**No: 10/90** **Ref: EW/G90/04/10** **Category: 1c**

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|---|---|
| **Aircraft Type and Registration:** | Stolp Starduster Too SA300, G-BOBT |
| **No & Type of Engines:** | 1 Lycoming O-360-A1F6 piston engine |
| **Year of Manufacture:** | 1983 |
| **Date and Time (UTC):** | 16 April 1990 at 0920 hrs |
| **Location:** | Stapleford Aerodrome, Essex |
| **Type of Flight:** | Private |
| **Persons on Board:** | Crew - 1 Passengers - 1 |
| **Injuries:** | Crew - None Passengers - None |
| **Nature of Damage:** | Substantial to landing gear, propeller, lower wing and fuselage undersurface; engine shock loaded, engine mount deformed |
| **Commander's Licence:** | Private Pilot's Licence |
| **Commander's Age:** | 34 years |
| **Commander's Total Flying Experience:** | 97 hours (of which 35 were on type) |
| **Information Source:** | Aircraft Accident Report Form submitted by the pilot; examination of parts of aircraft by AAIB |

The Stolp Starduster Too is a two place tandem biplane with fixed, tailwheel type, landing gear. The main structure of the fuselage is a welded tubular steel space framework clad with aluminium sheet. The framework section is generally square, but lightweight curved steel hoop formers fastened beneath the main framework provide a curved undersurface profile to the fuselage.

Each main landing gear wheel is mounted on a welded tubular steel leg assembly, which is pin jointed to two attachment fittings welded to the lower outboard corner of the fuselage structure (Fig 1). The assembly comprises a main tube carrying the axle assembly, stabilised fore and aft by a diagonal drag strut and laterally by a side brace. The upper ends of the main tube and the side brace are joined by a horizontal lateral tube. Lateral pivoting of the assembly, for shock absorption, is controlled by two shock cords anchored to fuselage structure and applying an upward load to the horizontal lateral tube.

The accident occurred when the aircraft was landing on grass Runway 28 at Stapleford Aerodrome after a flight from Manston Aerodrome, Kent. The runway was 698 metres long by 46 metres wide, level and smooth. The reported wind was from 270°M at 15 - 18 kt.

The pilot reported that, after a normal sideslipping approach to offset the slight crosswind and to improve forward visibility, he flared the aircraft, added a small amount of power to arrest the descent and achieved a fairly light touchdown. It then became apparent that the main landing gear was collapsing. The pilot pulled the mixture control to the cut-off position and, as the fuselage hit the ground, switched off the fuel pump, alternator and magnetos. After a ground slide of some 10 metres the aircraft came to rest in the centre of the runway, on runway heading and around 45 metres beyond the landing threshold. Both occupants were wearing five-point aerobatic harnesses and were unhurt. The pilot informed Stapleford Radio of his problem, received an acknowledgement, reportedly switched off the radio, master switch and fuel supply cock, and evacuated the aircraft along with the passenger. Both main landing gear legs remained attached but were found to have pivoted outwards and the aircraft was resting on the grass on its belly. After the accident the pilot was aware of fuel flowing from the underside of the aircraft. There was no fire.

The aircraft had been bought from a private owner in the USA and imported in April 1989. At the time of the accident it had accumulated 204 operating hours from new. It could not be established whether the main landing gear assemblies had been fabricated by the aircraft manufacturer or had been home-built from a kit.

Inspection of the aircraft by a maintenance organisation appointed to repair it revealed that for both main landing gears a fracture had occurred at the welds joining the horizontal lateral tube to the main tube. The horizontal lateral tube had also separated from the side brace. In addition, each of the horizontal lateral tubes had buckled upwards near its inboard end. Close examination revealed that, in the case of both landing gear assemblies, there was little penetration of the weld material into the failed welded joint and that the welds tended to form an external load path bridging the gap (Fig 2). The failure was generally in the weld material itself. However, in spite of the lack of penetration, an inspection by the Materials Department of Royal Aerospace Establishment, Farnborough, revealed no evidence of fatigue. It was to be expected that had fatigue damage occurred, it would have been evident. It was concluded that the failures were probably caused by overload, consistent with excessive vertical velocity on touchdown. Whether the damage had occurred on the accident flight or in the course of a previous landing could not be established. No evidence was found of previous similar failures on this type of aircraft.

