Printed by David Syme & Co. Limited, publisher of "The Age," 233 Collins Street, Melbourne, C.1.

# AVIATION SAFETY DIGEST

DEPARTMENT OF CIVIL AVIATION AUSTRALIA

No. 45 MARCH, 1966

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Department of Civil Aviation . . . Australia

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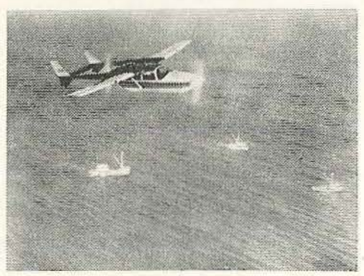
## Contents



Australian Tuna Fisheries Cessna 337 seen against the background of the Company's fishing vessels at sea south of Eden, New South Wales. The security afforded by the aircraft's two engines, coupled with the excellent downward visibility offered by its high wing, makes the aircraft very suitable for deep sea tuna spotting operations off the continental shelf of south-eastern and southern Australia.



*Aviation Safety Digest is prepared in the Air Safety Investigation Branch and published quarterly. Enquiries and contributions for publication should be addressed to The Editor, Aviation Safety Digest, Department of Civil Aviation, Box 1839Q, P.O., Elizabeth Street, MELBOURNE, C.1.*





# WINTER WEATHER WISE

Once again we are on the threshold of a season when we must expect weather conditions to complicate to some extent the operation of light aeroplanes. Days will be shorter, low cloud and poor visibility more in evidence, weather conditions generally less predictable and less favourable to VFR flight, air temperatures will be more conducive to engine icing, and frost will form on aircraft left standing overnight in the open. None of these problems of winter flying need be particularly hazardous in themselves but if we do not make allowances for them and if they catch us unprepared, they can compound, more easily than summer flying conditions, to set the stage for an accident.

Some aspects of winter weather operations are mentioned in this issue of the Digest; other problems are to be discussd in our June issue. But the one potentially most dangerous has already been discussed at some length in previous issues. The situation arises when pilots not qualified for instrument flight press on into deteriorating visibility, often at low altitude, to the point where visual reference is finally lost altogether and the pilot either loses control of his aircraft and it dives into the ground, or the aircraft simply collides with obstructing terrain. Two years ago, four accidents of this type occurred within a period of six weeks and cost the lives of eight persons. These accidents prompted the Director-General to write personally to all light aircraft pilots, and all four accidents were subsequently reported in the Digest.

Last year, it seems, pilots were much more on their guard against being caught in similar weather conditions, and there were no accidents in Australia arising directly from this cause. But man forgets and it might well be that some pilots has already forgotten the tragic lessons at Burketown Ballarat and in the Adelaide hills. So let any who are inclined to be sceptical first look again at the circumstances common to all these accidents and ask themselves how they would have reacted.

Then let each of us go about our flight planning and operations in the coming months, determined that they shall be accident-free, and that winter flying conditions will not find us wanting in flight preparation or airmanship.

# FIRE IN FLIGHT

**While a Viscount 832 was en route from Canberra to Melbourne on a regular public transport flight on 4th August, 1965, an uncontrollable fire developed in the No. 1 engine. The captain diverted to Mangalore, Victoria, where an emergency landing was made in the dark with all emergency services standing by. Thanks to the actions of the flight crew and the efficiency of the fire crew, the intense fire was confined to the engine nacelle and all occupants were able to evacuate the aircraft safely.**

The Viscount had departed from Canberra at 1800 hours Eastern Standard Time with a crew of five and 38 passengers. The flight proceeded uneventfully until soon after the aircraft had passed the Kelly reporting point, 86 nautical miles north-east of Melbourne, but, at 1843 hours, just as Melbourne Control was acknowledging the aircraft's position report, the aircraft without warning yawed violently to port with the noise of a rapidly coarsening propeller. The first officer uncoupled the auto pilot and the captain took control but just as suddenly the yawing ceased and the aircraft swung back to its original heading. A few seconds later the yawing and propeller noise occurred again. As the aircraft swung to port the second time, the first officer saw the No. 1 feather light flicker and the No. 1 turbine gas temperature gauge rapidly decrease to 850°c from the abnormally high indication of 900°c. In cruising flight, the turbine gas temperature indication is normally about 730°c. At the same time, the first officer noticed the engine torque pressure gauge fluctuating between 60 and 90 pounds per square inch. Normal cruise torque pressure is around 220 pounds per square inch and the propeller auto-feathers at 50 pounds per square inch.

Again the yawing ceased and the aircraft returned to its heading. The captain called for the feathering drill and crew identified and shut down the No. 1 engine. The captain was using the wing inspection light to visually check that the propeller had feathered when the senior hostess reported sparks were coming from the engine. A few seconds later the No. 1 engine fire warning came on and the fire warning bell began ringing. The captain called for the "engine fire in flight" drill and the first officer fired the No. 1 fire extinguisher bottle while the captain reduced airspeed to 150 knots. The fire warning continued and after 45 seconds the second bottle for No. 1 engine was fired. Still the fire warning system operated,



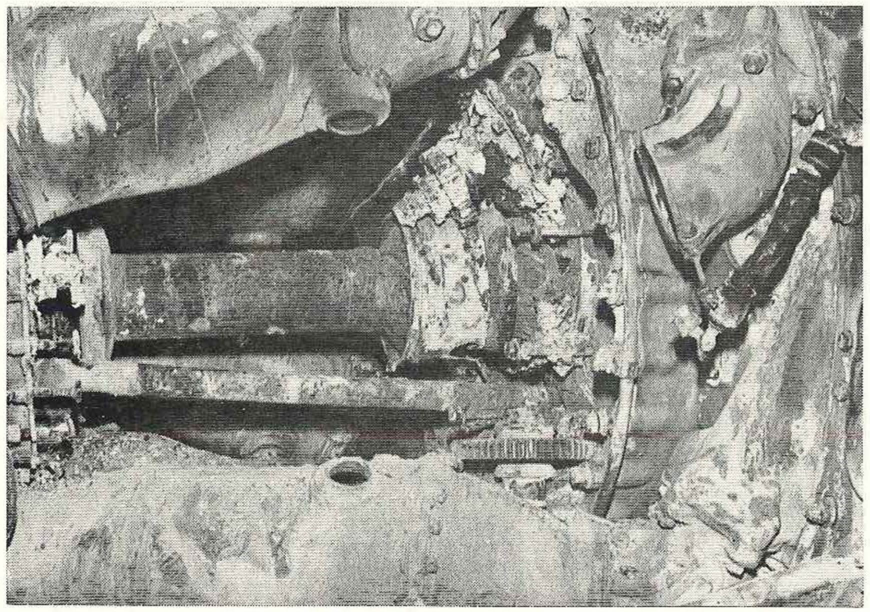
so the first officer isolated the bell, and at the captain's request, advised Melbourne that the aircraft had an engine on fire and they would divert to Mangalore, which was some 30 miles closer than Melbourne.

As the aircraft was being progressively stepped down by Melbourne Control, the senior hostess reported more sparks coming from the engine. The first officer went back to the passenger cabin to visually check the No. 1 engine but there was no indication of fire. He returned to the cockpit and the crew completed the descent check list. At 6,000 feet, the aircraft arrived over the Mangalore N.D.B. in cloud, and the captain began a descending turn with the intention of intercepting the north-eastern leg of the V.A.R. At 4,500 feet, still in cloud, the engine fire became visible from the cockpit as a brilliant white glow increasing rapidly in intensity. Glowing pieces of metal and showers of sparks streamed back from the engine and the fire seemed to be enveloping the wing. At 4,000 feet the aircraft broke out of cloud two miles abeam the south-western end of Runway 23. Deciding that an extreme emergency existed and that the aircraft must be landed in the shortest possible time, the captain closed the throttles, selected the undercarriage and flaps down, and instructed the first officer to complete the pre-landing checks. The captain reduced speed to 135 knots, and banked the aircraft steeply into a minimum distance left circuit for runway 23. It was 1906 hours as the aircraft touched down.

As soon as the captain had braked the aircraft to a halt on the runway, he ordered the three live engines feathered, the flaps retracted to the 32 degrees position to facilitate evacuation of passengers over the wing, and requested the first officer to supervise the evacuation of the passenger cabin. The captain remained in the cockpit to complete the emergency "engine fire on the ground" drill.

Meanwhile, the previously alerted Mangalore fire crew had taken up their fire-fighting positions near the blazing engine and were confining the fire to the nacelle with a covering of foam over the port wing and fuselage side. The fire crew had correctly assessed that the fire was being fed by burning magnesium, and were withholding any attempt to extinguish it until every one was safely out of the aircraft.

*Fig 1. The intermediate casing completely burnt away, exposing the damaged compressor shaft and auxiliary drive gear trains.*



Seeing that the engine fire was still well alight and that the fire crew were playing foam over the port side of the aircraft, the first officer opened the starboard rear door, placed the escape chute in position and opened the three starboard emergency exits on to the wing. The captain came down from the cockpit, left the aircraft by climbing down the side of the escape chute to check briefly with the fire crew, then ordered the passengers to leave their hand luggage behind and evacuate the aircraft. While the captain supervised the passengers leaving via the chute, the first officer assisted others out through the over-wing exits and down on to the ground. The three hostesses were the last to leave the aircraft and the captain directed them to group the passengers together 100 yards behind the aircraft. He and the first officer then obtained a ladder from the fire crew and climbed back into the aircraft to ensure everyone was out. The first officer turned off the master power switch and the captain informed the senior fireman that the aircraft evacuation was complete.

Using dry powder and carbon dioxide, the fire crew then attacked the main fire in the engine. It was quickly contained but the engine cowlings had to be removed before the extinguishent could penetrate to the source of the fire, the burning magnesium intermediate casing of the engine. A secondary fire was burning in the nacelle behind the fire wall and the captain used an axe to cut holes in either side of the nacelle to allow the fire crew to reach it. It was put out almost immediately but the main magnesium fire could not be finally extinguished until pieces of the burning magnesium alloy had been raked out on to the ground and a layer of foam used to smother what fire remained in the engine.

It was found that the engine fire had been sustained principally by combustion of the magnesium alloy intermediate casing, which was almost completely destroyed. (Fig. 1). Residual fuel in the low pressure fuel line, and engine oil probably also contributed to the intensity of the fire. Incandescent magnesium falling from the burning casing had burned a large hole in the underside of the engine cowling (Fig. 2), but the rest of the cowling was intact though buckled by heat. The fire behind the bulkhead had been burning in two places. Electrical insulation had ignited from radiant heat, and waste oil lying in the base of the engine cowling had been set on fire by hot gas and magnesium particles coming from the engine breather pipe. The engine fire had been extinguished before it could damage the airframe structurally.

A detailed examination of the damaged engine after it had been removed from the aircraft, disclosed a failure of the rear compressor bearing. Metal from the failed bearing had contaminated the engine oil scavenge filters and the main pressure filter. Cracks in the flame tube air cases, the flame tube support lugs and the failure of an oil cooler mounting lug indicated that the engine had been subjected to high vibration. Mechanical damage to the blades of the second stage compressor, the bearing air seal and the teeth of the gears in the auxiliary drive gear train, suggested that the failure of the rear compressor bearing had been the primary failure, permitting the second stage compressor shaft to move forward until the turbine to compressor spline drive became disconnected.

There was no evidence to suggest that the engine fire had been started by torching emitted from the combustion chambers, and there was little doubt that the fire had originated from over-heating of the failed compressor bearing. The bearing had obviously been extremely hot and had probably ignited its lubricating oil. Once started, the fire would have been fed with air from the failing adjacent bearing oil seal, and would have spread from the inside to the outside of the magnesium alloy intermediate case, where it became visible to the crew from the cockpit. The fire warning system would have been triggered by the detector mounted on the engine breather pipe while the actual fire was still confined within the engine. Under these circumstances, the external fire extinguishing system could not be immediately effective.

The two instances of the aircraft suddenly yawing to port, which were the first indications of trouble, were determined to have been caused by the No. 1 propeller auto-feathering. A strip inspection of the propeller revealed no evidence of any malfunction and the auto-feathering process was probably initiated by a fall in lubricating oil flow to the torque meter pump, resulting in the engine torque pressure indication momentarily falling below the auto-feather setting.

### COMMENT

In the first place, the incident manifests the worth of team efficiency and sound training in dealing with emergencies of this nature. Had it not been for the way in which the aircraft crew handled the situation in getting the aircraft safely on to the ground in the least possible time and organizing the safe evacuation of all occupants, and for the sound judgment and concern for safety shown by the Mangalore fire crew, what amounted to no more than an air safety incident could instead have easily been a major aircraft disaster.

