Aviation's Most Silent Partner

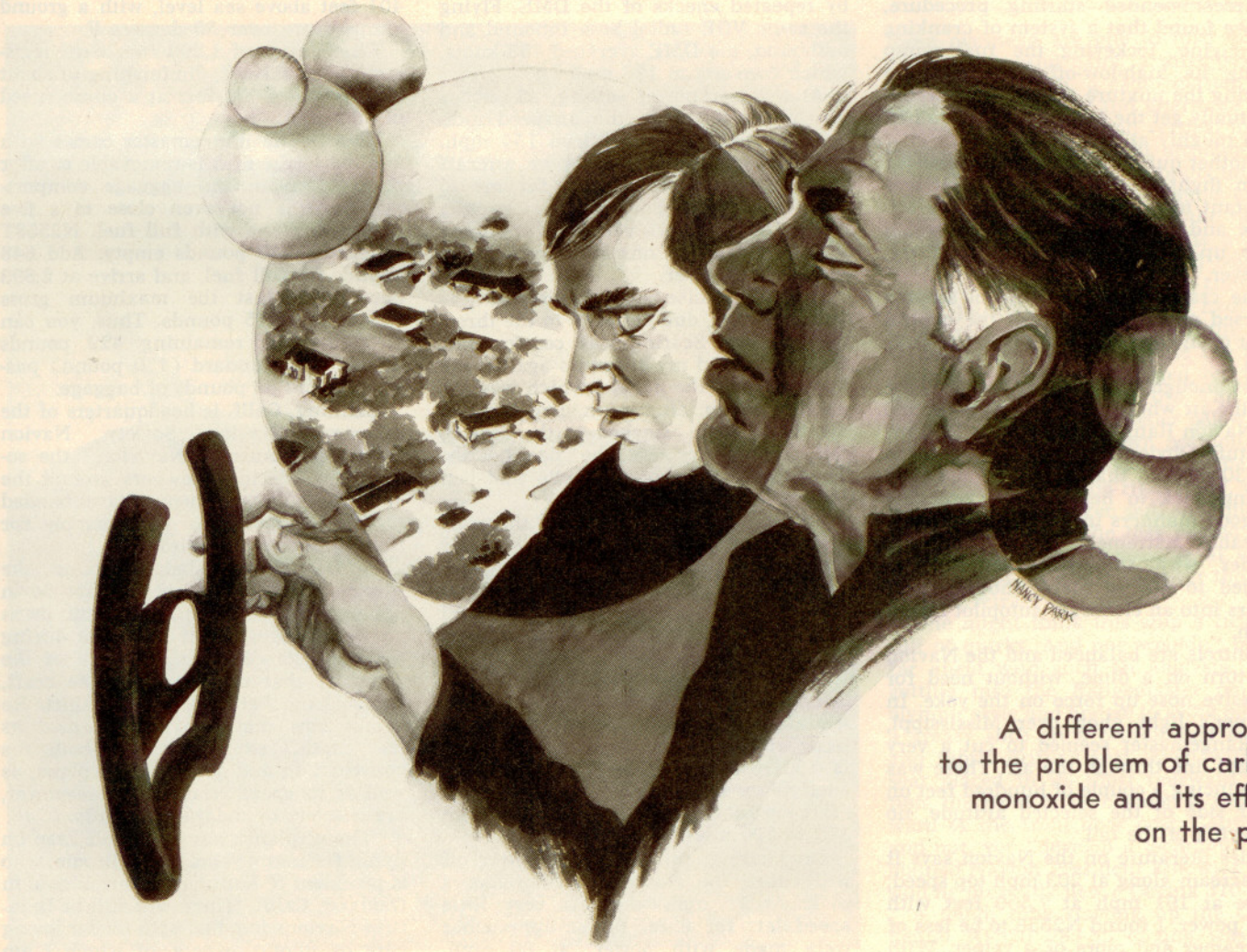
by JAMES D. GREINER / AOPA 500038

■■ To most of us, amateurs and veterans alike, the substance called carbon monoxide gas is merely a rather vague term included in FAA bulletins and high school chemistry texts. We have seen the little plastic indicators attached to the panels of small aircraft, but once airborne we pay them scant attention.

Ask a pilot what carbon monoxide is and he will invariably reply, "It's a poisonous gas which can kill you if you breathe too much of it." Although this sounds like the correct answer it is not, for carbon monoxide (CO) is not poisonous in the usual sense, and in airplanes rarely kills in the manner most airmen assume.

