Factual Report
Ref: NTSB Identification Report CEN14FA010

Altimeter, Model 5934

January 13, 2014
United Instruments, Inc.

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Altimeter, Model 5934
manufactured by United Instruments, Inc.

Time: 10:00 am, Tuesday, December 17, 2013

Location: Repair station at United Instruments, Inc., [redacted] Wichita, KS 67226

Attendees:
Andrew L. Hall, Sr. Air Safety Investigator, Cessna Aircraft Company, Wichita, KS 67277
Christy Eckerman, Continued Airworthiness Specialist, FAA ACO, Wichita, KS 67209
Craig Henrichson, FAA ACO, Wichita, KS 67209
Steve Henrie, Instrument Technician, United Instruments, Inc., Wichita, KS 67226
Hiroaki Asai, Manager, Engineering and Quality Control, United Instruments, Inc., Wichita, KS 67226
Toshio Kawawa, President, United Instruments, Inc., Wichita, KS 67226

Instrument/Component: Altimeter, United Instruments Model 5934 series, Part No: N/A, Code No: N/A, Serial Number: 121120 (?), Manufactured Mo/Yr: N/A

Purpose: to examine the condition and functionality of an altimeter recovered from the aircraft accident site.

The box containing the altimeter was brought to United Instruments at 10:00 AM, Tuesday, December 17, 2013, by the FAA and Cessna representatives. (Photo-1)

Opened the box at the United Instruments Repair Station. (Photo-2)

1. Examined the external appearances:
   A. The instrument's identification by its part number or code number, except by the number 121120, could not be read on the instrument.
   B. The outer surfaces of the instrument were dirty and charred. (Photos-3, 4, 5, 6, 7, 8 and 9)
   C. All views
      1). Front: The barometric adjustment stem, P/N 1114-309101, with knob, P/N 1114-300100, was broken off (Photo-14) from the case assembly P/N 1114-032602. The pointers as received indicated approximately: 925 ft per large pointer, P/N 1114-030101, 4,950 ft per intermediate pointer, P/N 1114-030201, and 4,000 ft per disc pointer, P/N 5934-1-105 (Photo-3). All 3 pointers were loose and no longer connected through the gear train. The barometric pressure setting was 29.98 inches of mercury. The instrument's dial configurations were United instruments' standard type and were not to Cessna specification.
      2). Right Side: Number, 422537, with date, May 24, 197 ( ), ink marked. (Photo-4)
      3). Left Side: There were no significant markings, but a Mid Continent maintenance label at the left corner of the case was visible (Photos-6 and 11).
      4). Top: There were labels, which appeared burnt. (Photo-7)
      5). Bottom: Ink marked 'MAR 25 19( ) ( )'. (Photo-8)

6). Rear Side: The UI nameplate , or ID plate, on the rear side the housing was missing. The pressure fitting at the pressure port was melted or broken flush at the rear side of the case. (Photos-5 and 10)

D. A few of the large parts seemed to be rattling and were loose inside the case.

2. No functional testing was performed, since it was obvious that unit will not respond to any pressure change.

3. Disassembly
   A. Removed the instrument's bezel, 1114-300500 (Photo-13), from the case and again checked the pointer indications: 140 ft per large pointer, 5,100 ft per intermediate pointer, and 78,000 ft per disc pointer, this time (Photo-12). The bezel (Photo-13) was securely tightened to the case assembly, and the cover glass, P/N 1114-300700 and sealing gasket, P/N 1114-310002, appeared to be undamaged by the heat and/or impact. The large pointer hub had paint detached, possibly caused by heat from the glass where the pointer hit at the impact. As shown in the photo, all three pointers came loose, being detached from the mechanism with dial toward the cover glass due to impact(s). (Photos-17 and 18) The white and black substances observed on the dial appeared to be the paint from the above large pointer. (Photo-19)
   B. The top plate assembly, P/N 1114-030401, had a brown spot (Photos-20, 21 and 23), but we could not determine what that was from and when it started. This would not have caused any loss of the function of the altimeter. The gear train in the top plate ran smoothly when driven with a finger. This might need to be run in an actual altimeter mechanism to ascertain the actual smoothness if the FAA and NTSB wishes. (Photos-23 and 24)
   C. Top plate ring, P/N 1114-302301, and retaining pin, P/N 1114-304400, were securing the mechanism assembly in the case. (Photo-21)
   D. The top side of the altimeter mechanism assembly, P/N 1114-031100, looked normal. (Photo-22)
   E. The mechanism assembly had its major parts components detached: the diaphragm assembly, P/N 1114-033600 (Photo-25), and the balance assembly, P/N 1114-032000 (Photo-26), totally came off from the mechanism assembly.

