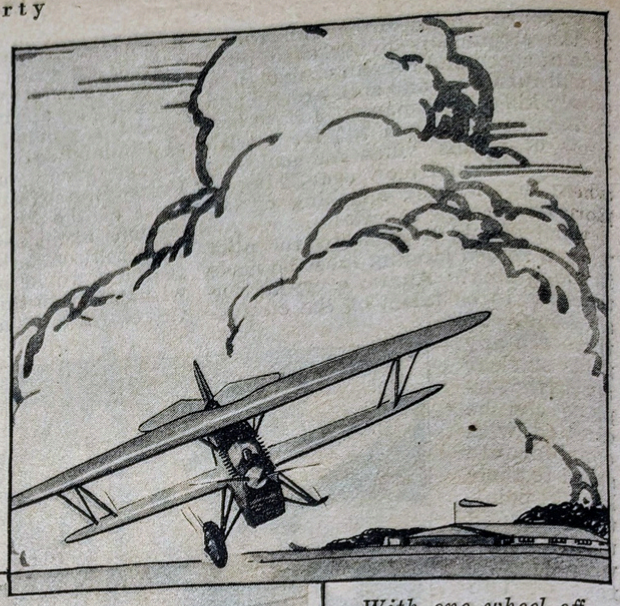
Here were three entirely different ways of bringing an airplane in, demonstrated by leaders in the art of aviation. Each was good and according to the particular temperament of the man making it. While certain rules cannot be transgressed in the air without sure death, a great deal of art is essential in a finished pilot. We made several other landings on this trip in the heart of the mountains, showing that we could get in and out of almost any place.

A forced landing in a fog is one of the worst contingencies that a pilot has to face. Nothing is visible in the direction of the earth.

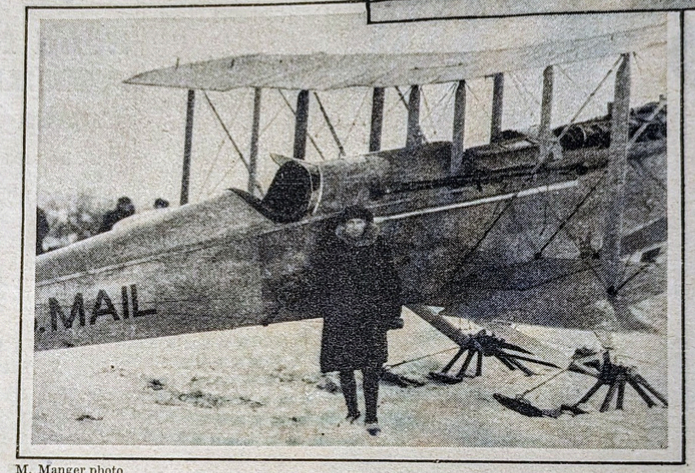
An airplane is only kept on an even keel by the use of instruments. If the pilot is not equipped with a parachute he must remain with the airplane, and the only thing he can do is to let his plane glide down with the minimum speed possible until the crash comes.

He should let out the gasoline, and put some sort of pad in front of his head and chest—coats, clothing, or anything that is soft. He should remove his flying glasses and keep his head as near the pad as possible so that it will not have a long way to swing when it hits.

If the airplane comes down slowly in this way, a pilot has more than an even chance to land safely.



With one wheel off, a normal landing on the ground can often be made.



M. Manger photo

A mail plane in Alaska with skis. A plane with wheels cannot land or take off in more than two feet of snow.

UNDER these conditions also it is extremely difficult not to stall and fall to the earth out of control. Nowadays, when everybody is equipped with a parachute, most pilots jump out when their engines stop or they are forced to land in a fog. A drop of ninety feet is necessary when a parachute jump is made, in order that the chute may open. If an airplane is going at very high speed, say around 200 miles an hour, the chute will open in less than ninety feet. Usually two or three swings from side to side are made by the body of the pilot after the parachute begins to spread out in the air, and it is seldom that a man can save himself before the third swing is made. However, I have seen one instance in which a pilot jumped out of his airplane apparently within 100 feet of the ground and struck it on the second swing. He was uninjured except for a sprained ankle.