Secondly, the incident has a vital word to say about fire warnings. Because false fire warnings occur far more frequently in aircraft than do actual engine fires, there is a tendency for crews to discount cockpit fire warnings as "false," if they cannot see any visual indication of fire. The R.A.A.F. are also very concerned with this attitude by crews and the problem is discussed in some detail in a recent issue of the R.A.A.F.'s "Flight Digest." Some of their comments are extremely pertinent to this aspect of the Viscount fire and we have been given the R.A.A.F.'s permission to quote them—

"Fire in the air is not a common occurrence in modern aircraft, but it does occur, and not as infrequently as we should hope. Recognition of this continuing hazard to aviation is reflected by the inclusion in even the most modern aircraft, of highly sensitive fire warning systems, and costly, complex, highly efficient fire extinguisher systems. Technological effort is constantly being expended to increase the reliability of these systems, but infallibility is still a long, long way off . . .

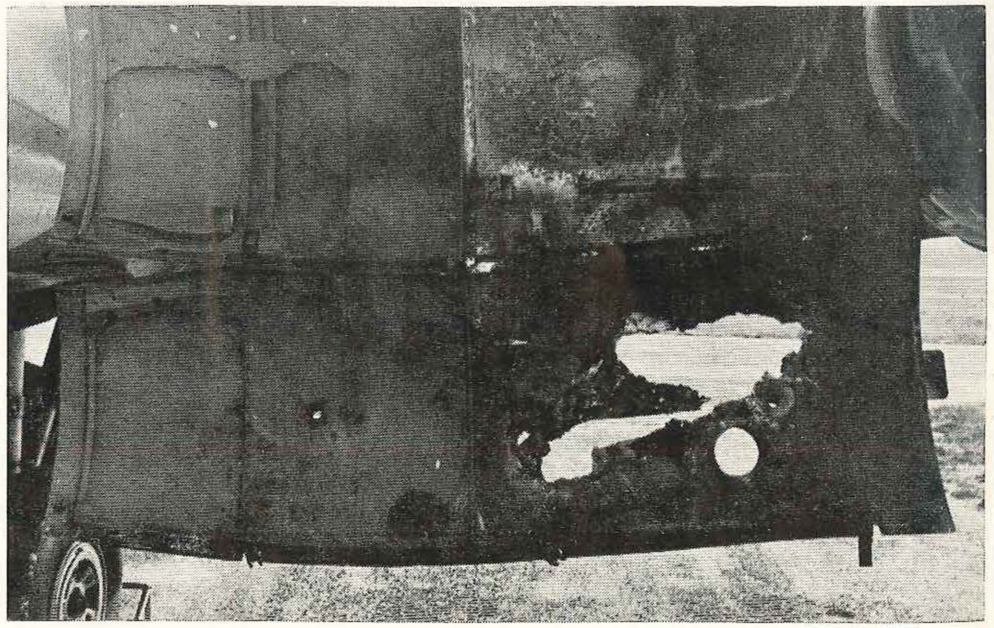
"In 1959 the eight-man crew of a Neptune perished when the aircraft crashed while attempting an emergency landing near Richmond, New South Wales. In those days, although fitted with a fire warning system, Neptune aircraft had no fire extinguisher system fitted. If the captain of that aircraft could be asked today what advice he would offer other pilots faced with a fire warning in flight, is there any question as to what that advice would be ? Is it possible that he would recommend delaying positive fire control action, pending physical evidence in the form of flames or smoke ? From the first report of fire to the final catastrophic crash, his last adventure took only slightly longer than one minute thirty seconds.

"Nothing in this life is infallible, and yet, to be effective, a fire warning system must be as close to it as possible. If it is to fail, it should fail safe. Of the two failures possible, it is preferable to have a warning where no fire exists on occasions, than to have a fire, where no warning is given. To ensure the highest possible reliability in detecting a fire, the system must be extremely sensitive to as many manifestations of fire as possible. This makes the problem of discrimination most difficult. Technical effort and research is constantly striving to eliminate the false warning but it will never be entirely successful.

**"False fire warnings amount to 'fail-safe' protection only so long as the aircraft captain treats every warning as a real one.** If he is prepared to wait for more spectacular evidence of fire before taking positive action, a fire warning system is useless."

**And, we could add, his first "real" warning is likely to be his last !**

*Fig. 2. Heat damage to the engine cowlings. Incandescent magnesium falling from the intermediate casing burnt the large hole in the lower cowl.*



## SECURE THAT OIL CAP

**Only a little item in a pre-flight inspection — but how important! Yet, even the most fastidious pilots can be caught out — as witness this incident:**

**Before beginning a cross-country flight from Sydney to an aerodrome on the western side of the Great Dividing Range, the pilot of a Cessna 210 carried out his daily inspection while he waited on the apron for the refuelling tanker. When it arrived, one attendant set about refuelling the aircraft while the other proceeded to top up the engine oil. He removed the oil cap, produced quart tins of oil ,and prepared to pour them into the oil filler neck. The attendant had omitted to bring a funnel, and because the filler neck is located some four inches below the top of the cowling, the pilot refused to allow him to pour the oil in without one. The pilot re-checked the oil level and after finding it adequate, told the attendant that he would not require additional oil.**

**Turning then to the other attendant who had finished the refuelling in the meantime, the pilot climbed up to see that both fuel tank caps had been properly secured before checking the tanks for water. By the time the pilot had done this, both the engine oil cap and the oil filler access panel in the engine cowling had been replaced, but because the men were now urging him to sign for the fuel, he didn't re-open the cowl to check the security of the oil cap. Instead he made a brief visual inspection through an air intake in the front of the cowling, saw the cap in place and was satisfied.**

**As soon as the tanker had driven away, the pilot climbed aboard, started the engine and taxied out. The run-up was normal, and he took off, but at about 200 feet, oil streamed from the engine cowling and over the windscreen. The pilot turned back and landed, taxied in, and opened the cowling to inspect the engine. The oil cap was loose, allowing oil to be forced out of the neck and over the engine.**

**The hour that it took to clean up the mess sufficiently for the flight to continue, probably seemed a high price to pay for the few seconds saved in the pre-flight inspection. But how incomparably higher it could have been if the oil cap had come off a little later when the aircraft would have been crossing the Divide!**

**This incident happened because the pilot was distracted while carrying out his pre-flight routine. It is a well-substantiated fact that interruptions of this sort during vital routine "drills" and checks, both on the ground and in the air, have helped to set the stage for many an aircraft accident. A strict personal rule not to allow your attention to be diverted at such times, and not to be "steam-rollered" into interrupting your set routine, makes for safer flying and helps to avoid these "accidents in the making." SAFETY IS PARAMOUNT — LESSER THINGS CAN USUALLY WAIT A MINUTE OR TWO.**

# Don't forget THE CHOCKS!


To judge from the accidents that have occurred in recent months, starting aeroplanes by hand must be an operation absolutely fraught with hazards, not only to the particular aircraft involved, but also to anything else that happens to get in the way ! The three photographs on this page and the next bear mute testimony to this thought.

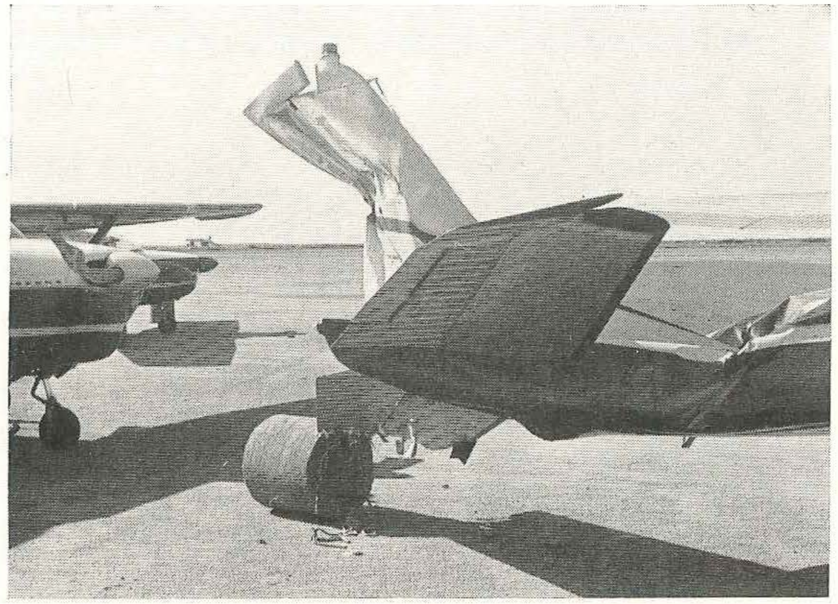
In some of the cases we have in mind, at least one of which has already been reported in the Digest, (See "An Expensive Mistake," Aviation Safety Digest No. 40, December, 1964), the aircraft have run away while being hand-started when, for one reason or another, the brakes failed to hold.

Air Navigation Regulation 223B clearly defines the pilot's responsibility, during a hand-starting operation, to ensure that "adequate provision is made to prevent the aircraft moving forward." It is perhaps understandable that the pilots of the two modern aircraft shown did not think to use chocks for a hand start that was, for them, a very rare occurrence. What is difficult to understand is that this "no chocks required" thinking is sometimes applied to the surviving representatives of aircraft built in an era when chocks were standard equipment for starting—aircraft of the type exemplified chiefly today by the Tiger Moth.

Not long ago, in Victoria, a pilot, making a cross-country flight in one of these aircraft, landed at Echuca to refuel. After taxi-ing to the refuelling point, he turned into wind and switched off, but didn't chock the wheels. After he had refuelled the aircraft, the pilot checked that the throttle was closed, turned on the ignition switches, and walked around to swing the propeller. The engine fired after a couple of pulls and the aircraft started to move forward. The pilot caught hold of the port wing, but

*All that remained of a Cessna 182 that ran away, after being hand started, and coralled itself in a cattle stock yard.*





*The aircraft with the bent propeller (left) also ran away after being hand started. Its starboard wing collided with the fin and rudder of the aircraft in the foreground, telescoping the tail and fuselage as shown, while the whirling propeller blades hacked into the port tailplane.*

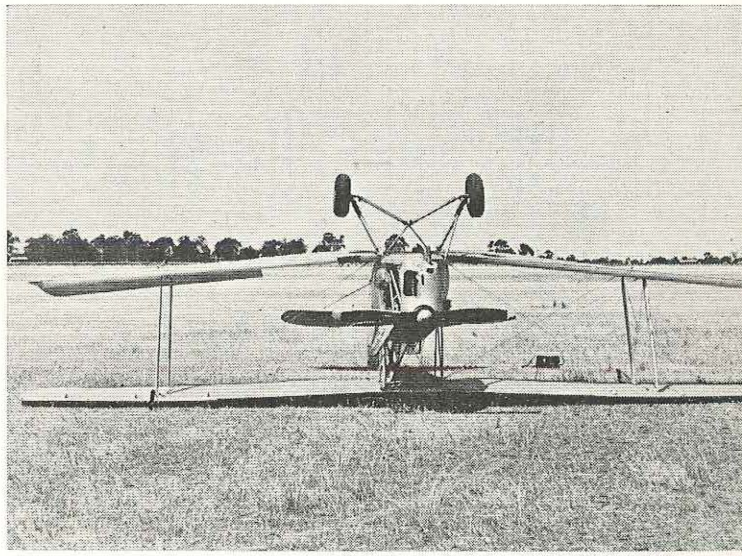
only succeeded in swinging the aircraft broadside to the wind, which was now gusting between 10 and 20 knots. The aircraft continued to gain speed and the pilot rushed for the front cockpit switches, but as he flicked them off, a gust lifted the starboard wing, the aircraft swung down-wind and was blown over on its back as shown.

Only a few weeks later, another Tiger ran away in similar circumstances at a station property airstrip in South Australia. The aircraft, which was parked unchocked on the tarmac in front of the strip's two hangars, was to make a local flight. The passenger was installed in the front cockpit, the throttle set for starting, and the pilot swung the propeller. When the engine started, the aircraft began to roll forward and turned towards the hangars where the tarmac sloped slightly downhill. The passenger had the presence of mind to close the throttle and the pilot jumped up and cut the switches, but the aircraft gathered momentum down the slope, ran between the hangars and collided with two posts. Happily the passenger was not injured but this aspect of the accident nevertheless points up the wisdom of the third condition laid down in A.N.R. 223B.

In years gone by when nearly all light aeroplanes had to be hand started every time they flew, accidents of this sort were rare. They were avoided because the hazards of hand starting were fully recognized, accepted as normal, and proper precautions taken. It is paradoxical that today's aircraft, with all their refinements designed to make handling safer and easier, can promote practices leading to an accident where, for some reason or another, the pilot is temporarily denied some of the advantages inherent in a modern aircraft.