Examination of the aircraft, in a partially repaired condition, also revealed that parts of the fuel system were particularly vulnerable in a situation where main landing gear legs failed. Fuel was contained in tanks in the upper wing and in a triangular section fuel tank located in the forward part of the fuselage, immediately behind the engine bulkhead. Tank selections were made by a fuel cock situated low down in the rear cockpit in the shallow interspace between the bottom of the main structural framework and the undersurface formers (Fig 3). Four rigid aluminium pipelines connecting the tanks and the engine to the fuel cock also ran in the undersurface interspace, generally over a distance of around 3-4 feet and around 2-3 inches above the undersurface fairing. Thus both the fuel cock and the pipelines, immediately below the cockpits, appeared vulnerable to damage in a case where the aircraft belly contacted the ground. Three of these pipelines cannot be shut-off by operation of the fuel cock. In this accident, at least one pipeline had sustained significant distortion (Fig 4), as a result of contact with distorted undersurface structural members, although rupture had not resulted.

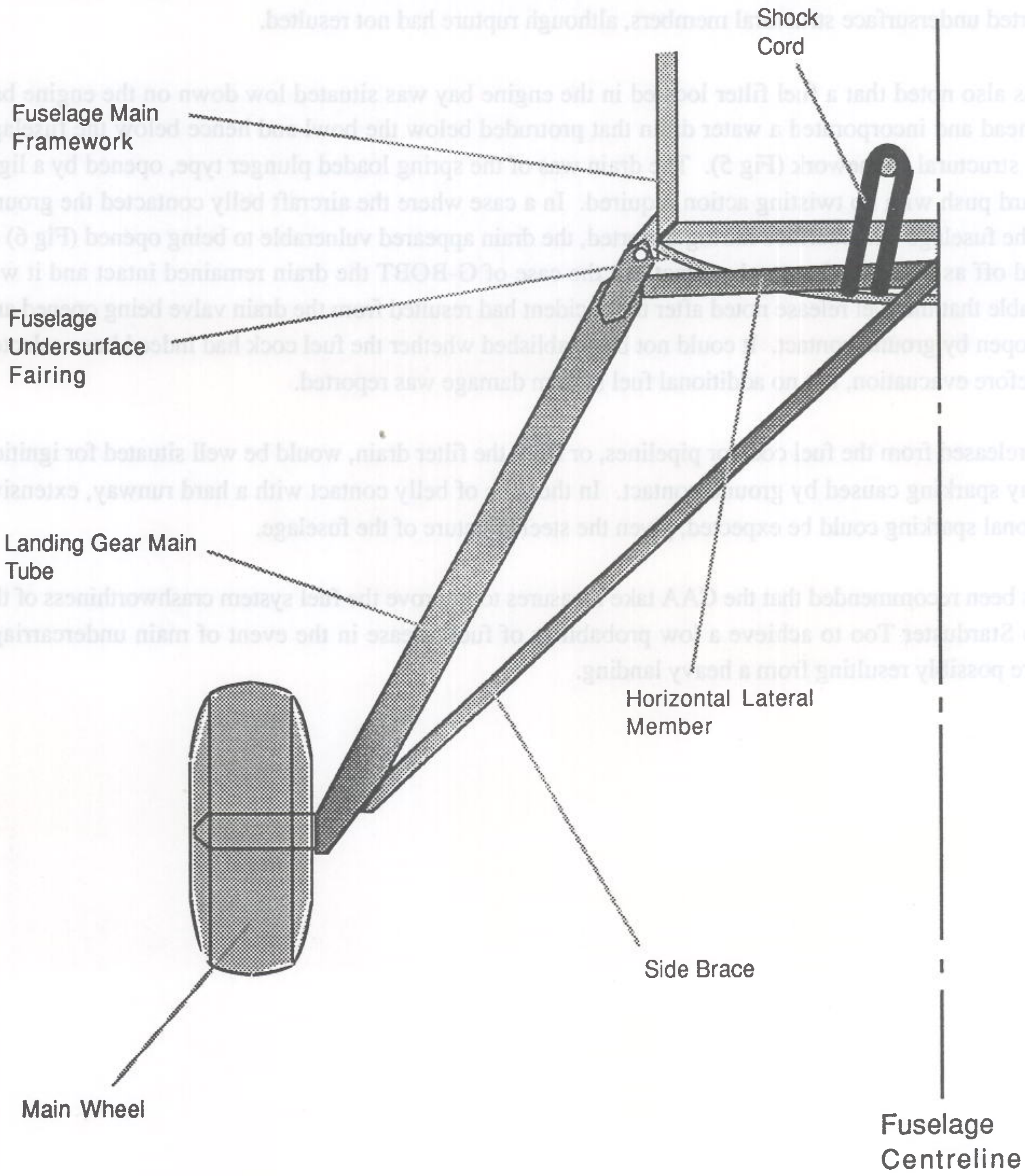
It was also noted that a fuel filter located in the engine bay was situated low down on the engine bay bulkhead and incorporated a water drain that protruded below the bowl and hence below the fuselage main structural framework (Fig 5). The drain was of the spring loaded plunger type, opened by a light upward push with no twisting action required. In a case where the aircraft belly contacted the ground and the fuselage undersurface fairing distorted, the drain appeared vulnerable to being opened (Fig 6) or wiped off as a result of ground contact. In the case of G-BOBT the drain remained intact and it was probable that the fuel release noted after the accident had resulted from the drain valve being opened and held open by ground contact. It could not be established whether the fuel cock had indeed been selected off before evacuation, but no additional fuel system damage was reported.