We had no parachutes in our airplanes during the war. Many a good man would have been saved had we been able to obtain them. Our balloons had them, and the Germans had them toward the end of the conflict.

Fire is the worst disaster that can occur to an airplane in flight. When those on the ground see an airplane begin to blaze in the air, the fire has usually been preceded by an explosion which has killed or rendered unconscious the people in the plane.

It may occur from a variety of causes. There is no escape under those conditions except to jump in a parachute. Sometimes merely the carburetor catches fire, usually from a back fire in the cylinder.

IN this case the airplane can be slipped sideways, on the side farthest from the carburetor, and either the fire will burn out or a landing can be made on land or in water.

If an airplane with the carburetor on fire flies straight ahead, the fire will stream back and it may cause disastrous results.

I remember once thinking that my carburetor was afire when I was over the middle of Lake Michigan, so I started slipping down toward the water. I kept smelling what I took to be the rubber hose connections in my engine burning. Behind me sat Short, my head mechanic. I motioned to him to stand up so I could speak to him, and shouted in his ear that I thought the carburetor was on fire. He asked me why I thought so. I replied that I could smell the rubber hose connections burning. For reply, he held up a cigar which he had been smoking under the cowling of the rear seat. Its odor had reached me due to the back current along the floor of the plane. At the end of our trip I presented him with some good cigars.

Once in France when I was warming up my engine on the ground the carburetor caught fire and made a great flame. The mechanics near the ship were so excited that they grabbed one of the fire extinguishers which we always had near the planes and, instead of directing the stream toward the engine, hit me squarely in the eyes with it. Fortunately they diverted it and put the fire out quickly, but my eyes remained in bad shape for some time.

Before we had parachutes, many men were lost by fire in the air. Fatalities still occur when a plane catches fire as it hits the ground. This is largely due to the fact that airplanes are not equipped with fireproof and crash-proof tanks.

Landing in deep snow is not a difficult matter. It

In 1932, he won the world land plane speed

should be done in the same way as landing on water. The ordinary wheeled airplane is able to land or take off in eighteen inches or even two feet of snow if it is not too wet. Three, four, or five feet requires skis or special landing gear.

An amusing experience occurred when I landed in the snow at Camp Borden, Canada, a few years ago. I flew up there from Selfridge Field, near Detroit, en route to pay a visit to the Governor General. I was in a two-seater DH plane, with Captain Christie, the British air attaché, as a passenger in the back seat. Lieutenant Bissell, my aide, and Woodruff, a mechanic, accompanied us in another ship. The temperature was a little above zero as we flew across Lake Saint Clair, escorted by about thirty airplanes of the First Pursuit Group. There was very little snow on the ground when we took off and we had been informed that there was less than eighteen inches at Camp Borden, so I decided to use wheels instead of skis, as our skis were none too good. When we arrived at the international boundary, the First Pursuit Group turned back to Selfridge and we went on.

Upon checking my compasses on the shore of Lake Huron, I found them to be 60 degrees off for some unaccountable reason. Having found this out, we kept on our true course. Soon we began to notice that the snow was getting deeper; fences along the fields disappeared; and as we went farther few roads could be made out, for the rest were covered with snow. Then we saw a snow plow on a railroad, tossing the snow in all directions.

AFTER proceeding about 150 miles I decided to go down to a railroad station and read the name, to be sure we were on our course. I came down within thirty or forty feet of a station and read the name, and just as we shot by the back part of the building there was an old man with long whiskers driving a team of horses hitched to a bob-sleigh.

They ran away and threw the old man into a snowdrift, and as we left we could just see his head and whiskers sticking out above it, so we knew we would certainly have trouble in landing in such deep snow.