The title of this article is, of course, sound advice for pilots who still fly Tigers or Gypsy Moths or perhaps ultra-lights not fitted with brakes. But it also has something to say to the pilots of the modern light aeroplanes, not so much as a literal instruction, but as an adage to develop a right attitude of mind in all aspects of our flying. **Let us be careful that the improvements and comforts built into todays' aircraft do not make us complacent in our attitude to safety.**

*This DH 82 moved off unoccupied after being started without chocks, swung downwind, and was blown over on to its back.*



# Negligence in Re-fuelling destroys Helicopter

At Kunanurra, in the Ord River district of Western Australia, a Bell 47 helicopter was engaged in spraying cotton crops. Beginning operations at 0600 local time, the helicopter completed spraying 340 acres at one farm, then flew on to the next property to refuel and begin working there.

The refuelling was carried out by the operators from 44-gallon drums carried on a utility truck that served as a refuelling tender. After the helicopter had been refuelled and the spray tanks reloaded, the pilot took off to begin his first spraying run. Fifty yards after lifting off, while the helicopter was moving forward at about 55 knots, 10 feet above the ground, the engine back-fired and lost power completely. The pilot tried to flare the helicopter for a landing, but the landing skids dug into the muddy, irrigated ground and the aircraft lurched forward heavily on to the cockpit bubble. The whirling rotor blades severed the spray booms, the hopper tank mountings and the fuselage behind the engine, scattering these components over a wide area, before the main fuselage section fell back on to the landing skids. Despite the fact that the cockpit bubble was completely shattered and the cabin assembly distorted and buckled, the pilot escaped with minor injuries.

Investigation of the accident established that the engine failure had been caused by contamination of the fuel system by water. The contents of the main fuel filter, the fuel line from the filter to the carburettor and the carburettor itself, aggregating together about a pint, were drained into a jar and were found to consist entirely of water. With the aircraft's fuel selector turned on, the fuel filter line was drained again and a further half pint of water was discharged before fuel began to flow. The amount of residual water in the fuel tanks could not be positively determined because one tank had been split open in the crash and the other was lying in a position from which the contents could not be readily drained. It was nevertheless clear that there had been sufficient water in the tanks to occupy all the unusable fuel space and to cover the base of the fuel line stand pipes.

The aircraft maintenance engineer who had carried out the daily inspection on the helicopter before it began operations on the morning of the accident, was certain that there was no trace of water in the aircraft's fuel system at that time. The drum of fuel from which the helicopter had been serviced immediately before the accident was checked for signs of water, but none was found. Further enquiries then established that, while working at the first spraying site, the helicopter had been refuelled beside an irrigation canal, and, with the refuelling tender parked on a bridge over the canal, it had been necessary to run the refuelling hose across the canal to reach the aircraft. The refuelling equipment used by the operators consisted of a quart stroke drum pump to which was attached a 60 feet length of one-inch plastic garden hose. On completion of the refuelling on this occasion, the hose had been dropped on the ground and pulled back through the canal before being re-stowed on the refuelling tender, which was then driven on to the next refuelling site. It was evident that the water had entered and been trapped in the hose during this process. Laboratory analysis of samples of the water drained from the helicopter's fuel system yielded results consistent with the theory that the water had come from the irrigation canal. The volumetric capacity of the hose was approximately a third of a pint per foot, and it would have been easy for the hose to have taken in sufficient water to produce the results found while it was submerged in the 14-foot-wide canal.

*This picture was taken from where the helicopter landed for the first refuelling. The tender was parked as shown, and the refuelling hose was afterwards dragged back through the canal before being replaced on the vehicle.*

Investigation of the refuelling procedures used by the particular operating crew revealed that they were, to say the very least, highly unsatisfactory. In the first place, although the fuel was decanted into empty drums from an underground installation leased by the operators at Kununurra aerodrome, there was no evidence of any water testing having been carried out either before or after the decanting operation. Secondly, once the drums had been filled, they were loaded upright on the refuelling tender, where they remained overnight in the open.

The only form of checking evidently used during the actual refuelling of the helicopter was to run a few strokes of the hand pump through the hose on to the ground, after which the hose was inserted directly into the aircraft tank and the delivery made. No fuel filter was used, and there was no subsequent fuel drain check of the aircraft's fuel system. When questioned about this, the pilot explained that " . . . we do not normally do water checks in the field as the engine is not shut down during refuelling." The fact that refuelling with the engine running is in itself entirely contrary to the requirements of Air Navigation Order 20.9, paragraph 2.2.6, was evidently quite beside the point !

In addition to contravening this and A.N.O. 20.2, Paragraph 20.2.5, relating to fuel system inspections, the pilot and refuelling crew had chosen to ignore the requirements of the operator's Operations Manual, which lays down most stringently the procedures to be followed in the handling of drum stocks and during refuelling operations.

A further unsatisfactory aspect was the fact that during the refuelling operation the plastic garden hose was the only connection between the fuel drum, the refuelling tender and the helicopter. The consequences of disregarding electrical bonding requirements during refuelling are dealt with elsewhere in this issue. (See pages 14 and 15.) It will suffice to say here that this was a further contravention of A.N.O. 20.9, this time, paragraph 2.4.4.

The pilot of the helicopter, although holding a valid Australian Commercial Pilot Licence endorsed for both fixed wing aircraft and helicopters, was not an Australian citizen and had been trained overseas. Although his total aeronautical experience amounted to over 6000 hours, of which more than a third was helicopter time, he had flown over 280 hours on agricultural helicopter operations, most of it since coming to Australia.

Whether the pilot's carelessness was the result of his having been accustomed to more sophisticated refuelling methods overseas while engaged on non-agricultural helicopter operations, or whether it sprang from mere ignorance of the Department's requirements, is difficult to say. But whatever the reason, the pilot is no doubt infinitely wiser now. Perhaps others, similarly cavalier in their attitude to refuelling procedures, can now learn the same lesson without writing off a valuable aircraft in the process !

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## Cessna 185 destroyed after striking Fence

While taking off from an agricultural strip near Gladstone, New Zealand, a Cessna 185 failed to become properly airborne and the tail struck a post and wire fence, tearing off the port elevator. The aircraft left the ground and flew out over the slopes which fall away steeply beyond the end of the strip, then dived into the ground several hundred feet below. Examination of the wreckage showed that as well as removing the elevator, the impact had also disrupted the tailplane trim jacks, allowing the tailplane enough free movement to deprive the pilot of all control.

The total length of the strip was 1318 feet, but surface undulations reduced the useful length to about 1000 feet. Initially, the strip runs down-hill for about 1000 feet, then for 120 feet rises abruptly into a "hump" before curving downwards again over the final 200 feet to the fence line.

The aircraft had made at least 48 take-offs from the strip that morning, many of them at an all-up weight at least equal to that carried on the last load, and on each occasion the aircraft became comfortably airborne just before reaching the "hump." Wind conditions had been calm until fifteen minutes before the accident, when occasional gusts gave the first indication of a down-wind condition developing on the strip. Two hours after the accident a strong wind was blowing down the strip and it was apparent that the last take-off had coincided with the onset of a continuous down-wind component on the strip.

An aircraft failing to become airborne by the time it had run 1000 feet down the strip would then have to run uphill for 120 feet and would probably cease to accelerate and perhaps even decelerate during this time. Under such circumstances the length of strip up the "hump" would at best contribute nothing to attaining flying speed and, on reaching the crest, the pilot would be left with a downhill grade of only 200 feet in which to become airborne.

Tests showed that a fully laden Cessna 185 can leave the ground in 950 feet, and it was evident that the aircraft was becoming airborne within this distance on the runs before the accident. The strip was therefore satisfactory for the operation provided the aircraft could become airborne before reaching the "hump." Nevertheless, because in calm conditions the aircraft was not leaving the ground until after running 950 feet, it was clear that only a slight down-wind component would have been necessary to extend the run to more than 1000 feet, i.e. to the point where the strip began to rise, thus placing the aircraft in difficulties.

The accident shows that when strip operations in calm conditions leave only a small margin of safety, it is especially necessary to watch for the onset of any down-wind component which may make all the difference between a successful take-off and one ending in disaster.

*Department of Civil Aviation, New Zealand*



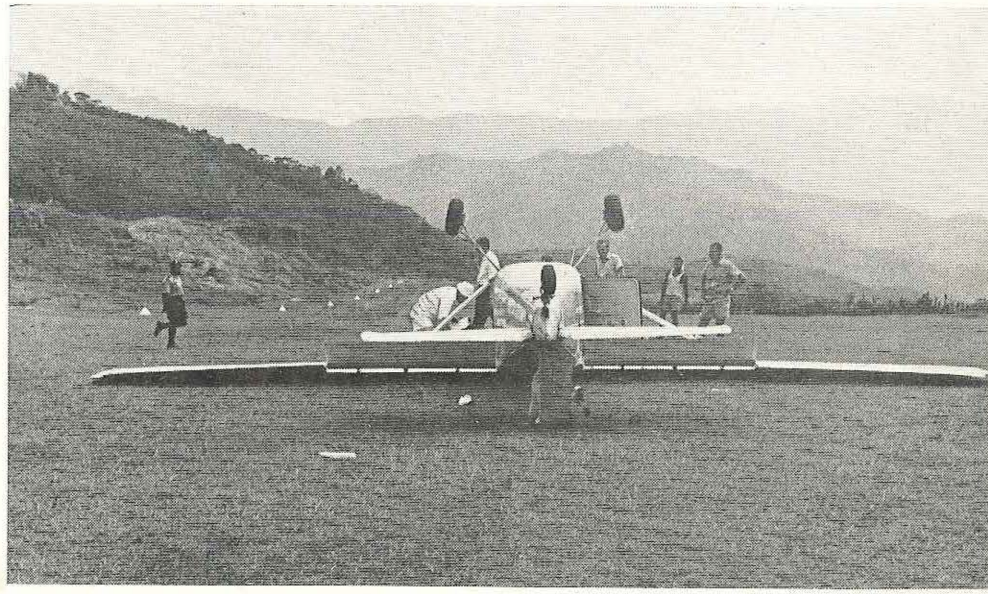
# Overshoot leads to Overturn

**Attempting to land at Tabibuga, a one-way airstrip in the New Guinea highlands, a Cessna 185 carrying freight for the nearby Patrol Post overshot and touched down too fast. The pilot braked heavily, the aircraft skidded for some distance then tipped over on its back. The aircraft was badly damaged, but the pilot was not injured.**

Tabibuga airstrip, typical of many in the highlands of New Guinea, lies 4300 feet above sea level in mountainous country and is aligned north-east—south-west with an 8.7% slope up from the south-western end. Within 200 yards of the northern side of the strip a heavily timbered ridge rises to 150 feet above the strip and on the southern side and immediately beyond the north-eastern end, ridges of similar height encroach almost to the strip's edge. For this reason, a pilot making an approach to Tabibuga has to decide very early on final whether or not to continue, and once having decided to do so, he is committed to a landing.

The pilot of the Cessna, after flying from Mt. Hagen, had approached the strip from the south-west. Close in, he made a right-hand turn to place the aircraft on a low-level base leg, lowered 20 deg. of flap and reduced speed to 80 knots. He had turned on to a short final approach, closed the throttle and lowered full flap before he realized that the aircraft was over-shooting. Too low now to abandon his approach, the pilot had no alternative but to continue with the landing and he forced the aircraft on to the ground at over 80 knots some 300 feet beyond the threshold. Holding the control column right back he applied full braking to try and stop the aircraft before it ran into the hillside beyond the end of the strip. He was able to hold the aircraft in a flying attitude at first, but as the speed fell off, and elevator control was lost, the aircraft began to tip forward on its nose. As it approached the end of the strip, still travelling quite fast, the propeller blades began to slash the ground, the nose dug in and the aircraft somersaulted violently on to its back, sliding to a stop only 70 feet from the end of the strip.

The weather at the time was fine, with unlimited visibility but a seven-knot wind blowing from the south-west was producing a pronounced down-wind component in the landing direction. The pilot had nearly 600 hours' aeronautical experience, but had been flying for the operating company for only 2½ months before the accident, and of this time, six weeks had been spent in route endorsement training under the supervision of the chief pilot.



The approach technique that the pilot employed was in complete disregard of a company instruction requiring pilots to complete full circuits at non-controlled aerodromes, and was also a contravention of Air Navigation Regulation 143(1) (ba), which requires aircraft to join the traffic pattern of a non-controlled aerodrome on the up-wind, cross-wind or down-wind legs. The pilot had obviously not given much thought to the likely consequences of an abbreviated circuit procedure that allowed him so little time to make a decision at an aerodrome where the decision, once made, is irrevocable. In this case, the completion of a proper circuit would have enabled him to see that there was a substantial down-wind component on the strip and given him time to make adequate allowances for it.

No doubt the wisdom of following the correct procedures is now clearly evident to this pilot. There may be others similarly inclined to take 'short cuts,' who can profit from his frightening and expensive experience.