4. Examination of the components
   A. The diaphragm assembly consists of a post on one side, and the bimetal assembly on the other, both of which are soldered to the diaphragm, P/N 2644-452101, (Photos-28 and 31). Both the post and the bimetal assembly were separated from the diaphragm at the solder points. (The bimetal assembly, consists of an adjustment plate, P/N 1114-306201, compensator assembly, P/N 1114-033700, hold plate, P/N 1114-306300, and screw, P/N 2112-173042, connected to the rocking shaft assembly, P/N 1114-032300, with the link, P/N 11145-308100, (Photosd-34, 35 and 36)). The soldered areas looked smooth as if the temperature became high enough to melt solder during or after their detachment of the parts (Photo-32 and 33). The link between the bimetal and the rocking shaft was bent (Photo-30).
   B. The balance plate, P/N 1114-032100, had been sheared at the spring and the linkage within the assembly totally separated. (Photos27, 29 and 39)
   C. The rocking shaft and sector assembly, P/N 1114-032201, had its pivots at both ends, one on the shaft and the other on the mechanism frame, broken and no longer secured (Photo-38). The sector gear on the rocking shaft assembly, P/N 1114-032300, was bent (Photo-37).

5. Abnormal appearances and functions: the appearances are as noted above and the functions could not be verified because of the severity of the damage to the internal parts.

6. Reassembly: the parts were assembled to the extent possible and the loose parts were placed in the small plastic bags. (Photos-41, 42, 43 and 44)

7. Functional Testing: was not possible to assembled back to an altimeter since the major parts of the instrument were broken to pieces.

8. Further examination requested: none

All parts were placed back in the original box brought in by the FAA. The box was sealed and taken away when the FAA and NTSB personnel left.

Summaries

A. The nameplate on the instrument was missing. However, the stamped number on the case, 121120, means it was likely manufactured in late 1974.
B. The markings on the case, 422537, dated May 24, 197 ( ), may be related to the seal attached by Mid Continent Instrument, which may have performed the last maintenance for the instrument.
C. The subject altimeter was severely damaged due to multiple impacts, evidenced by the facts that the both the external and internal parts were extensively damaged. Therefore, it was not possible to determine functionality of the altimeter failure prior to impact.

Findings

External

- barometric adjust knob shaft broken
- aluminum nameplate missing or burnt
- pressure fitting melted or broken

Internal

- all pointers shifted forward
- diaphragm assembly detached from the mechanism assembly
- balance plate assembly torn off at the spring
- rocking shaft assembly pivots broken off and the sector gear bent by the counter-weight