When we reached Camp Borden we looked down and saw members of the Canadian Air Force running around the airdrome on snowshoes. They had made a circle of charcoal on the snow to indicate where we should land. I signaled to Bissell that I would land and that he should stand by and see what happened, then use his own judgment. After telling Christie to remove his goggles and prepare for a turnover, I came down with the slowest speed possible and landed in the deep snow just at the edge of the circle.

My airplane went ahead in the snow a little way, to the exact center of the circle, then slowly went up on its nose and stayed there. There was no particular jar or shock. I had not hurt the airplane in any way outside of straining the landing gear a little. I looked back at Christie and he was clapping his hands to show his approval of the kind of landing we had made.

IN the meantime, Bissell in the other plane had been watching me carefully. He decided he could make no better landing than I had, and possibly a worse one, so he told Woodruff to take off his goggles and fold his arms in front of his head as they landed, to protect himself from the shock. He shut off his main gas tank and let the pressure out of it, to guard against an explosion, and shifted his engine on to the small emergency gravity tank in his upper wing. He looked to see if any grass was sticking up through the snow, because that, he thought, would be an indication of a rise of ground where the wind had blown the snow away, and at that place there would only be a few inches of snow.

Having found a place he thought was suitable, he came down, stalled his ship about six feet above the ground, and let it fall.

Down it went into the snow for several feet, because what he supposed was grass was the tree tops sticking out of a ravine that was filled straight across with snow. No one was hurt, but it damaged his undercarriage and propeller, and the Canadians had to shovel out a trail to the place and then bring horses to plow out a space around the airplane before they could extricate it.

When we returned a few days later we fitted our airplanes with skis. We found that the snow was so mushy and wet that we could not get off easily, so the evening before we were to leave I had two pieces of log dragged across the snow in the direction of the wind.

During the night this trail froze hard and I was able to get off the following morning without any trouble.

I had learned the trick of making trails in this manner many years before in Alaska. If soft snow is stamped down and allowed to remain overnight, it invariably freezes hard.

Landing in soft and muddy ground is another matter that requires careful attention. Again the minimum speed must be used.

Often when the tail of the airplane starts to go up on encountering mud, a good blast on the propeller will direct a stream of air back on the stabilizer which will hold the tail down.

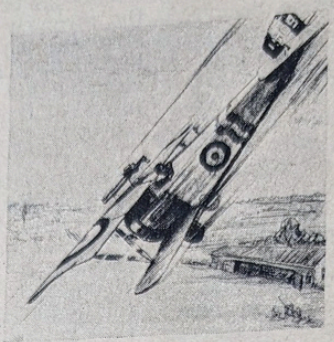
[CONCLUDED ON NEXT PAGE]

GETTING DOWN

[Continued from page fifty-five]

In getting out of muddy places, the wheels of an airplane frequently throw large gobs of mud up on the propeller and break it. This can be counteracted by smearing the wheels with heavy oil or axle grease, which will prevent their picking up the mud.

When airplanes parked on the ground are hit by heavy winds, many pilots new at the game are inclined to face the airplane toward the wind. But an airplane is made to rise when it goes forward. What should be done under these conditions is to put the airplane's tail to the wind and pass a rope, attached to two stakes secured in the ground, over the back part of the fuselage, and also to tie the control members in the pilot's seat. If the wind shifts the airplane has to be shifted, and in this way airplanes can ride out terrific storms. If they are headed into the wind, they will be blown upward and turned over on their backs.



Airplanes are being improved constantly. Instruments are gradually taking the place of the human element. Some day we shall obtain devices that will prevent stalling, that will automatically level off the airplane near the ground and land it, that will take the airplane off the ground and direct it straight through the air.

But for many years safety in flight will depend, in the last analysis, upon the ability, resourcefulness, and coolness of the man at the controls.

In the world's history, no individual has had to assume and shoulder a greater responsibility, or show quicker and sounder judgment, than the airplane pilot of the present day.