# STALL . . . . during forced landing

**Soon after departing from a Western Australian cattle station for Carnarvon, Western Australia, a Chipmunk sustained a complete loss of engine power. During the ensuing forced landing approach, the pilot lost control and the aircraft nosedived into the ground. The Chipmunk was virtually destroyed but the pilot and passenger escaped with a shaking.**

The aircraft was being flown by a private pilot and it had taken off for the 75-mile flight to Carnarvon at 11.40 local time. Shortly after the pilot had levelled out at his selected cruising altitude of 3500 feet, the engine R.P.M. dropped to idling without warning. The pilot went through the emergency cockpit drill and found that movement of the throttle lever had no effect on the engine.

The pilot transmitted a Mayday call and position report then looked around for the most likely area for a forced landing. He selected a flat piece of ground covered with light scrub, lying between two parallel sand ridges about fifty feet high, carried out his forced landing check and set up an approach. The surface wind was blowing at about 30 knots from the south-west, at an oblique angle to the line of the sandhills, and he elected to land slightly out of wind to obtain a landing run parallel to the sandhills.

The pilot maintained a steady 60-knot glide then, on final, brought the speed back to 55 knots. About 30 feet above the ground, just as he was about to round out, he saw that the airspeed indicator had dropped to stalling speed. Almost at the same instant, the aircraft stalled, the nose dropped and the aircraft struck the ground heavily, about 45 degrees nose-down. It bounced twenty feet and came to rest with both wings broken off and the fuselage jack-knifed behind the rear cockpit. Fortunately for the pilot and passenger, the cockpit section remained reasonably intact.

Investigation of the wreckage showed that the throttle linkage had failed when the throttle control rod connecting the carburettor to the cross shaft behind the engine became disconnected. The failure no doubt resulted from wear in the ball joint and consequent looseness of the fittings. The Maintenance Release for the aircraft, which was registered in the private category, had been issued fourteen months previously, and was valid for 100 hours' flying or twelve months, whichever occurred first. Although the aircraft had flown only 79 hours since the last inspection, the Maintenance Release had expired and the flight was thus a contravention of Air Navigation Regulation 34(1)(a).

The general condition of the aircraft suggested that it was normally well maintained, and it was evident that the reason for the lapse of the Maintenance Release was only an oversight on the part of the aircraft owner. Nevertheless, the fact remains that the engine failure resulted from inadequate maintenance, and if the 100 hourly maintenance inspection had been carried out at the proper time, the defective ball joint would have been found and replaced, and the accident would not have happened. The importance of properly maintaining engine control linkages has been stressed repeatedly in the Digest, and this accident only serves to underline these earlier warnings.

The other aspect of the accident that bears thinking about is that the forced landing was being made on to a reasonably good surface and should have been successful. It was unsuccessful, and the aircraft was written off because the pilot failed to monitor the airspeed during the final stages of his approach. The pilot knew that the surface wind was blowing strongly at an angle to the line of the sandhills and should have recognized that these conditions were likely to produce a marked wind gradient in the area between the ridges. By allowing for this condition and approaching at a higher airspeed, the pilot would have had a margin of safety to cope with the steep wind gradient that evidently existed at around the height of the sandhills.

Such conditions should never be a reason for losing control. **On the contrary, they should only act as a stimulus to watch an approach even more intently.**

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# Some Radio Incidents

## PA22

When making a charter flight from Kairoo to Clovernook, Queensland, a PA.22 failed to answer calls from Rockhampton communications unit. At 0544 the aircraft had reported estimating Clovernook at 0615 and a minute later Rockhampton called the aircraft to pass traffic information. No reply was received. Adjacent COM stations and other aircraft in the area were then asked to call the aircraft, but without success. The uncertainty phase was declared at 0600, but, when the aircraft called and reported circuit area Clovernook at 0620 this was cancelled. Communication conditions throughout the flight were poor. The pilot said later that after transmitting his position report at 0544, he had removed his earphones and had maintained a listening watch on the cabin speaker. On arrival over Clovernook he had again used the earphones. He admitted he had been having some difficulty during the flight in reading stations on HF because of storms in the area.

The cause of this incident was that the pilot endeavoured to maintain a listening watch on HF with the cabin speaker when atmospheric conditions were such that this was impossible. In thunderstorm conditions an adequate listening watch can only be maintained by the use of earphones.

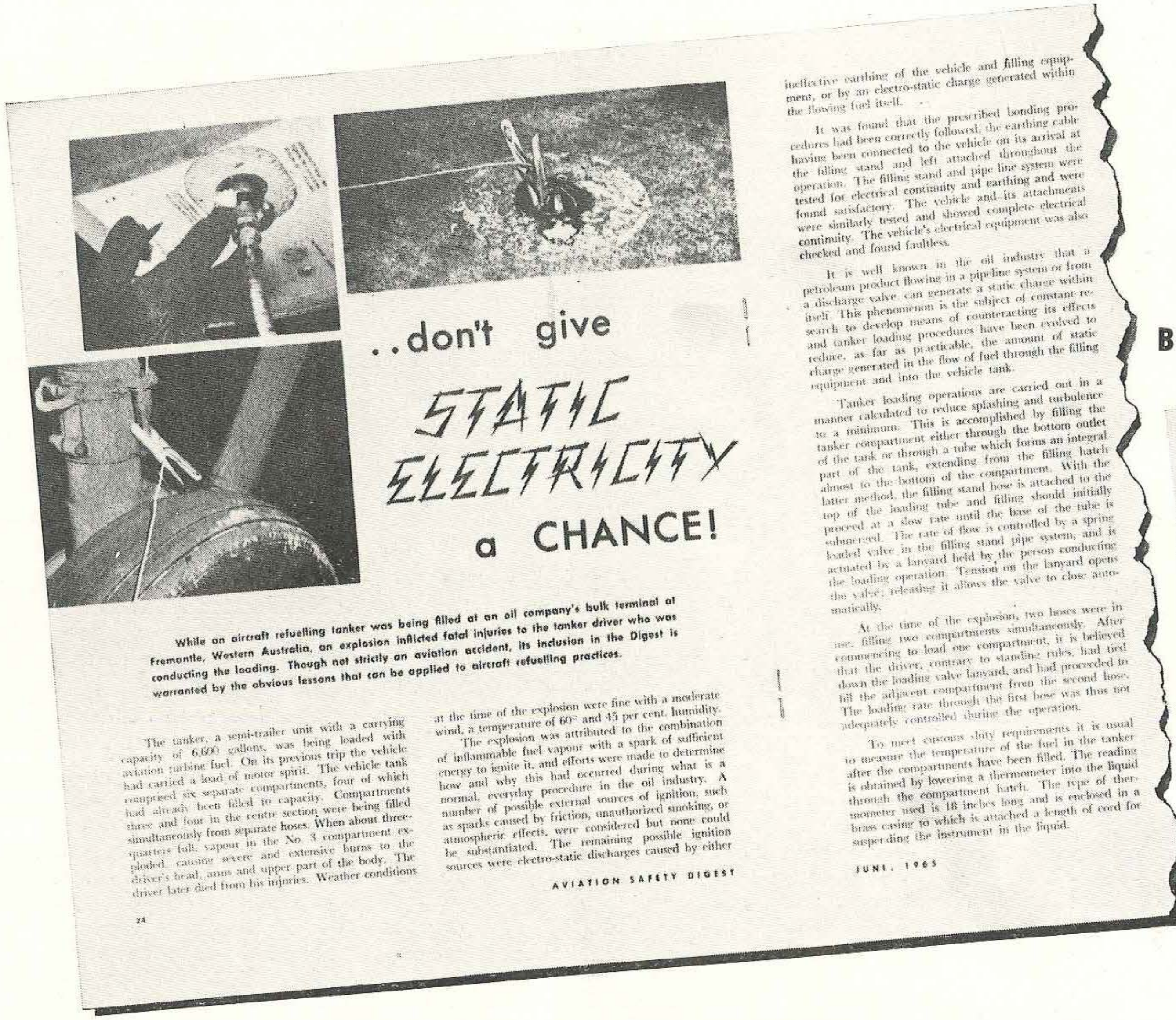
## F27

Over Holbrook, while en route from Melbourne to Canberra, the crew of an F.27 experienced a complete failure of the aircraft's communication equipment. All frequencies were tried in an attempt to contact air traffic control, but to no avail. The flight was continued to Canberra, and a let-down was carried out in accordance with the radio failure procedures. It was later found that the aircraft transmitters were permanently keyed, thus preventing reception. The fault was traced to a selector box on the control pedestal and the unit was removed for overhaul. During the overhaul, a sticky substance, together with evidence of moisture, was found in and around the selector box COM switch. **It was apparent that at some time a cup of tea or coffee had been spilt over the selector box and in the course of time the resulting stickiness had caused the malfunction in the switch.**

## SURFACE VEHICLES

At Sydney airport, the surface movement control frequency became jammed by a continuously operating transmitter. A large number of departing and arriving aircraft were affected, and it became necessary to handle all aircraft movements on the approach control frequency. Meanwhile, all company and departmental vehicles were checked for sources of interference and the continuous carrier transmission was finally traced to a Department of Works vehicle which was being used in the reconstruction of a taxiway. Technicians found that the glove box lid of the vehicle had fallen open and was pressing down on the press-to-talk button on the microphone. The microphone holder in the vehicle was so located that this would occur whenever the glove box was opened to its full extent. The fault was also attributable to a faulty cradle switch on the microphone. In normal circumstances the equipment cannot be activated while the microphone is lying on its cradle. The incident nevertheless demonstrates that radio equipment should be kept clear of obstructions at all times.

# Do you remember . .



..don't give

STATIC ELECTRICITY

a CHANCE!

**While an aircraft refuelling tanker was being filled at an oil company's bulk terminal at Fremantle, Western Australia, an explosion inflicted fatal injuries to the tanker driver who was conducting the loading. Though not strictly an aviation accident, its inclusion in the Digest is warranted by the obvious lessons that can be applied to aircraft refuelling practices.**

The tanker, a semi-trailer unit with a carrying capacity of 6,600 gallons, was being loaded with aviation turbine fuel. On its previous trip the vehicle had carried a load of motor spirit. The vehicle tank comprised six separate compartments, four of which had already been filled to capacity. Compartments three and four in the centre section were being filled simultaneously from separate hoses. When about three-quarters full, vapour in the No. 3 compartment exploded, causing severe and extensive burns to the driver's head, arms and upper part of the body. The driver later died from his injuries. Weather conditions at the time of the explosion were fine with a moderate wind, a temperature of 60° and 45 per cent. humidity.

The explosion was attributed to the combination of inflammable fuel vapour with a spark of sufficient energy to ignite it, and efforts were made to determine how and why this had occurred during what is a normal, everyday procedure in the oil industry. A number of possible external sources of ignition, such as sparks caused by friction, unauthorized smoking, or atmospheric effects, were considered but none could be substantiated. The remaining possible ignition sources were electro-static discharges caused by either ineffective earthing of the vehicle and filling equipment, or by an electro-static charge generated within the flowing fuel itself.

It was found that the prescribed bonding procedures had been correctly followed, the earthing cable having been connected to the vehicle on its arrival at the filling stand and left attached throughout the operation. The filling stand and pipe line system were tested for electrical continuity and earthing and were found satisfactory. The vehicle and its attachments were similarly tested and showed complete electrical continuity. The vehicle's electrical equipment was also checked and found faultless.

It is well known in the oil industry that a petroleum product flowing in a pipeline system or from a discharge valve can generate a static charge within itself. This phenomenon is the subject of constant research to develop means of counteracting its effects and tanker loading procedures have been evolved to reduce, as far as practicable, the amount of static charge generated in the flow of fuel through the filling equipment and into the vehicle tank.

Tanker loading operations are carried out in a manner calculated to reduce splashing and turbulence to a minimum. This is accomplished by filling the tanker compartment either through the bottom outlet of the tank or through a tube which forms an integral part of the tank, extending from the filling hatch almost to the bottom of the compartment. With the latter method, the filling stand hose is attached to the top of the loading tube and filling should initially proceed at a slow rate until the base of the tube is submerged. The rate of flow is controlled by a spring loaded valve in the filling stand pipe system, and is actuated by a lanyard held by the person conducting the loading operation. Tension on the lanyard opens the valve; releasing it allows the valve to close automatically.

At the time of the explosion, two hoses were in use, filling two compartments simultaneously. After commencing to load one compartment, it is believed that the driver, contrary to standing rules, had tied down the loading valve lanyard, and had proceeded to fill the adjacent compartment from the second hose. The loading rate through the first hose was thus not adequately controlled during the operation.

To meet customs duty requirements it is usual to measure the temperature of the fuel in the tanker after the compartments have been filled. The reading is obtained by lowering a thermometer into the liquid through the compartment hatch. The type of thermometer used is 18 inches long and is enclosed in a brass casing to which is attached a length of cord for suspending the instrument in the liquid.