One fact stands out clearly—precious few of us have ever had the opportunity to find out for ourselves what inhaling more than our share of this invisible, odorless product of all internal combustion engines is really like. Two exceptions are Geoffrey "Pop" Fountain and his passenger Tom Johnson, both of Fairbanks, Alaska.

On Palm Sunday, 1969, Fountain took off in his green and white Cessna Skyhawk from Fairbanks International's Runway 19 Right, departed the pattern, and by habit trimmed the little plane slightly nose down at 1,500 indicated. Sixty years old and operator of a local service station, he was a veteran of several thousand hours of Alaskan bush aviation. Johnson, a 30-hour student pilot, was along for the ride, which was planned to be short. Fountain would fly east to the settlement of North Pole, only 10 miles away, for the purpose of



A different approach to the problem of carbon monoxide and its effect on the pilot

"warming the engine properly" prior to a needed oil change.

Bright sunshine flooded the plane's cabin as Pop lit a cigar from a supply of a half dozen in his breast pocket. He offered one to Johnson, who accepted though he did not normally smoke them, and puffing on the stogy the younger man settled back to monitor the Cessna's gauges. In minutes the plane overflew North Pole, and Fountain rolled into a gentle 180-degree turn, heading back to the airport. It was at this time that Johnson recalls feeling mildly nauseous and, blaming it on the cigar, he extinguished it.

Having crossed the frozen and braided Tanana River and with Fairbanks over the nose, Fountain prepared to call the tower for landing instructions. "We were just passin' over Blackie's Liquor Store, and I noticed that he had a large number of cars out front," he recalls. "I turns to Tom and says, he's sure doin' a business, and old Tom just kinda went Unnn-Hunhh. I didn't pay him much attention, reached for the mike and . . . ". What happened next? A vague, "I'll be damned if I know," is the best that Fountain can come up with.

"I remember staring at the bent prop tip about six inches from my face," says Johnson. It took him several long minutes just to be certain that he was, indeed, looking at an airplane propeller and in the cold afternoon silence he worked at sorting out the jumbled thoughts his drugged mind was forming. "It was getting dark and I could see Pop over on my left, slumped onto the panel and out cold. I remember wiping his forehead, because of the blood getting in his eyes, and recall wondering why I was having so much trouble pushing myself back in the seat. I thought for one horrible moment that my back was busted and I guess that it really wasn't 'til then that I realized I'd been in an airplane crash."

Johnson craved a cigarette, but for some reason and despite the fact that he was not aware of the odor of leaking avgas, he did not light one. Instead, he turned his attention to his partner. "I shook him and after a bit he came around. He asked me if I was all right," Johnson recalls, "and I assured him I was. I had found that my back was not broken after all, and that my problem with moving stemmed from the airplane being tipped steeply on its nose." Somehow, the two men got out of the plane, though Johnson finds it impossible to remember just how.

Fountain's recollections are interestingly different from Johnson's. Among other things, Fountain does not remember regaining consciousness until he discovered himself standing hip deep in the powdery snow, staring at his ruined airplane. "I was shivering, my head was throbbing, and my leg hurt terribly. I told Tom to get some firewood and he just stood over there and agreed it was a good idea, but he didn't move. I finally went and got some myself and got a fire going several hundred feet away from the airplane. Then Tom went over (he does not recall doing this) and got a flashlight and blanket out of the plane. Then he starts flashing the SOS signal at passing planes."

It was almost dark when a passing student pilot and his instructor spotted Johnson's light signal, in minutes a helicopter plucked the two men from the snow, then rushed them to Bassett Army Hospital at nearby Fort Wainwright.

During the weeks which followed their rescue they had adequate time in which to ponder frustrating questions, such as how long the Cessna flew after they blacked out. They will never know. Some observers speculated that Fountain flew the airplane to a safe landing, but because of his near unconscious state, failed to recall doing so. Pop Fountain doubts it. Whatever happened has been relegated to the category of the academic. But one fact emerges loud and clear. Both men were victims of the gas called carbon monoxide.

During recent years, many experts have been taking a considerably different look at the effects of CO. Prior to now, simple cause and effect speculation have sufficed to alert the pilot to the dangers involved and believing what he reads, the average airman blunders ahead fully confident that if he should somehow be exposed to the effects of the gas, he will feel the oft-quoted tightening of the skin over his forehead and cheeks. He will, he assumes, at least experience nausea and dizziness, then, continuing to follow the terse dictates of his flight instructor or the last FAA bulletin he read, he will open a cabin vent and execute the necessary "precautionary landing."