Fuel released from the fuel cock or pipelines, or from the filter drain, would be well situated for ignition by any sparking caused by ground contact. In the case of belly contact with a hard runway, extensive frictional sparking could be expected, given the steel structure of the fuselage.

It has been recommended that the CAA take measures to improve the fuel system crashworthiness of the Stolp Starduster Too to achieve a low probability of fuel release in the event of main undercarriage failure possibly resulting from a heavy landing.

## MAIN LANDING GEAR SCHEMATIC

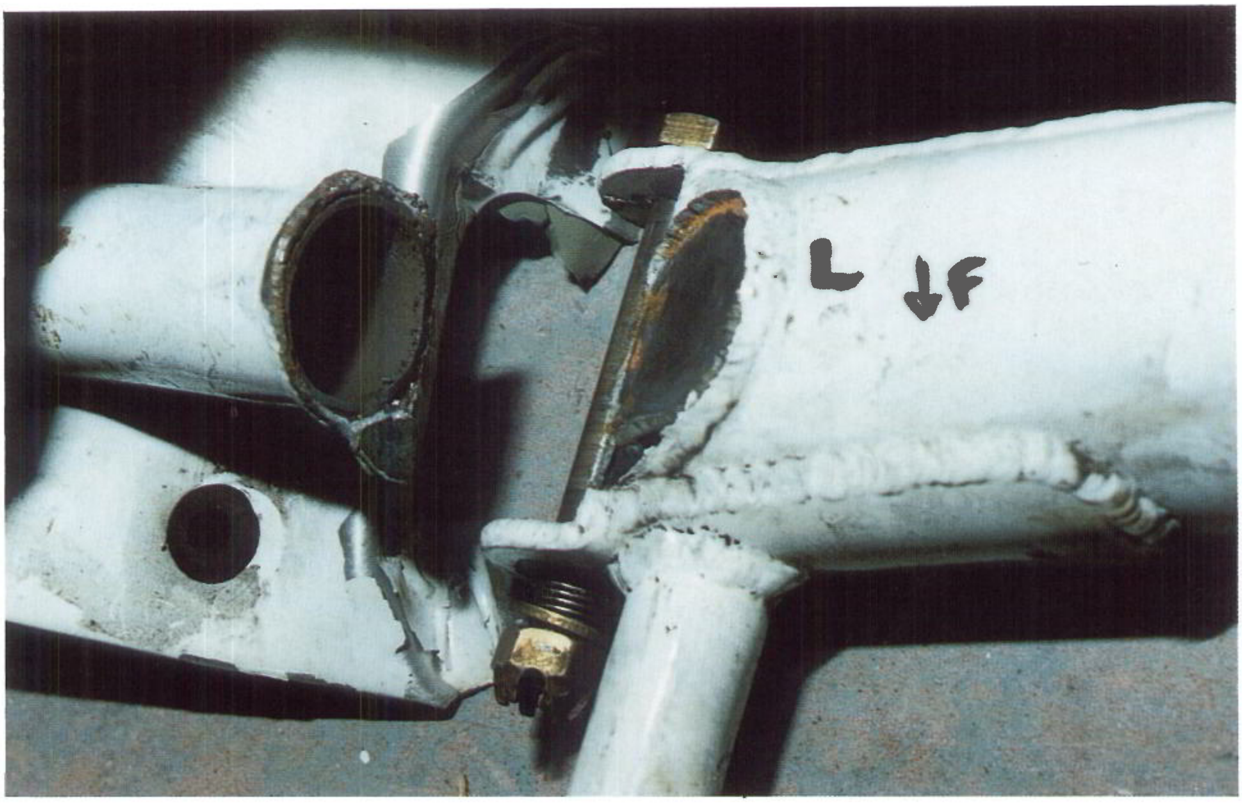
