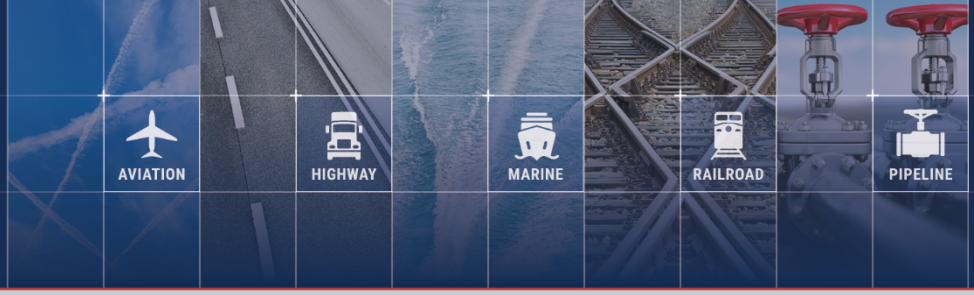

Aviation Investigation Final Report

Location:	Wilder, Idaho	**Accident Number:**	WPR22LA314
Date & Time:	August 20, 2022, 18:00 Local	**Registration:**	N4133S
Aircraft:	Beech F33A	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	2 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The airplane sustained a catastrophic engine failure shortly after takeoff due to a separated crankshaft counterweight. The pilot performed a forced landing, during which the airplane sustained substantial damage. The engine had been overhauled about 14 years and 950 flight hours before the accident. Examination of the remaining counterweights revealed that, during that overhaul, some of their retaining pins had been installed back to front. According to the engine manufacturer, such installation has been known to cause failure of the counterweights and the catastrophic damage observed. The correct installation is documented in the engine maintenance manual and reiterated in a service bulletin that was published 5 years before the engine was overhauled.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

Catastrophic engine failure during the initial climb due to an incorrectly installed crankshaft counterweight retaining ring.

Findings

Aircraft	Recip eng rear section - Incorrect service/maintenance
Personnel issues	Scheduled/routine maintenance - Maintenance personnel

Factual Information

History of Flight

Initial climb	Loss of engine power (total) (Defining event)
Emergency descent	Collision with terr/obj (non-CFIT)

On August 20, 2022, about 1800 mountain daylight time, a Beech F33A, N4133S was substantially damaged when it was involved in an accident near Wilder, Idaho. The pilot and passenger sustained minor injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The pilot and a mechanic had been performing maintenance, attempting to resolve a problem where the engine would intermittently shudder during flight. After checking the cylinder compression, replacing a set of spark plugs, cleaning the fuel injectors, and confirming the engine timing, they decided to perform a test flight.

The engine runup and takeoff were uneventful, and during the initial climb they monitored the engine instrument gauges, and all indicated nominal values. A short time later, the engine shook violently, and stopped producing power. They performed a forced landing into a field, and the airplane sustained damage to the lower forward fuselage and both wings.

The airplane was powered by an IO-520-BA engine manufactured by Continental Motors, and overhauled by T.W. Smith Engine Company in 1998, about 950 flight hours before the accident. During the 14-year period leading up to the accident, routine maintenance was performed on the engine, with no work that would have required opening the crankcase or removing any cylinders.

The engine was equipped with two sets of moving counterweights mounted to crankshaft blades adjacent to the journals of cylinder Nos. 1 and 2, and 3 and 4. Each counterweight was attached to their respective crankshaft blade by two pins housed within bushings and held in place at their ends with retaining plates and internal retaining “snap” rings.

Examination of the engine revealed a large hole in the upper rear section of the crankcase, next to the Nos. 1 and 2 counterweights. Both counterweights had separated from their respective blades and showed similar damage signatures, with one counterweight mounting hole intact with its bushing in place, and the other split open with its material formed outwards. The Nos. 1 and 2 connecting rod caps had detached, and the rods remained attached to their respective pistons. Remnants of the connecting rod caps and bolts, along with two counterweights, fragments of counterweight bushings, a single counterweight pin, and four retaining rings and plates were found in the oil sump. Examination of the fracture surfaces of the remnants

revealed features consistent with ductile overload, including granular and rough separation areas, bolt necking along with smear and bending damage consistent with impact. There was no evidence of scoring or heat distress to the rod journals or rod bearings contact surfaces for cylinder Nos. 1 and 2.

The engine was then completely disassembled, and although the two counterweights for cylinder Nos. 3 and 4 were intact and essentially undamaged, one retaining ring, retainer plate, and pin were missing.

The Continental Maintenance Manual applicable to the engine gives specific instructions for the installation of the counterweight assembly. It states that the retaining rings, which are stamp-cut, have a sharp side and a beveled side, and should be installed with the sharp side out. The retaining ring ears should be installed towards the crankshaft centerline, and to confirm proper fitment after installation the gap between the ears should be no less than 0.179 inches (Figure 1).