24 AVIATION SAFETY DIGEST

JUNE, 1965

# In the JUNE, 1965 DIGEST ?

**We commented . . .**

"... the Department and some oil companies as well, have warned against the use of plastic containers and funnels for refuelling . . .

"... plastic articles can accumulate a heavy static charge. Because the plastic will not conduct electricity, the charge cannot be earthed properly by earthing cables and clips. A statically charged plastic utensil can therefore quite easily cause a spark when placed close to metal fittings such as fuel tank filler neck or a refuelling hoze nozzle.

"We have noticed that some light aircraft pilots who conduct their own refuelling operations in country areas, still occasionally resort to the use of plastic funnels or containers for the sake of expediency. If you are one of these, we urge you in your own interest to discontinue the practice immediately."



The pilot of the Debonair shown in the photographs below obviously didn't remember! Short of fuel, the aircraft had previously made a precautionary landing, on a roadway in a remote part of Western Australia, and had sustained minor damage. Aircraft engineers went to the site and repaired it for a ferry flight to Port Hedland and when it was ready, a pilot arrived to fly it out. He had brought with him two four-gallon drums of avgas, and set about refuelling the aircraft. First of all he earthed the aircraft by forcing a long screwdriver into the ground and connecting it to an earthing lug on the aircraft. Using a plastic funnel, over which he had placed a dry chamois, he tried to pour the contents of one drum into the starboard tank, but found he could not hold the funnel and pour the fuel at the same time. After he had spilt a small amount of fuel he asked one of the engineers to help him. The engineer took the drum while the pilot held the chamois and funnel. More fuel was spilt when the engineer tried to pour with the neck of the drum downwards. The engineer then turned the drum round so the neck was uppermost and began pouring again, but after about half a gallon had flowed into the tank, fire broke out at the filler neck and spread quickly. The engineer suffered minor burns to his hands before he could jump clear and the fire engulfed the aircraft. The aircraft was fitted with two fire extinguishers, but because these had been left in the cabin, they could not be reached once the fire had broken out. In any case, small hand extinguishers would hardly be adequate to deal with a refuelling fire once it had established itself.

**Before . . .**

**—— After!**

There is no doubt that the fire was started by a static discharge. The static electricity hazard involved in using a plastic funnel that cannot effectively be earthed is serious enough at any time, but it would have been compounded on this occasion by the extreme heat of the day. The shade temperature at the site was +40°C. and as the aircraft had been standing in the sun, the surface of the wing would have been very hot indeed. The spilt fuel would have quickly formed dangerous vapour that only required the slightest spark to ignite it. The likelihood of a static discharge in these circumstances could have been eliminated by ensuring that the aircraft, the drum and the funnel were all at the same electrical potential. This is normally achieved by electrically bonding the three elements, but such bonding can never be effective while one link in the chain, the funnel, is non-conductive plastic.

**Remember :**

**REFUELLING + PLASTICS = STATIC DISCHARGE**

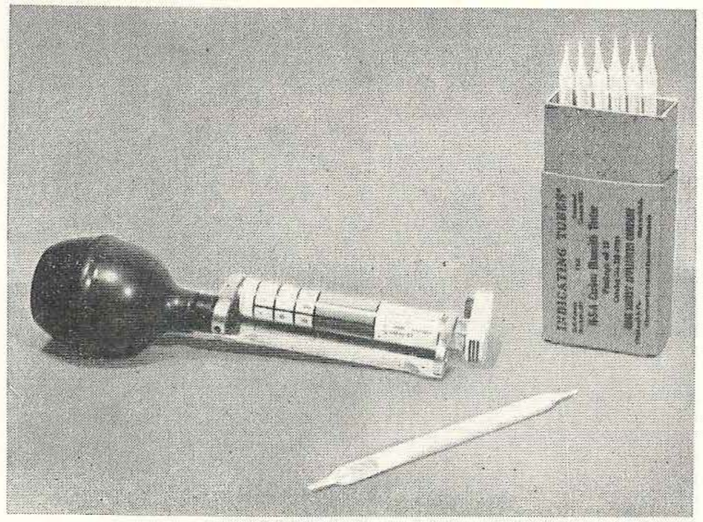
# CABIN HEATERS and CARBON MONOXIDE

From time to time, the Digest has quoted various overseas reports of fatal accidents to aircraft caused by incapacitation of the pilot or crew as the result of carbon monoxide leakage from a faulty cabin heater. Now that the summer is over and many pilots will be resorting to the use of their cabin heaters to make flights more comfortable in cool weather, it would be well to heed the lessons of some of these overseas accidents to make sure none of them are repeated here.

Carbon monoxide, a gaseous product formed by incomplete combustion of carbonaceous matter, is found in the smoke, fumes, or exhaust gases from stoves, furnaces, internal combustion engines, and almost any other process in which hydro-carbon fuels are used for power or heat production. The amount of carbon monoxide in the exhaust gases of a piston type aircraft engine varies with the operating conditions, but is generally proportional to the fuel/air ratio of the mixture being fed to the engine. A full rich mixture setting for take-off power produces about eight per cent of carbon monoxide by weight in the exhaust gases; a typical cruising power mixture setting will yield about three per cent. Because it is colourless, odourless and tasteless, the presence of carbon monoxide is not readily detectable when mixed with air, and it is this factor that poses such a hazard when the gas contaminates the air inside an aircraft cabin.

The toxicity of carbon monoxide to human beings is well known. A concentration of only 0.06 per cent. in air inhaled can cause unconsciousness within two hours; 0.1 per cent. can cause death in as short a time as an hour, depending on the physical condition of the person affected. Even a concentration of carbon monoxide as small as 0.02 per cent. can have perceptible effects over a period of an hour and a half. The effect on pilots is particularly dangerous because it is so insidious — a pilot may suffer from impaired vision and judgment, reduced alertness and reasoning power, yet he may be completely unaware that his efficiency is deteriorating and so the gradual carbon monoxide poisoning process goes on undetected until it is too late — too late because the pilot has already become unconscious, or too late because he had been reduced to a state in which he is simply incapable of handling the situation that now confronts him.

In the early days of enclosed cockpit aircraft, there were a number of accidents caused by pilots becoming affected by carbon monoxide, and this led to the adoption of design specifications aimed at keeping cockpit air contamination within safe limits. Today in Australia, the Department also carries out carbon monoxide contamination checks as a routine part of the type-certification for new types of aircraft, but even with these safeguards, there have been cases where new aircraft have later proved faulty in this respect. In most of these instances, the type-certifications had been carried out on a prototype aircraft, and subsequent production models later underwent minor modifications which adversely affected their cabin sealing or ventilation. A typical case involved a single-engined cabin aeroplane in which a small hole had been cut in the floor for a camera installation. The hole did not affect the structural integrity or performance of the aircraft but it provided a means by which cabin air could become seriously contaminated with carbon monoxide from the engine exhaust. In another single-engined aircraft, exhaust fumes were able to enter an area of reduced pressure in the fuselage, through an unsealed tail wheel strut aperture, again resulting in serious carbon monoxide contamination in the cabin. In this case the source of the cabin contamination was discovered only after prolonged investigation. In yet another case, a "do-it-yourself" modification to the louvres of an engine cowling caused contamination of the air flowing around the cabin cold air vent in the side of the fuselage, and allowed carbon monoxide to be drawn into the cabin when the cold air vent was opened.



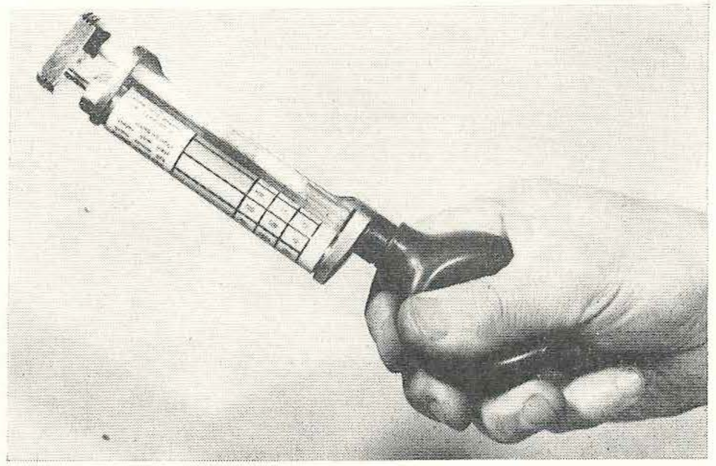

*Testing instrument and spare indicator tubes.*

As a result of these and similar incidents, the Department now requires carbon monoxide contamination checks to be carried out not only on new aircraft types during type-certification, but also on any aircraft that has been modified in a way that could possibly produce results similar to those described.



It might be argued that the cases we have described are isolated ones and that they haven't a great deal of application to the vast majority of normal light aircraft operations, but they do serve to illustrate how easily and unsuspectingly carbon monoxide contamination can occur in an aircraft. This brings us to an item of equipment fitted to most modern light aircraft which, although fully meeting the design specifications we have already mentioned, is an ever-present source of treachery and danger **if it is not carefully maintained** — the aircraft cabin heater and the engine exhaust system associated with it.

Most light aircraft cabin heaters utilize a heat exchanger which consists essentially of a sheet metal jacket wrapped around part of the engine exhaust pipe or exhaust muffler. Ram air is admitted to the jacket, usually through a flexible hose leading from an air intake at the front of the engine nacelle, heated in the jacket by the engine exhaust, and then ducted to outlets at various points inside the cabin. It is obvious that if a crack or a hole develops between the exhaust pipe and heater jacket, the ram air will become contaminated and carbon monoxide will be piped to the cabin hot air outlets. Clearly, the danger will be greatest during the winter months when cold weather encourages full use of the cabin heater and the other cabin air sources are kept closed, but it is as well to remember that carbon monoxide can also enter the cabin at any time through the various small openings in the firewall, if gas leaks develop in other parts of the engine exhaust system. Cracks and holes can develop in a relatively short time and, for this reason, exhaust manifold and cabin heater assemblies should be thoroughly inspected for defects, including blown gaskets, at regular intervals. Some aircraft manufacturers in fact recommend inspections as often as every 25 hours flying time.



*Instrument assembled ready for use.*

Not long ago, a private pilot flying a Cessna 172 from Cobar to Bourke, New South Wales, found himself suffering from inexplicable nausea, and a tight feeling across his forehead. As time went on he had difficulty in focusing his eyes, his sense of balance deteriorated, he became incapable of working out even simple navigational problems, and he felt a compelling urge to fly closer and closer to the ground. The pilot was wise enough to realize something was seriously wrong and he landed the aircraft at a strip which was a few miles closer than his destination. Here he walked around for half an hour until he felt better, then flew on to Bourke aerodrome where he immediately declared the aircraft unserviceable. The aircraft's exhaust system was examined and a 5/32 inch hole was found in the heat exchanger. The hole had been made by an excessively long PK type attaching screw, which had pierced the inner wall of the heat exchanger.

The best protection against carbon monoxide poisoning is to be alert, as this pilot was, to its early symptoms — the smell of engine exhaust gases, a generally sluggish feeling, drowsiness, tightness across the forehead, headaches. If you experience these warning signs, assume that carbon monoxide is getting into the cabin and take all reasonable precautions. Shut off the cabin heater immediately and open a cabin window or other fresh air source. Refrain from smoking because this also increases the carbon monoxide level in the body, and make a landing at the first suitable areodrome. **Do not resume flight** until all effects of the carbon monoxide have disappeared. At the first opportunity have the aircraft checked for carbon monoxide contamination either by a thorough physical inspection of the suspected components, or by having the cabin air sample-tested under operational conditions.

The testing instrument, which the Department uses for this purpose, is illustrated on these pages. The main feature is the replaceable glass indicator tube containing yellow silica gel crystals. To use the tester, the sealed ends of the indicator tube are broken off and the tube is inserted in a spring-loaded holder on the instrument. An air sample is then drawn through the tube by squeezing the rubber bulb and allowing it to re-inflate. If the air thus sampled contains carbon monoxide, the yellow silica gel turns green, the depth of colour being directly proportional to the concentration of carbon monoxide in the air. To measure this concentration, the discolouration of the chemical is compared with a colour scale on a small cylinder mounted beside the tube, the cylinder being revolved to bring the varying shades on the scale successively into position for comparison with the indicator tube. The tester is capable of indicating concentrations of carbon monoxide from 0.001 to 0.10 per cent.