FIG 1




VIEW ALONG FUSELAGE LONGITUDINAL AXIS

Horizontal Lateral Tube

Failed Weld




Main Tube

# FUEL SYSTEM UNDER COCKPIT FLOOR

FIG 3/4

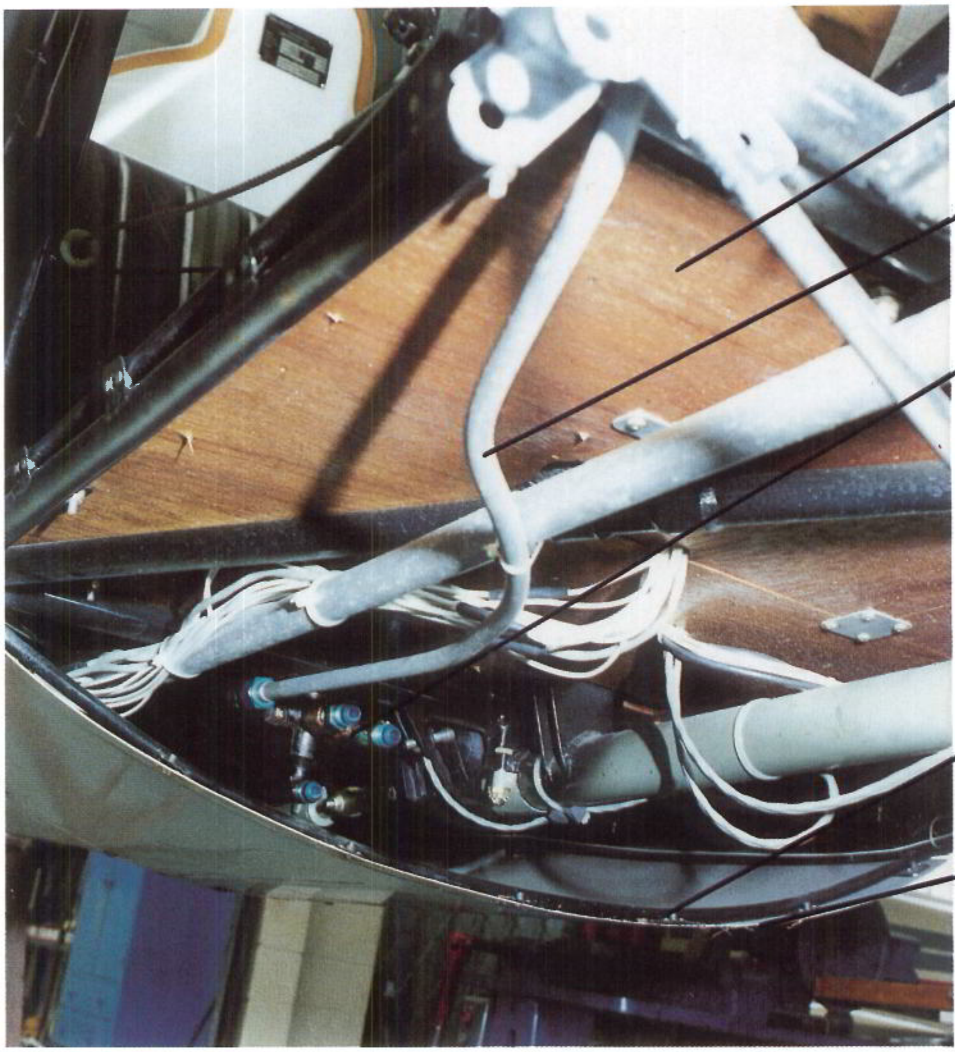



FIG 3

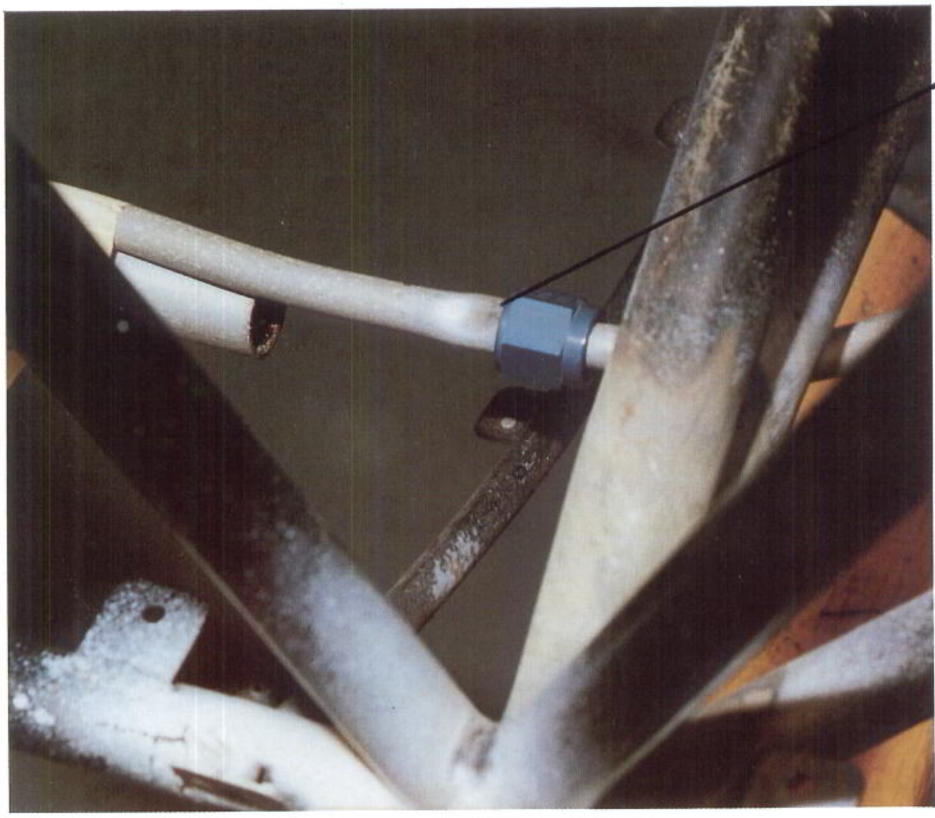
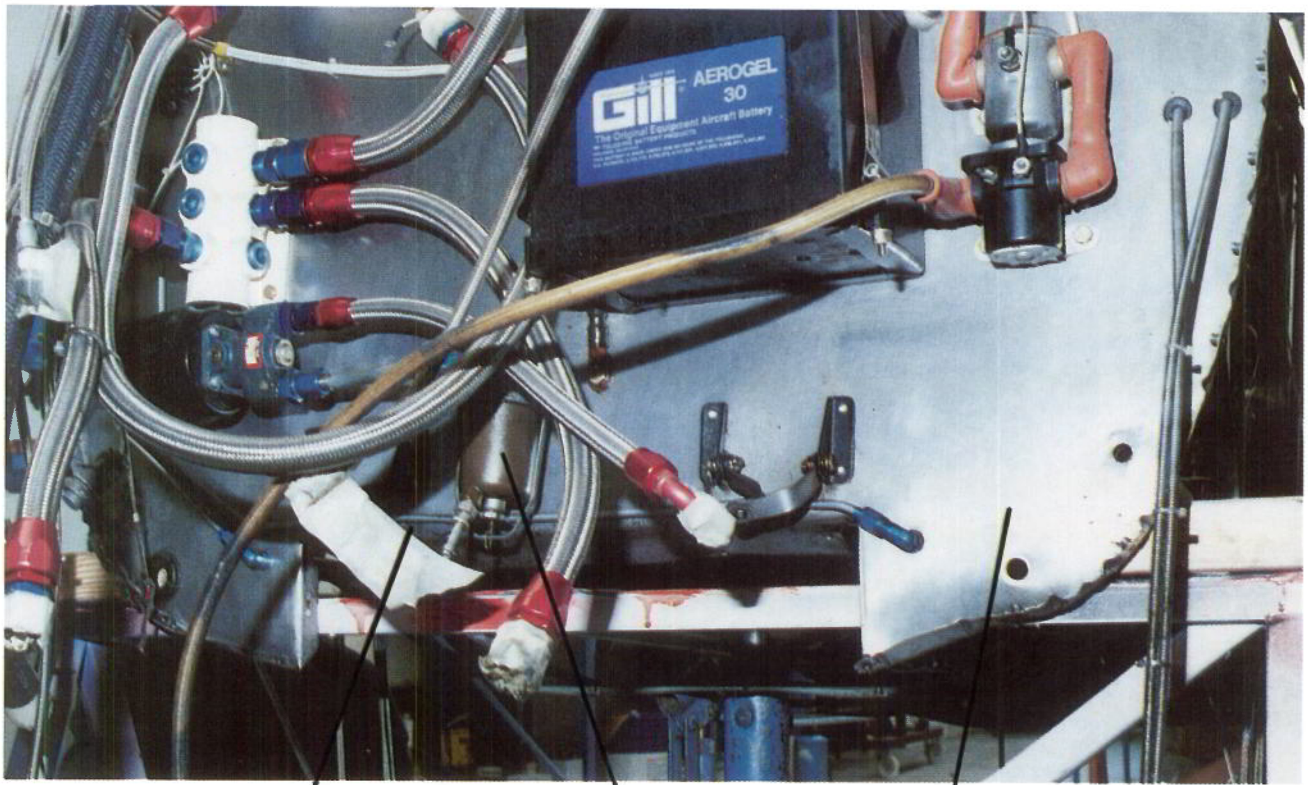