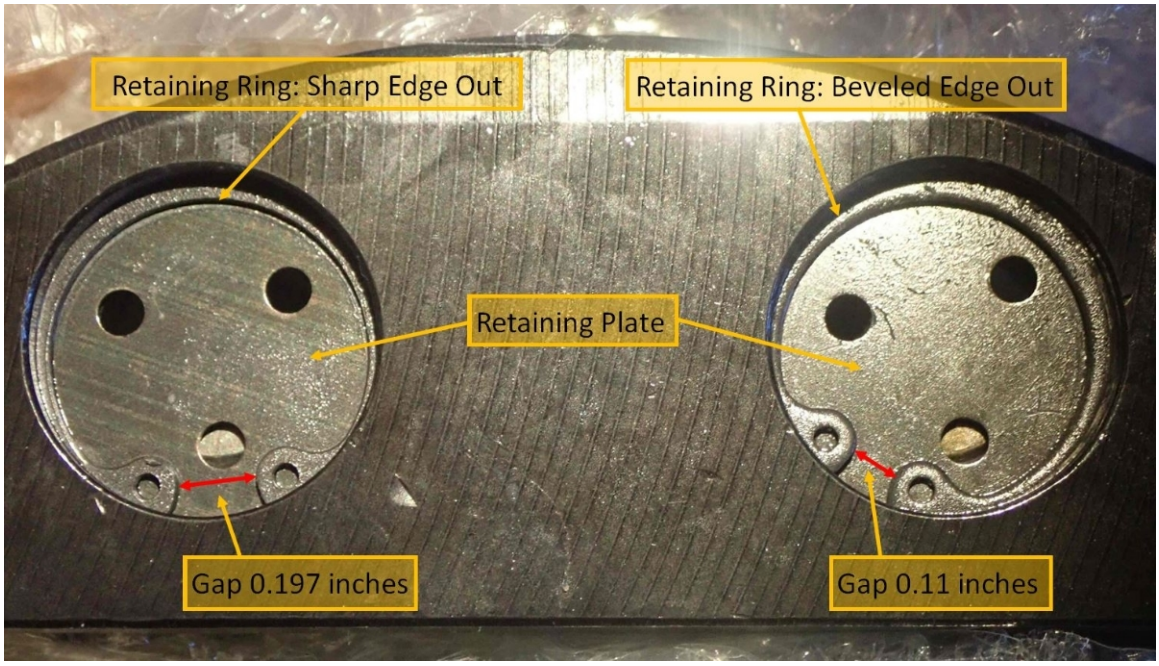

Figure 1 – One of the counterweights with its retaining plates and rings, showing the incorrectly installed ring on the right.

Examination of the engine revealed that one retaining ring on each of the remaining counterweights was installed incorrectly with the sharp side in, and both had ear-gaps of 0.11 (Figure 1) and 0.14 inches respectively.

Continental Service Bulletin (SB) M93-4, issued in February 1993, reiterates the importance of thorough inspection and proper assembly of crankshaft counterweights during engine overhaul, or any time the crankshaft is removed from the engine. It warns that improper installation of the bushings, retaining plates, or retaining rings will cause engine failure. The SB

also states that the retaining rings should be fully seated in the bushing bore grooves with the sharp edge facing out.

Pilot Information

Certificate:	Private	**Age:**	43,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	None	**Second Pilot Present:**	
Instructor Rating(s):	None	**Toxicology Performed:**	
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 200 hours (Total, all aircraft)		

Pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	64,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	December 1, 2020
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 10000 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N4133S
Model/Series:	F33A	**Aircraft Category:**	Airplane
Year of Manufacture:	1975	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	CE-591
Landing Gear Type:	Retractable - Tricycle	**Seats:**	5
Date/Type of Last Inspection:	June 21, 2022 Annual	**Certified Max Gross Wt.:**	3400 lbs
Time Since Last Inspection:	25 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	2460.88 Hrs as of last inspection	**Engine Manufacturer:**	Continental
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-520-BA
Registered Owner:	On file	**Rated Power:**	285 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KEUL,2429 ft msl	**Distance from Accident Site:**	13 Nautical Miles
Observation Time:	17:56 Local	**Direction from Accident Site:**	105°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	260°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.85 inches Hg	**Temperature/Dew Point:**	36°C / 13°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Parma, ID (50S)	**Type of Flight Plan Filed:**	None
Destination:	Parma, ID (50S)	**Type of Clearance:**	None
Departure Time:	17:55 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	PARMA 50S	**Runway Surface Type:**	Asphalt
Airport Elevation:	2228 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	12/30	**IFR Approach:**	None
Runway Length/Width:	2700 ft / 50 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Minor	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	2 Minor	**Latitude, Longitude:**	43.705708,-116.9131

Administrative Information

Investigator In Charge (IIC):	Simpson, Eliott
Additional Participating Persons:	Kenneth J. Greenwell; Federal Aviation Administration FSDO; Boise, ID
Original Publish Date:	April 25, 2024
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=105790