Should you have any reason to suspect carbon monoxide contamination in your aircraft do not hesitate to ask the Department to arrange an operational check with the test instrument; in certain cases the Department will make the tester available on loan for pilots to carry out their own checks. **And make it a habit to have your cabin heater inspected regularly. Time so spent is time well spent.**

# Fatal Fire in Wheel Brakes

*(Based on Report by Commission of Enquiry convened by Federal Accidents Investigation Office, Geneva).*

**In September, 1963, a Caravelle 3 engaged on a scheduled flight from Zurich to Rome via Geneva crashed eight minutes after take-off from Zurich. The 74 passengers and six crew were killed and the aircraft was destroyed.**

After a lengthy and detailed investigation, the Commission of Enquiry ascribed the crash to the destruction of important structural components by fire which was initiated by general heating of the brakes before take-off.

The Zurich airport was enshrouded in fog when the crew went aboard the Caravelle for departure at 0700 hours local time. At 0705, after being informed that the visibility on runways 16 and 34 was 60 metres and 210 metres respectively, the crew asked for a guide vehicle and approval "to taxi on the runway, on 34, and back again, and have a look round." This request was approved and a guide vehicle was provided.

After guiding the aircraft out from the apron, the vehicle driver lost his way in the dense fog, to the extent that he entered "taxiway 4" instead of "taxiway 5" and guided the aircraft on to runway 34 at a point about 400 metres from the threshold. The aircraft turned on to the runway and proceeded in the take-off direction for some 1400 metres, then turned and taxied back to the threshold. Witnesses working in the vicinity of the runway later testified that while the aircraft was taxi-ing on the runway, the engine noise level was considerably louder than that normally associated with taxi-ing.

At 0709 the crew reported that the fog was in banks, with varying conditions and that the blast of their exhaust had had some effect in clearing the fog from the runway. They intimated that they were, at that time, preparing for take-off, approval for which was given at 0712 hours.

About one minute after take-off, the flight reported on top of the fog bank at about 1700 feet and normal departure communications were effected. At 0721 the flight transmitted a MAYDAY call, after which communication was lost. A ground witness who saw the aircraft at about this time noticed a whitish stream of smoke issuing from the port side and then saw flames stream out along the fuselage. The aircraft continued straight on for some time without sinking, then turned left and began to lose height. Finally, it went into a steep dive and disappeared from sight into the fog crashing into open fields about 19 nautical miles from the airport at 0722. It was subsequently establshed, from the data recorder, that the aircraft had reached 8780 feet before it commenced to lose height.

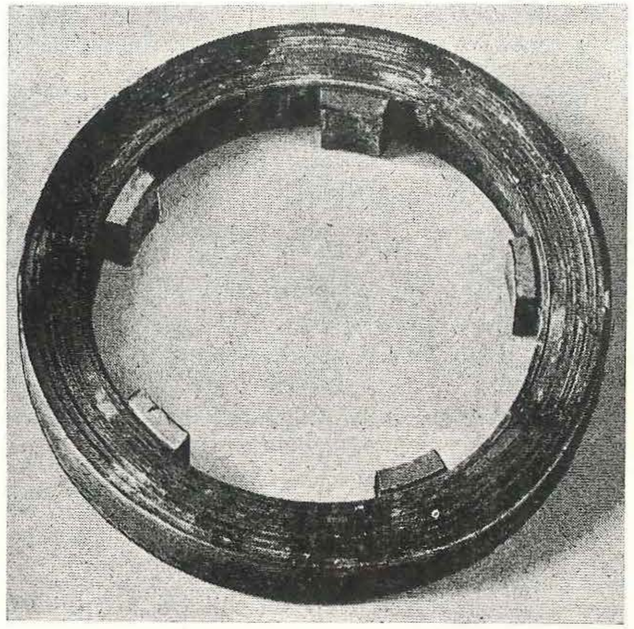
Fragments of the outer rim of No. 4 wheel (the rear inner wheel on the port undercarriage bogie), an earthing cable with its attachment, a blow-out stain, a small quantity of hydraulic oil and traces of burnt oil were found at the beginning of runway 34. The blow-out stain was between the tracks of the two pairs of wheels of the port main undercarriage and, beyond this point, the wheel tracks were covered with hydraulic oil. Parts of the tyre of No. 4 wheel were found along the take-off tracks over a range of 1350 to 1700 metres from the beginning of the runway. Other parts of the aircraft, from the port undercarriage area, the port wing and the rear fuselage, were found over the last seven miles of the flight path.

After a long and detailed investigation of all of the factors which could have caused or contributed to the accident, the investigating authorities found that three interrelated facts could be used as a starting point from which to reconstruct the sequence of events. These were the fracture of No. 4 wheel before take-off, the outbreak of fire while climbing, and the final dive to destruction.

It was evident that the rim of No. 4 wheel broke away and the tyre burst while the aircraft was turning on to the take-off heading at the beginning of the runway. The state of the brake mechanism led to a reliable conclusion that the braking system had been overheated and experiments and tests carried out proved that such overheating could lead to a wheel fracture of the type that occurred to the No. 4 wheel.

The external picture of the events, obtained from eye witnesses, is one of a rapid change, a few minutes after take-off, from a trail of white smoke coming from the aircraft to a sudden and extensive fire in the vicinity of the retracted port undercarriage while the aircraft was climbing. In considering the circumstances which led to this sudden outbreak of fire, the investigating authorities were faced with two alternative hypotheses. Firstly, it was known that hydraulic oil escaped from the brake system immediately following the blow-out of No. 4 tyre, and that this oil was burning at the take-off end of the runway. If the fire started when No. 4 wheel blew out and was still





*Left: Brake disc recovered from No. 4 wheel assembly showing deep grooves apparently made by heavy braking while taxi-ing on runway before take-off.*
*Right: A typical blow-out stain similar to the one found at the beginning of the runway from which the Caravelle took off.*

burning on the wheels when the undercarriage was retracted, it could be expected to spread to the other wheels and eventually burst out of the undercarriage housing. Alternatively, there was evidence to show that there had also been a primary fire in No. 3 wheel (the rear outer wheel on the port bogie, adjacent to No. 4) and its brake discs showed clear signs of overheating. Tests and calculations established that wheel rims do not reach their maximum temperature for a few minutes AFTER the original braking process, hence it could well have been that No. 3 wheel rim also burst after take-off, causing damage to fuel lines and the ignition of a separate fire which eventually ate its way out of the undercarriage housing. In either case, it can be deduced that the fire was caused by overheating of the brakes.

In their reconstruction of the various phases of the flight, the investigating authorities concluded that the flight proceeded normally for about five minutes, with the crew unaware of the situation that was developing. Information derived from the data recorder indicates that the first obvious effects were a falling off in aircraft performance, which was followed by a deviation to the left and loss of height. In the second phase, structural parts of the aircraft began to fail and evidently control of the aircraft became increasingly difficult. The final phase, in which the aircraft entered the vertical dive, was probably produced by loss of rigidity in the port wing structure, loss of hydraulic power for the control system and structural damage to the port tailplane.

## COMMENT

In their investigation of this accident the authorities responsible went to great lengths to determine the cause of the brakes overheating, with particular reference to the possibility that high engine powers were used as a means of improving runway visibility while the aircraft was taxi-ing on the runway. Several hypotheses were explored but no firm conclusion could be reached on the evidence available. Although isolation of the specific cause of overheating was important in relation to this particular accident, the long term significance of the accident is its demonstration of the danger that can exist **after** heavy braking, irrespective of the circumstances which lead to such braking. In one recent local incident, fire broke out in the port wheels of a Viscount after heavy braking. In this case, the aircraft was taking off on a scheduled flight and one engine was observed to be below nominal power. Take-off was rejected just below $V_1$ and the aircraft was braked to a halt. The aircraft was taxied back to the terminal, the other three engines were cut and ground running commenced on the suspect engine. In the course of this ground running, fire broke out in the port wheels. Several other cases of a similar nature have occurred during training.

One significant fact emphasised in the report on the accident is that the temperature in the wheel rims continues to rise for several minutes **after** braking has ceased. This fact should be kept in mind when assessing the time interval that should be allowed between an abandoned take-off and the beginning of another run, particularly when the aircraft wheels are not fitted with fusible plugs.


# Be Alert for CARBURETTOR ICE

"Carburettor Icing: A sweet substance applied over carburettors to improve palatability and/or appearance." Thus was the condition defined in a little piece of light-hearted nonsense entitled "Aviation Terms," that appeared recently in one of our overseas contemporaries ! But if last winter's spate of carburettor icing reports is any indication, some pilots' comprehension of the problem isn't much closer to reality !

The Auster Autocar shown in the picture on the next page was the victim of this inexpertise. Loss of engine power from carburettor icing forced it down only a few minutes after taking off on a cross country flight in South Australia, because the pilot didn't recognize the trouble in time to correct it.

Not long afterwards, in New South Wales, an almost certain accident in similar circumstances was averted only by the watchfulness of a Sydney communications officer. A private pilot flying a PA.22 from Goulburn to Bankstown reported to Sydney that his engine was running roughly and that he might have to force-land. The alert phase was declared and close contact maintained with the aircraft. The engine continued to lose power and the pilot next reported he was down to 300 feet above rough terrain and was losing height at 200 feet per minute. Asked by Sydney if he was using carburettor heat, the pilot selected it on and almost immediately the engine cleared itself and ran normally again. The pilot continued to an airstrip near Mittagong where the engine was subsequently checked and found faultless.

At Geraldton, Western Australia, the engine of a Cessna 175 failed to respond when the throttle was opened after a simulated forced landing approach, and the aircraft had to be force-landed in the field already selected. This time the forced-landing was successful. The engine continued to idle after the aircraft had been brought to a stop, but opening the throttle produced almost no response. Carburettor heat was selected on and the engine left running. After a short time the carburettor ice cleared and the engine was capable of being run-up normally. The aircraft was then flown back to Geraldton Aerodrome, where an inspection failed to reveal any defect in the engine. Weather conditions at the time were conducive to the formation of carburettor ice, with a series of cold fronts accompanied by heavy showers passing through the area, and there was six eighths of strato-cumulus and cumulus cloud at 3000 feet.

These three cases are sufficient to show how vitally important it is for pilots to be able to recognize the conditions in which the carburettor heat control should be used. This can be achieved by learning to recognize the atmospheric conditions favourable to carburettor icing and by being alert in such conditions for symptoms of icing in aircraft engines.

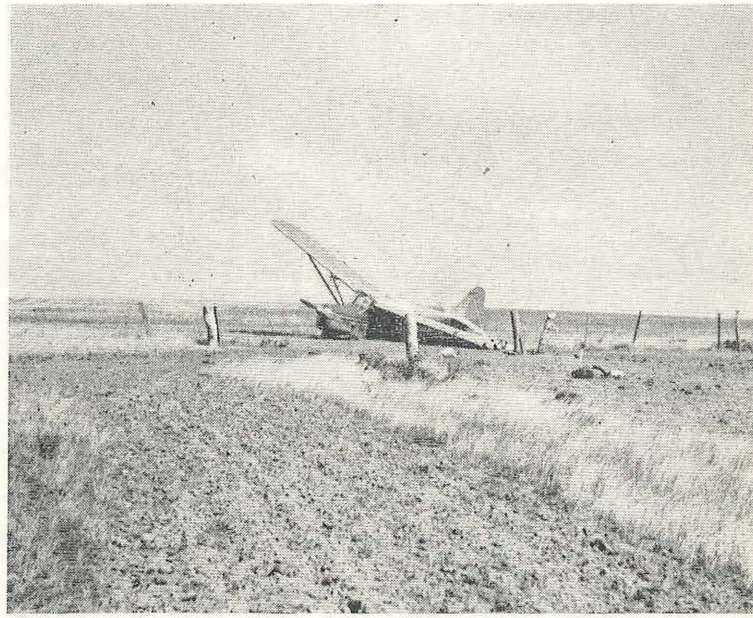
Carburettor icing, or induction system icing as it is sometimes called, results from a process quite different from that by which structural ice is formed on aircraft, **and it can form in conditions in no way conducive to the formation of structural ice.** Indeed, if the humidity of the free air is high enough, carburettor icing can occur in air temperatures as high as 27°C. The ice may form in various places and on various parts of the induction system—in the air intake, in curves of the inlet manifold, at the main jet, in the venturi, or on the throttle butterfly valve. Ice formation in the induction system causes a loss of engine power by obstructing the air passages and disturbing the fuel metering, and in extreme cases, by rendering movable parts inoperative.

Three types of icing can occur in aircraft engine induction systems: refrigeration icing, throttle icing and impact icing.

**REFRIGERATION OR FUEL - EVAPORATION ICING** is caused by evaporative cooling of all induction system surfaces that are wet with fuel. This type of icing occurs on days when the humidity of the air is high, with moderate air temperatures between 5° and 27°C. If the surfaces are cooled below the local dew point or if free water is present and the local temperature is reduced below 0°C, then ice forms and builds up on the surfaces. Float-type carburettors, which mix fuel with the air before it reaches the throttle so that the fuel is evaporated during the throttling process, are especially liable to this form of icing, which is the result of the refrigeration action that accompanies the vaporisation of the fuel as it combines with the air. The principle can be demonstrated easily by placing a small amount of avgas on your hand, and noting the cooling effect as the fuel evaporates. Because the heat required to evaporate the fuel is taken from your hand, you experience a cooling sensation.