The facts tell us otherwise. Unless we consider them carefully, some of us will surely continue toward a grim and abrupt termination of our flying careers.

Though there seems to be little, if any, reliability in the time-honored symptoms of CO exposure, there does appear to be a pattern in the conditions which lead up to it. Winter, as most of us know is the time of year when problems are most likely to arise.

During the cold months we fly with cabin air vents closed and cabin heat full on. Many airplanes are equipped with winterization kits, which consist of sundry devices, most of which are designed to decrease the cooling effects of winter air upon engines and oil coolers. Such alteration of cowling inlets also decreases ventilation of the engine compartment.

I asked Cliff Westbrook, General Aviation Inspector stationed in Fairbanks, about the means available to the general aviation pilot by which he might assure his safety with respect to carbon monoxide.

"First of all, most pilots believe that the most obvious way of cleaning the air in the cabin of their airplane is to open a vent," he said. "If CO is entering, sometimes this is the worst thing that can be done." Westbrook commented upon my look of surprise, then continued.

"Certain vents are designed so that, rather than creating an airflow to the inside, opening the vent causes suction, pulling air out of the plane.

"If CO already is entering through openings in the firewall, and perhaps other places, this suction will only serve to increase the flow. In addition, the spiralling slipstream also contains carbon monoxide, though in rather small quantities, and as a result exhaust gas being sucked in will only serve to increase the already existing problem."

In addition to Westbrook's words, another situation which came to mind as I listened, also relates to simple ventilation of the cockpit area. I know of several Super Cub drivers who religiously crack the sliding window at their left "to make sure that the air in the airplane stays fresh."

I fly a Citabria and do the same thing. Next time aloft, I plan to determine which way the wind blows. In actuality, Westbrook's proposition has already been adequately proven, as should be common knowledge to those pilots who fly the Cessna 185. AD notes have required that this model be equipped with auxilliary air scoops whose sole purpose is to accomplish exactly what Westbrook proposes—pressurization of the aircraft's fuselage against exhaust gases.

No one argues that the single most dangerous source for carbon monoxide is the heater system of any airplane. Muffs carrying fresh air to cabin and carburetor heat inlets surround the exhaust stacks. The muffs are precision made of high-quality stainless steel on most airplanes, and with proper and thorough annual inspection remain highly dependable for long periods of time.

Many pilots have learned that white streaks near slip-ring clamps in the exhaust system signal leaks, and they look for them during preflight. These white streaks, however, tell little, if anything, about the internal condition of the muffs. I have flown many rented Cherokees, which bore these chronic stains and know that after just so many careful preflights of the same airplane, they garner no more attention than the presence of the engine itself. Are these white streaks a valuable aid in the detection of a possible carbon monoxide

source? I asked Westbrook.

"Not really," he said. "Part of my job entails routine testing of aircraft for carbon monoxide levels inside. I've found over the years that not only do most single-engine planes have readable levels inside, but that a shocking number are downright dangerous. Many of these airplanes, especially the older models, seem to remain relatively safe only because of the number of cracks and crevices in the fuselage, which continually ventilate the cabin."

What about the little plastic CO indicators that we've all seen on the instrument panels of the airplanes we fly? "They're fine," says Westbrook," in fact, they seem to be supersensitive." When I admitted that my own airplane was not so equipped, he suggested that instead of buying one I purchase a dozen. "Remember, these little gadgets are not designed as a means by which you can monitor the air over extended periods of time.

They are merely test devices—it says so right on the package they come in. But many pilots fail to read the directions and therefore use them for a purpose for which they were not designed. Use a fresh one, per directions, every 25 hours aloft, and then throw it away. The indicators become inaccurate with age, gradually turn dark, and the pilot does not notice it even if he scrupulously monitors the device while flying."

I mentioned earlier that carbon monoxide gas is not poisonous, and this is a true statement. Unlike chlorine gas and others, CO itself does nothing corrosive to the human system. It does, however, limit the amount of oxygen, that comes with the air we inhale, we can utilize. Just how this occurs was explained to me by Dr. Wayne Myers, director of the University Of Alaska's school of human medicine. Myers is an expert on CO, being currently involved in experimentation with the air Fairbanksans breathe while laboring along in dense ice fog which forms when temperatures plunge to the minus-40-below level each winter. The condition intensifies the concentration of carbon monoxide gas as well as that of other noxious elements, but that's another story.

