Self-sealing fuel tank

Self-sealing fuel tanks are an aviation technology that saw widespread use during World War II, when it quickly became apparent that fighter aircraft lacked adequate protection. The design prevents a plane whose fuel tank has been shot from leaking and igniting, destroying the plane. In addition to armor, self-sealing fuel tanks protect both pilot and aircraft.

Construction

Self-sealing tanks are made by having two layers of rubber, one vulcanized and one not. If a fuel tank is punctured the leaking fuel will spill over the different layers and cause them to swell and expand, thus sealing the hole.

World War II

In the newer generations of pre-war and early-war aircraft, self-sealing tanks were tanks used to minimise the potential damage from leaking or burning fuel. A conventional fuel tank, when hit by enemy fire, would leak fuel rapidly. This would not only reduce the aircraft's effective range, but was also a significant fire hazard. Damaged fuel tanks can also rupture, destroying the airframe or critically affecting flight characteristics.

Early attempts at protecting fuel tanks consisted of metal tanks, covered inside or outside by a material that expanded after being pierced. Research revealed that the exit of the projectile, rather than the entry, was the problem, as it tumbled and created a large exit hole.

The solution was to create a flexible container, made of a self-sealing material like vulcanized rubber and with as few seams as possible. As early tests showed that the impact could overpressure a fuel tank, the self-sealing fuel cell is suspended, allowing it to absorb shocks without rupture. U.S. Navy fuel tanks during the war were able to withstand .50 caliber (12.7 mm) bullets and, on occasion, 20 mm cannon shells.

Not all fighters were fitted with the relatively new invention. Those that were, regularly took more punishment than those without self-sealing fuel tanks. Victory ratios in the Pacific showed that the heavily protected American aircraft could take far more damage than the lightly armored Japanese designs without self-sealing fuel tanks.

Modern use

Most jet fighters have some type of self-sealing tanks. High altitudes require the tanks to be pressurized, making self-sealing difficult. Newer technologies have brought advances like inert foam-filled tanks to prevent detonation and self-healing designs.

References