The interaction of the various factors involved, such as the volatility of the fuel, manifold pressure, air temperature and humidity, is complex. However, the practical result with normal aircraft fuel is that serious evaporative icing will not form with air temperatures above 25°C whatever the humidity, or with a relative humidity below 60 per cent, whatever the temperature. The most severe icing occurs when the outside air temperature is around 13°C. Obviously, the icing will be more severe if there is water in liquid form in the outside air, so pilots should be particularly alert for icing during flight in rain or cloud at these temperatures. For a given relative humidity, the severity of this type of icing decreases with a reduction in temperature and it is unlikely to give trouble at temperatures below minus 10°C.

**THROTTLE ICING:** A reduction of air pressure and a consequent fall in air temperature, accompanies the increase in the velocity of the air as it flows through the carburettor venturi and past the throttle butterfly. When free water from rain or cloud is present, ice is likely to build up on the surface cooled by the air stream, even at outside air temperatures up to about 5°C. This form of icing is likely to be troublesome when engines are running with the throttle nearly closed, for example when warming up on the ground, but generally it clears when the throttle is opened. The additional cooling effect in the throttle does, however, intensify other icing effects.



*Carburettor icing forced this Auster down only a few minutes after taking off. The aircraft struck a fence during the landing.*

**IMPACT ICING:** The conditions required for the formation of impact icing in the induction system are similar to those that produce airframe icing. For this reason it is not as insidious as the other two forms of carburettor icing. Impact icing occurs when the air temperature is between minus 10 and 0° C, and supercooled water droplets strike any part of the air intake or induction system. In these conditions, the water droplets, at a temperature below freezing but still in liquid form, freeze immediately they come in contact with any surface colder than 0°C. Supercooled moisture may be encountered in the form of freezing rain, clouds or wet snow. Above minus 10°C, clouds always contain water droplets and so are prolific sources of impact icing, which can build up on air intakes, heater shutters, duct walls, carburettor screens, throttle butterflies and carburettor metering elements. The most serious form of impact icing is clear ice which occurs readily at around minus 5°C, especially at high airspeeds, when there is a high liquid water content in the air, or when the water droplets are large.

It can now be seen that carburettor icing is not only a low temperature phenomenon, but that it can occur at air temperatures well above freezing point, and in clear air as well as in cloud and precipitation. Moreover, the onset of carburettor icing is not always apparent and its symptoms can easily be confused with other engine troubles. Unfortunately, no completely reliable icing indicator has yet been devised, but the only remedy is nevertheless prompt and correct use of carburettor heat. One of the best indications of icing in the induction system is an otherwise unaccountable loss of manifold pressure (or r.p.m., with a fixed pitch propellor) which is restored after carburettor heat has been applied for long enough to melt away any ice present. Remember that a small loss of power will *always* occur when carburettor heat is selected on, whether or not ice has formed. But if ice *is* present, the power will steadily increase again, though of course not quite to the original setting until the carburettor heat control is returned to "cold."

Icing in the induction system has exactly the same effect as gradually closing the throttle. The air flow through the carburettor is progressively restricted as the ice deposits build up, reducing the power being developed by the engine. Often, when pilots fail to recognize the symptoms of carburettor icing, they go on opening the throttle little by little to compensate for the gradually falling manifold pressure or RPM indication. It is just this set of circumstances that can lead to a complete loss of power, **for if the application of carburettor heat is delayed too long,** the ice accumulated in the induction system may be too much for the carburettor heat available at the resulting reduced engine power.

If icing conditions are suspected during flight, it is good practice to use carburettor heat at frequent intervals, to check for the presence of ice in the induction system. This can be done most effectively by noting the manifold pressure (or r.p.m., in the case of a fixed pitch propeller) with the control in the cold position, applying full heat to melt any ice present, then returning the control to cold. If the power indication is higher than previously when the control is returned to the cold position, ice had formed. When using carburettor heat in this way, be sure it is applied for long enough to get rid of all the ice which might have formed in the induction system. Even hot air cannot do it instantaneously — remember how long it takes to defrost a refrigerator. In most cases about thirty seconds should be sufficient.

Carburettor icing can also occur on the ground during taxi-ing or while the engine is idling. Last winter in fact, there were at least two instances of engines stopping while aircraft were at the runway holding point and the cause in each case was attributed to carburettor icing. Most light aircraft operators stipulate that the carburettor heat control should be left in the cold position during ground running to obtain the benefit of the air intake filter. This of course, is entirely reasonable, but it is important that the operation of the carburettor heat control should be checked during run-up, not only to see that it is working properly, but also to ensure that any carburettor ice formed during ground running is cleared before take-off.

# Oxygen Equipment Explosion

The article, "Fire dangers in oxygen systems" in our March, 1965, issue (see Aviation Safety Digest No. 41) referred to an overseas incident in which a fire broke out in the cockpit of an aircraft while an oxygen bottle was being replaced. The article emphasized the risks that are involved in handling oxygen equipment, particularly the danger of spontaneous ignition as a result of adiabatic compression when a shut-off valve is opened too suddenly. An accident of this type actually occurred in an airline company's oxygen cylinder recharging plant at Adelaide Airport recently, causing a flexible hose to explode and inflict injuries to an L.A.M.E. who was operating the equipment.

An investigation into the cause of the accident established that the trouble apparently originated in one of the shut-off valves of the recharging equipment. Continued operation of the valve had resulted in small pieces of material chipping off the plastic valve gland and the valve seat. It is believed that the fire started when the chips of the gland and valve seat material ignited as oxygen at 2,200 lb. per square inch was suddenly admitted to the valve. The fire was carried down-stream into the flexible hose, which burst under pressure after being weakened by heat. Examination of a second valve in the recharging equipment showed that it too had shed chips of the gland material.

This accident is a classic example of the dangers associated with handling high pressure oxygen. As pointed out in our earlier article, if substances having a low ignition temperature are present in any oxygen system, the rise in temperature which takes place spontaneously when the pressure is suddenly increased can cause them to burst into flame. For this reason, an oxygen cylinder valve should **never** be opened suddenly. By opening it very slightly at first, the oxygen can be bled slowly into the system, thus allowing the pressure to build up gradually without a rapid increase in temperature. Absolute cleanliness is, of course, vital in handling oxygen system components, but even when the utmost care is taken during assembly, it is impossible to be certain that valves and pipe-lines will always remain free from combustible particles.



# YOUR NEW HANDBOOK . . .


*Within the next few weeks, a new D.C.A. publication, the "Visual Flight Guide", should be available for distribution to all holders of the present Light Aircraft Handbook. The Visual Flight Guide is intended to replace the Light Aircraft Handbook. General aviation pilots will recall that this move was foreshadowed in Aeronautical Information Circular 10/1966 issued in January this year.*

More truly a "handbook" than its predecessor, the Visual Flight Guide is a bound octavo sized book, covering somewhat more comprehensively, the whole range of aircraft operational procedures. The book is, in fact, a synthesis of the Light Aircraft Handbook, the Aeronautical Information Publications, suggestions from the aviation industry, and recommendations of the committee appointed by the Director-General to look into the needs of general aviation in Australia. The information it contains is presented more systematically than previously and in a more easily readable form.

**It will not be necessary to amend large sections of the Visual Flight Guide every two months or so.** Instead, the Department intends to reprint the book approximately every 12 months, or whenever large or significant changes demand it. It may not even be necessary to reproduce the Flight Guide every 12 months as the greatest single source of amendments, the information previously contained in the MAP section of the Light Aircraft Handbook, will now, for the most part, be printed on the back of the Visual Enroute Charts (V.E.C.s). Information on the back of the V.E.C.s will include Visual Terminal charts, details of air traffic control, communication and radio navigation services, and prohibited, restricted and danger areas. It will thus be possible to deal with most amendments to operational information, merely by re-printing and re-issuing the V.E.C.s. Because the size of the Visual Flight Guide will be too small to contain the plastic pockets previously issued for the V.E.C.s, a special plastic map holder is to be made available for this purpose.

In addition to the normal distribution to private pilots and to those commercial pilots who normally use the Light Aircraft Handbook, a number of copies of the Visual Flight Guide will be issued to every flying school and aero club for distribution to student pilots who have reached a certain stage of their training. In this way, the Department intends that the Visual Flight Guide should be readily available to all who have a genuine requirement for it.

Altogether, we believe that the introduction of the Visual Flight Guide represents a significant step forward in simplifying flight planning and actual operational procedures for the majority of general aviation pilots, particularly those in the private category. By comparison with the Light Aircraft Handbook, the Visual Flight Guide is handier in size, easier to carry and stow in a small aeroplane, the sequence of topics follows a more logical operational order, and a comprehensive index enables the reader to find the information he is seeking very quickly.

We like to think that the advantages of this new method of presentation will, in time, be reflected in an overall improvement in airmanship and flight procedures throughout the general aviation industry !

# Comet Strikes Ground During Approach

*(Summary of Report Issued by Ministry of Aviation U.K.)*

With the first officer flying the aircraft from the right hand seat, a Comet 4 commenced descent for a straight-in night approach to Nairobi, Kenya, 5,327 feet above mean sea level. The terminal weather was fine with 2/8ths of cloud at 2,000 feet, QNH 1020 and QFE 839. At 20 nautical miles DME, the first officer called for the approach check and began to wind the starboard altimeter back to the QFE setting of 839 mbs. In doing so, he erroneously stopped winding when the sub-scale read 938 mbs, thereby making the altimeter over-read by nearly 3,000 feet. Meanwhile the captain set the correct QNH setting on the port altimeter. At this point the aircraft was cleared to 2,000 feet on QFE and the first officer checked the port altimeter setting as 1020 mbs, called for the landing check and closed the throttles to descend.

At 10 nautical miles DME, on descent with the undercarriage extended, the ILS indicated "fly up", while the first officer's altimeter indicated that the aircraft was passing through 4,500 feet instead of about 3,000 as expected if on the glidepath. Subsequently, the first officer looked ahead and saw the runway and approach lights fused almost into a continuous line. Realizing he was too low, he applied power but the aircraft touched down on the ground and ran along for about three seconds. The captain opened the throttles to full power and the first officer lifted the aircraft off. The captain reported that the aircraft had "hit something 8 miles out on final" and requested clearance for a visual circuit and landing with emergency services standing by. While climbing away on QNH, the first officer realized he had mis-set his altimeter to 938 instead of 839 mbs. The aircraft then made a normal landing and taxied to the apron unaided. Damage was confined to two cut tyres, a fractured brake line, and a damaged tie rod on the starboard main undercarriage.

The premature touch-down had occurred on a patch of open country dotted with outcrops of volcanic rock some 9 miles from the runway and the extended undercarriage had left impact marks 195 yards long and up to 5 inches deep. The rugged surrounding terrain made it virtually impossible to reach the site by surface transport and a helicopter had to be used for the inspection.

Giving evidence, the first officer said that the incorrect setting of 938 had given him a "visual appreciation" of the correct setting of 839 mbs. Subsequently, in intending to cross-check the altimeters by adding the aerodrome elevation to the starboard reading, he mentally substituted the height of 2,000 feet to which the aircraft had just been cleared. By an unfortunate coincidence, this happened to be the difference in the altimeter readings.

The captain stated that, after adjusting the port altimeter to the QNH setting of 1020 mbs., he checked the sub-scales on both instruments but did not check the difference in the instrument readings as required by the company's operational procedures. When the captain last checked his altimeter before the premature touch down, it read 7,600 feet on QNH., i.e., 2,273 feet above aerodrome level. He expected the aircraft to level out after this, and because he was concentrating on the landing check, he was not aware that the descent was continuing below 2,000 feet. His cockpit roof light was full on at this time and he did not look out of the aircraft.

The accident resulted directly from the fact that the first officer unconsciously transposed the figures of the QFE in setting his altimeter. Errors of transposition are easily made and are often not immediately apparent to the person making them. Because such errors are difficult, if not impossible, to prevent, cockpit drills and checks have been developed to ensure that if errors **are** made, they will be promptly detected. If the required checks had been properly carried out on this occasion, the error in the altimeter setting would have been discovered before the aircraft descended below the height to which it had been cleared. The captain's failure to ensure that this was done indicated an unsatisfactory standard of supervision.

### COMMENT

The first officer's undetected error placed this aircraft in a situation perilous almost beyond words and it is little short of miraculous that the flight did not become just another apparently inexplicable disaster. Although the altimeter procedures used by the operator concerned differ from our own, this in no way detracts from the principle at stake. The accident is a startling demonstration of how absolutely essential it is for crews to properly monitor and cross-check their instruments during an approach to land.