THE END

Prize Winners—A New List

Awards have been made as follows for the detection of errors in the "How Many Mistakes" picture which appeared in Liberty for October 19.

FIRST PRIZE—$500

H. L. Dobbin,
100 Fifth Ave., New York, N. Y.

SECOND PRIZE—$200

Edwin K. Borchard,
316 E. Dudley Ave.,
Westfield, N. J.

THIRD PRIZE—$100

Charles H. Gaines,
Oriental Bldg.,
Washington, D. C.

FORTY PRIZES OF $5 EACH

Catherine Akermann, 1137 Dupont St., Camden, N. J.

E. I. Angell, 2970 Sheridan Rd., Chicago, Ill.

Mrs. Ethel Armbrecht, 1200 S. Virginia St., Reno, Nev.

D. Floyd Barber, Alder Creek, N. Y.

Wm. E. Benedict, 4621 Dawson St., Seattle, Wash.

Jeanne A. Billings, 1916 Grand Concourse, New York, N. Y.

Ray Blain, Ft. Hayes, Columbus, Ohio.

Ferne Buttery, 3527 Holles Ave., Toledo, Ohio.

Felix Cadena, Prince Hotel, Houston, Tex.

Mrs. H. T. Carey, 257 E. Eighth St., Erie, Pa.

Mrs. G. H. Coffelt, 1804 W. Fortieth St., Oklahoma City, Okla.

Conrad Daniels, 1008 Oregon St., Urbana, Ill.

Gertrude M. Drake, 1294 E. 21st St., Portland, Ore.

H. T. Enstice, 217 Kearny Ave., Kearny, N. J.

Roberta Goodrich, 191 Orchard Lane, Columbus, Ohio.

D. H. Grootenboer, 825 W. Market St., Pottsville, Pa.

James J. Hagan, 512 Lafayette Bldg., Philadelphia, Pa.

Jane Hunt, 1402 Forest Ave., Dallas, Tex.

Wm. A. Jenkins, 952 Linden St., Allentown, Pa.

W. A. Kentner, 301 E. Broad St., Richmond, Va.

W. F. Lacaff, 3942 Wyandotte St., Kansas City, Mo.

E. S. Ladley, Kennett Square, Pa.

R. MacCarthy, 139 Lee Ave., Toronto, Ont., Can.

Mrs. H. McCartney, Jr., 1422 Seventeenth St., Bradenton, Fla.

S. R. Mountsier, Jr., 54 Church St., Hamden, Conn.

John T. J. Mulligan, 3504 E. Baltimore, St., Baltimore, Md.

Kathryn V. Neville, 1007 Washington St., Charleston, W. Va.

Raymond L. Posey, U. S. Naval Hosp., Chelsea, Mass.

L. R. Prather, 816 B. F. Keith Bldg., Cleveland, Ohio.

E. M. Robertson, 213 S. Eighteenth St., Keokuk, Ia.

Edna A. Rodgers, 2415 Rexford Ave., St. Louis, Mo.

Mrs. P. A. Sieverling, 405 E. Northern Ave., Springfield, Ohio.

Mrs. Watson Sittel, 702 W. Beech, Durant, Okla.

A. L. Smith, San Diego Hotel, San Diego, Calif.

Helen C. Struebin, 86 North End Ave., Kenmore, N. Y.

Stanley H. Vegors, Henry Ford Hosp., Detroit, Mich.

Arlie Weaver, 1435 Herschell Ave., Indianapolis, Ind.

Mrs. Jos. H. Webber, 606 Greenwood Rd., Roanoke, Va.

Robert Willard, Box 1143, Missoula, Mont.

Mrs. G. E. Williams, 909 Weschler Ave., Erie, Pa.

Prize awards for the picture in the October 26 issue will be announced next week.

Now turn back to page 16 and read about Liberty's contest, The Patriotic