FIG 4

# FUEL FILTER DRAIN

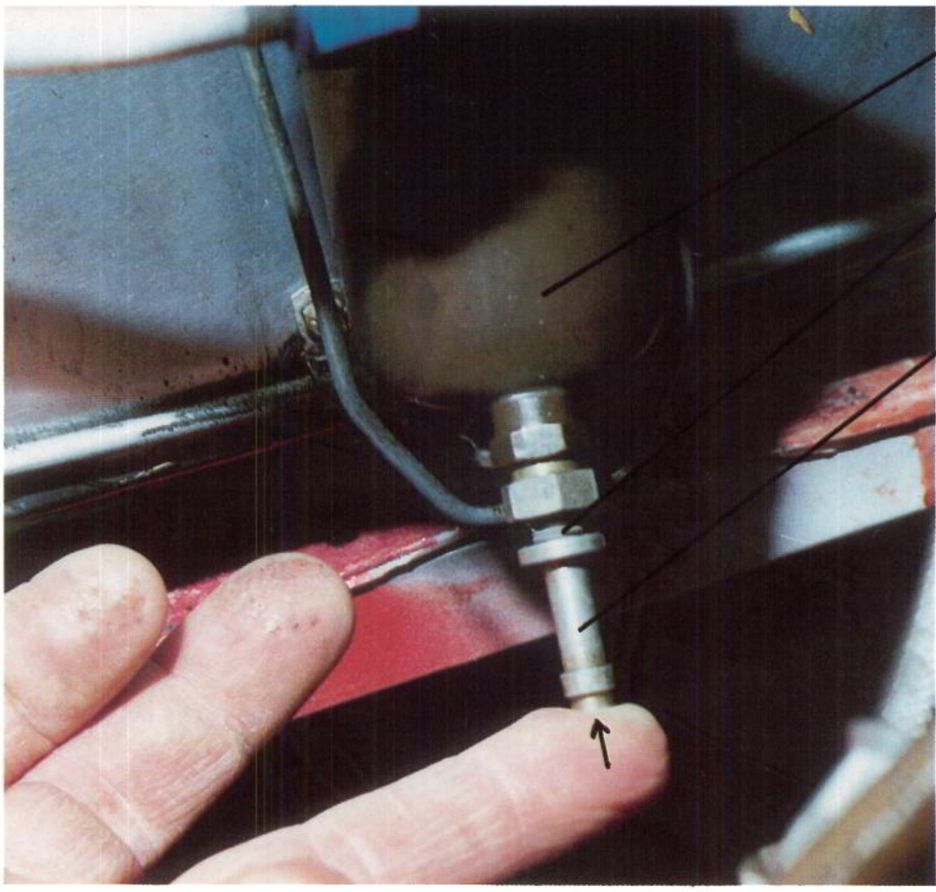



Bottom of Fuselage Main Framework

Fuel Filter

Engine Bulkhead

FIG 5



Fuel Filter Bowl

Spring

Drain (opened by upward push)

FIG 6