There can be little doubt that if it were possible to know the true facts, many of the world's unsolved major accidents which have occurred during the descent or approach to land phases of flight could be attributed to mis-read or mis-set altimeters. This particular case gives us a rare opportunity to study such an accident actually in the making. Let us not miss the vital lesson it contains.



# Lost And Found

Just one year ago in an article entitled "Air Age Jetsam" we discussed the problems being posed by tools and other maintenance equipment left in aircraft engine bays and wheel wells. The article instanced two cases of damage caused to aircraft and two in which pieces of equipment fell into closely settled residential suburbs from aircraft in flight.

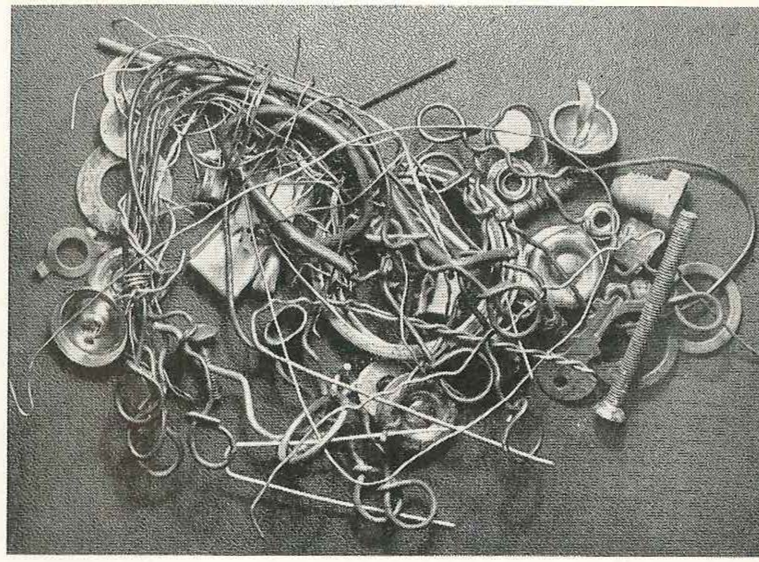
Since that time, far from diminishing, the problem has continued to mount alarmingly. The extent to which it has grown is best shown by the following list of some of the tools and aircraft parts found by airport maintenance staff on runways and taxiways at major airports at various times during past months:—

- Adelaide: Pair of multigrips
- Brisbane: Jacking pad, cold chisel
- Broken Hill: Hose clamp
- Cairns: Torch, socket wrench
- Darwin: Hose clamp
- Launceston: Aircraft door handle, metal bracket
- Mangalore: Aircraft jacking pad.
- Melbourne: Ball pein hammer, Weston thermostat, fuel tank dipstick, pneumatic system part, signalling bat, pair of pliers, wheel chock, coil of aerial wire, screwdriver.
- Moorabbin: Spanner
- Perth: Pair of multigrips
- Port Moresby: Length of copper pipe
- Rockhampton: Screwdriver, oil drain tube
- Sydney: Aircraft jacking pad, length of ½ in. pipe, toggle wrench, torch, turbine engine test probe, wheel chock.

The list of recovered articles is startling enough, but what of all the others that are **never** found — those that fall out of aircraft after they have taken off ?

There is no way of knowing how many items there are in this category. Nevertheless, when we consider that the time an aircraft spends manoeuvring on an aerodrome is but a very minor fraction of the total flight time, and the fact that a number of the articles found were dropped from aircraft **after** they had landed, it is reasonable to assume that articles are being dropped in flight at least as frequently as on aerodromes, and perhaps much more often.

Statistically speaking, if this trend continues, it is only a matter of time before a piece of equipment drops where it is going to kill or maim some innocent party on the ground. If an accident of this nature were to happen, there is no doubt that it would have a most salutary effect on the habits of aircraft maintenance personnel generally. But



*Debris picked up on the apron of a major airport.*

it would be tragic indeed if we had to wait for a fatality to punch home the vital importance of accounting for all equipment after work on an aircraft has been completed.

This potential is horrible enough in itself, but another possible consequence could be even worse — a situation where a forgotten piece of equipment becomes lodged in a position where it fouls a control line or, by some similar cause, leads to loss of control of the aircraft. And this is no idle thought. As most of us know, it **has** happened !

There is one other "good housekeeping" aspect of aircraft maintenance, which though not likely to lead to consequences as dire as the ones we have been discussing, could nevertheless inflict costly damage to an aircraft, particularly one with turbine engines. The photograph on this page shows an accumulation of debris picked up on the apron of a major airport. It is not difficult to imagine the damage that could be inflicted by some of this rubbish if it were ingested by a turbine engine.

A random check on the apron of a secondary airport, made while this article was being written, indicates that the problem is not confined to major airports. One piece of twisted locking wire that was recovered from the tarmac surface of a light aircraft parking area, could easily have punctured any light aircraft tyre that ran over it, with the chance of a landing accident resulting.

Aircraft maintenance engineers have a reputation for workmaship of a high order and scrupulous attention to detail. Why spoil that image by "slap-dash" cleaning up after the job is finished ?

# IS *YOUR* WINDSCREEN CLEAN?

It was just after first light, at a country aerodrome in Western Australia, and the pilot of an EP-9 had carried out his daily inspection and climbed into the cockpit, ready to ferry the aircraft to an agricultural airstrip for top-dressing operations. He started the engine and let it warm and, after completing a satisfactory run-up, he released the brakes and began to taxi. The aircraft was facing into the east and the rising sun, low on the horizon, made visibility from the pilot's seat difficult. The aircraft had rolled only a few yards when the spinning propeller struck an empty 44-gallon drum that had been used for refuelling the night before. The pilot straight away switched off the engine and braked the aircraft to a stop, but both propeller blades were already damaged beyond repair.

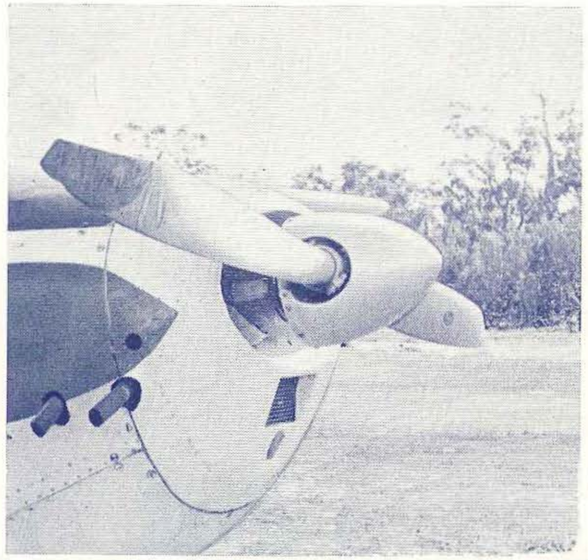
When the aircraft was inspected after the accident, the windscreen was found to be extremely dirty. This would have aggravated the blinding effects of the sun, making it almost impossible to see anything in front of the aircraft from the cockpit while taxi-ing into the east. It was also found that, even if the propeller had missed the 44-gallon drum, it would have struck the pumping equipment that been left in front of the aircraft. The pilot said later that he had noticed the drum and refuelling equipment when he arrived at the aerodrome, but not seeing them after he boarded the aircraft he thought they were further away and not a hazard. It is very likely that, had he cleaned the aircraft's windscreen before starting, as enjoined by the Daily Inspection Schedule, the pilot would have seen the equipment from the cockpit and the accident would not have happened.

Only a few days later, another dirty windscreen was responsible for a more serious accident to an agricultural aircraft: At Goulburn, New South Wales, the pilot of a Cessna 180 and his loader-driver arrived at the aerodrome early in the morning to fly to an agricultural airstrip. The morning was very cold with frost on the ground and the aircraft's windscreen was completely misted over. Before starting, the pilot rubbed the mist off a small area of the windscreen directly in front of his seat. The two men boarded the aircraft and, after warming up, the pilot taxied out and began to take off.

Forward visibility through the small "hole" rubbed on the misted windscreen deteriorated as the aircraft gathered speed, and the pilot lost directional control. At 40 knots he abandoned the take-off but the aircraft continued the swing to port and finally ground-looped. The starboard undercarriage leg collapsed and was torn away and both the starboard wing and the starboard tailplane struck the ground heavily, each being bent badly in mid-span.

Happily, neither the pilot nor his passenger was injured, but as with the first accident, this one could easily have been avoided if the pilot had taken the trouble to clean his windscreen before beginning his flight.





Some pilots are fastidious in their attitude to windscreen cleanliness and rub them over carefully before beginning each flight. Others are not so fussy and seem to accept that a bit of grime or mist on the windscreen doesn't matter much. If you are in this latter category watch out that the coming winter months don't catch you out in the same way as the pilot of the Cessna!

*Below: After taxi-ing forward a few yards, this EP9 collided with a fuel drum, damaging its propeller. Even if the propeller had missed the drum, the aircraft would still have run into the refuelling equipment. Inset: The bent propeller. Both blades were damaged beyond repair.*

## Extracts From Two Overseas Accident Reports —

After making a walk-round inspection of his aircraft, the pilot of a PA.22 taxied out for take-off. The take-off run seemed normal but immediately after becoming airborne the aircraft became uncontrollable and crashed.

Investigation revealed that the aircraft's rudder was missing from the empennage. A part-owner of the aircraft said later that two days before the accident he had removed the rudder to have it repaired.

★ ★ ★

A private pilot was practising circuits and landings in a Turbulent ultra-light aircraft. As the aircraft touched down on the fifth landing, the port wing fell off.

# WATER IN THE FUEL?

An interesting fact about mixing of fuels was demonstrated by an amusing incident recently. It also emphasised again the importance of *correctly* checking fuel tanks for water.

A pilot landed his aircraft which normally uses 80/87 avgas at an aerodrome where only 100/130 octane fuel was available, and not wishing to continue his flight on partially filled tanks, proceeded to top up with the higher grade of fuel.

When the aircraft had been refuelled, the pilot set about checking his tanks for water in the normal way, but only a colourless liquid, looking like water, came from the drain cocks. He kept on, taking sample after sample, but still the colourless fluid flowed out. Noticing what was happening, an L.A.M.E. came over and told the pilot he was draining off fuel, not water ! When the pilot queried the lack of color, the L.A.M.E. pointed out that this is quite normal when 80/87 and 100/130 fuels are mixed.

The L.A.M.E. was quite correct. When these fuels are mixed in the appropriate ratio of 1:3 a colourless liquid results. The reason is that Grade 100/130 is green in colour, the green being made up of blue and yellow dyes. When this is mixed with the red of Grade 80/87, we then have a mixture of the three primary colours, red, yellow and blue, which mixed in the correct ratio will give an approximately colourless mixture. So remember then that the colour of fuels when mixed can be misleading and that positive ways to check whether the liquid being drained is contaminated with water should always be used!

One satisfactory method is to drain the fuel into a glass receptacle which already contains a small quantity of pure fuel. Water will not mix with the fuel, regardless of its colour. Alternatively, samples can be checked by chemical means such as a water detecting paper or paste, where a change in colour of the detecting medium will give a clear indication of the presence of water. The distinctive smell of fuel, its colour and its speed of evaporation are also useful additional indicators, but if used alone can sometimes give quite the wrong impression.

One final comment: We would not wish it to be inferred that indiscriminate mixing of fuels is of no consequence. On the contrary, it is not recommended as a normal practice. However, when there is no reasonable alternative, no engine damage will result from **short periods of operation** with mixed fuels, provided the fuel added has a higher rating than that specified for the particular aircraft.

# Air Sense

There are two danger peaks in a pilot's life. One is when he has flown one hundred hours and believes that he knows everything there is to be known about it. The other is when he has reached the three hundred hour mark and knows that he knows all about it. It is only later, when he reaches the two thousand hour mark, that he realizes he will never know all there is to be known ! The best pilots are not fond of "shooting up" buildings, landing off steep turns, low flying, and other forms of self-advertisement. They get on with the job vigorously, quietly, and efficiently, assessing situations carefully and avoiding risks whenever they can.

All things which imply good airmanship mean conscious effort at first, from swivelling the head round to see that it is all clear before taking off, to doing a final cockpit check before vacating the aircraft after landing. Later on, all these hundreds of small points become habit. They are the sign of a good pilot and they are covered without any conscious thought or effort, and fit into a sense of what has sometimes been called mastery of the air.

This advice is not intended to cramp your style. Pilots without vigour and initiative, are dull automatons who make a poor show in an emergency. What you are asked to do is to strike a happy balance between commendable enthusiasm and sensible caution; to profit from the experience of others, that aeroplanes are excellent and willing servants when wisely and firmly handled, but treacherous and destructive when not controlled according to the basic laws of flying and common sense.

*(With Acknowledgement to "Air Sense," R.A.F. Directorate of Flying Training).*