"It might help to think of a given red blood cell as a light aircraft, perhaps a Cherokee Six," said Myers, "certified to carry a maximum of six passengers. Imagine twelve people waiting on the ramp, four of whom are burly pipeline workers and the rest elderly women. With the outside air temperature standing at 60 below zero, a free for all erupts. Obviously, the construction types are going to get seats leaving only two vacancies, one of which will be occupied by the pilot. The lone passenger and pilot can now be likened to oxygen molecules, and the heavies as CO molecules.

In short, he continued, "since both oxygen and CO molecules ride on the surface of red blood cells, the latter can compete for space much more effectively. Thus, when we breath excessive amounts of CO (there is always some in any air that we inhale), the molecules dive right in and limit the amount of available space for oxygen transport. In an atmosphere heavily laden with CO, it does not take long for the red blood cells to become pushed aside, then the body suffers."

I asked Myers about Pop Fountain's freakish dilemma. This was an event he was familiar with for, having been stationed at Bassett Army Hospital, he examined the two men when they were brought in.

"In Pop's case, all of the classic factors were present. The airplane was tightly closed during the flight. Both men were smokers and smoking at the time. The plane's exhaust system was defective, judging by the rapid rate at which they were overcome. Also, and importantly, Pop was overweight. Such individuals tend to assimilate dangerous levels of blood CO at an accelerated rate, especially if they use tobacco. In addition," Myers added, "It is a known fact that tolerance levels for CO vary considerably with individuals, and this is something that medical science does not understand as yet."

Hypoxia, a condition with which most pilots are reasonably familiar, stems from the same basic cause as does CO suffocation—a simple lack of available oxygen in the bloodstream. Treatment for both conditions is identical, the administration of pure oxygen. One large and glaring difference between the two ailments is the recovery time. After exposure to CO, several hours are often required before the body can dispel the effects of the gas, while recovery from hypoxia is dramatically rapid. An important, and possibly critical point relative to this recovery time, was made by Myers.

"Because of the difficulty the body has in throwing off the excess CO in the bloodstream, heavy exertion, especially after unconsciousness, should be avoided at all cost. It is common for a victim to panic after coming to and then suffering a coronary, simply because the heart was unable to pump blood fast enough to supply the body's oxygen demand."

Is there a safe method of assuring oneself that, while operating an aircraft, he or she will not suddenly lose consciousness without warning? Aircraft mechanics and FAA officials with whom I talked offered a somewhat hesitant "yes." Safety relates basically to preflight habits, and the development of meticulous inspection and maintenance of your airplane. During preflight, look for openings in the firewall of the bird, as a departure point. Sealant, applied at the factory around cables and wires, often hardens with age and falls out. Inspect the muffler system thoroughly.

One mechanic advised poking a flexible stick up into the open end of the exhaust pipe(s), and feeling around with its tip for soft spots which might indicate breaks in the inside wall. Also, though they tell little about the insides of the exhaust system, look for white streaks near attach points and clamps. If they grow or look excessive, ask a good mechanic about them.

Finally, invest a few bucks in several of the disc indicators, and use them periodically as directions prescribe. Remember they are only test devices, and can be used with a minimum of fuss and bother, even if the airplane is a rental. If you own your own plane, there can be no excuse for not making these periodic tests. While flying, avoid excessive smoking enroute, and by all means, check the airflow direction when you open a window or air vent in the plane you fly.

As has already been suggested, the FAA is taking a new look at carbon monoxide and its relation to aviation. Several investigators with whom I talked, indicated that during recent times, heretofore unexplainable aircraft mishaps have come under suspicion. As a result, the general consensus points to the fact that this odorless and tasteless component of the air we pilots breathe may well have been a contributing factor in many of them. Even if unconsciousness does not result—and in reality it seldom does, given the ominous lack of noticeable symptoms—carbon monoxide could, at the very least, have been a major cause of accidents thus far relegated to the unexplained or vague pilot error category.

In line with such a thought, consider cases which have actually been recorded where pilots complained about very mild dizziness and/or nausea after flying. Several hours—or days—later, they walked into their favorite flight surgeon's office, were examined and found to be disgustingly healthy. Why? Because the blood had cleared itself of the carbon monoxide which was causing the problem. After several such visits, competent aviation medics have given up, and classified their patient's problem as "undiagnosable"—a legitimate reason for license revocation.

I have had a glimpse into the gray world of this silent partner which could creep into my life at virtually any time, and sense that to ignore the possibility could prove to be very wrong, and terribly expensive. □