Prepared by Toshio Kawawa,

[redacted] Date: Jan. 17, 2014

Photo 1- as received at UI

Photo 2- alt in right side box

Photo 3- front view 1

Photo 4- right side view

Photo 5- rear view

Photo 6- left side view

Photo 7- top view

Photo 8- bottom view

Photo 9- front view 2

Photo 10- upper rear view


Photo 11- MCI seal on lower left side

Photo 12- case front side

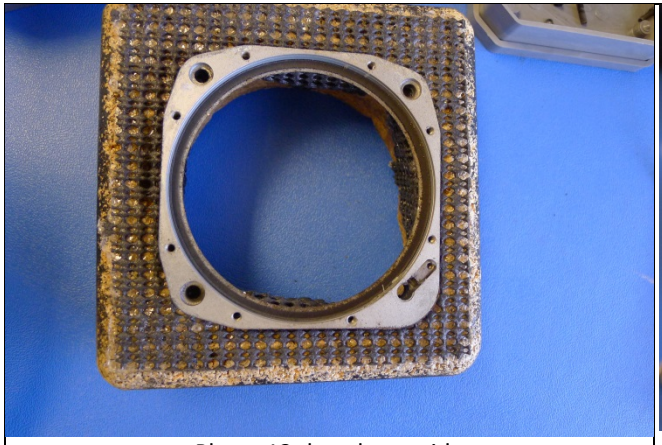
Photo 13- bezel rear side

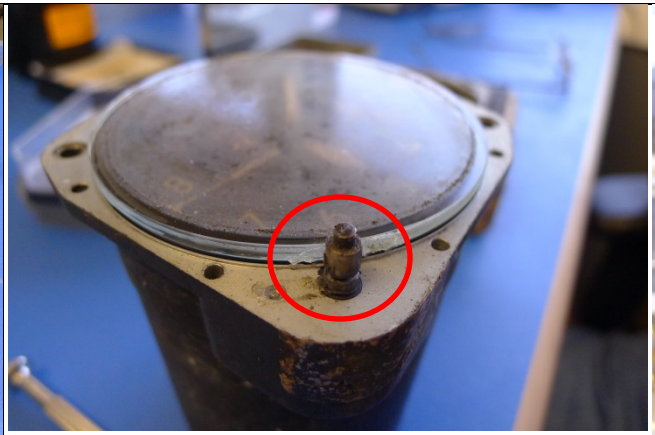
Photo 14- baro adj stem


Photo 15- bezel & cover glass removed

Photo 16- 3 pointers from front

Photo 17- 3 pointers top view

Photo 18- 3 pointers bottom view

Photo 19- pointers removed

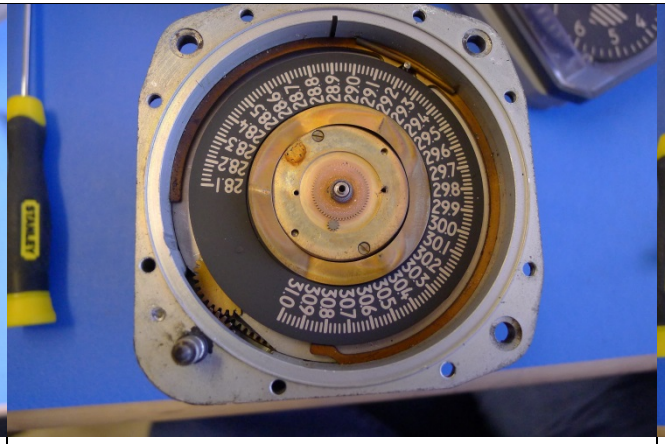

Photo 20- main dial removed

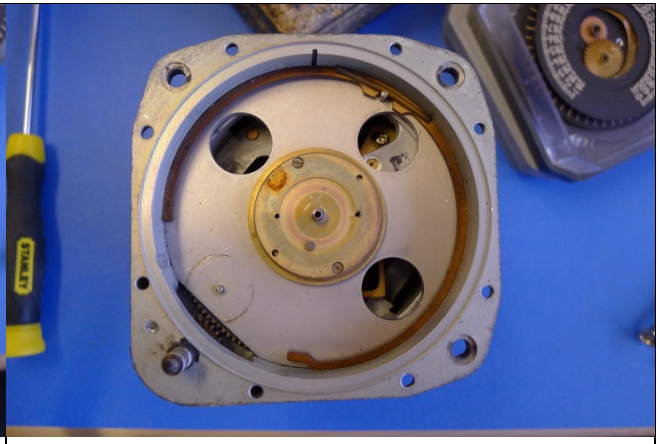

Photo 21- barometric dial removed

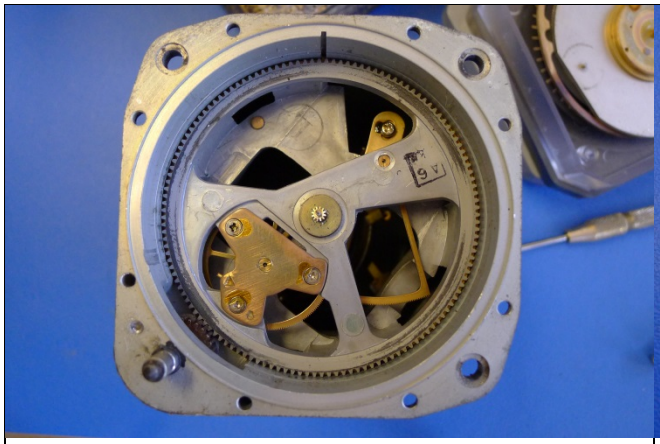

Photo 22-mech top view

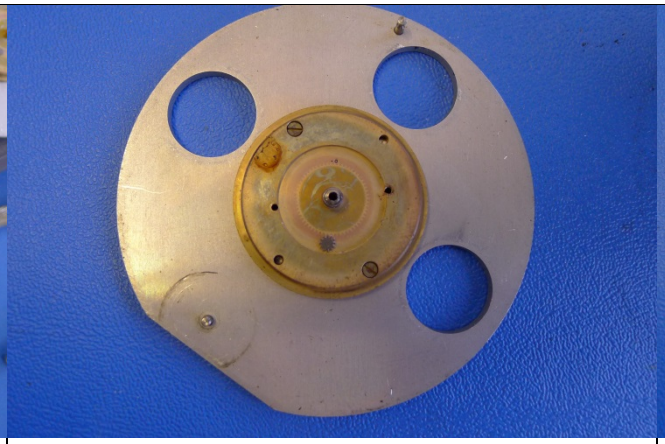

Photo 23- top plate top view

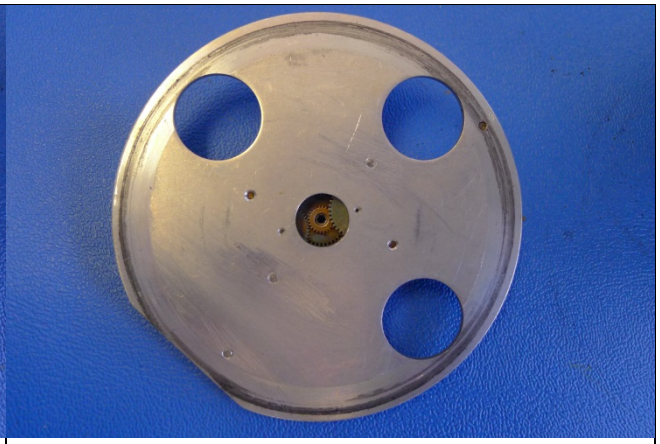

Photo 24- top plate bottom view

Photo 25- diaphragm assy, detached

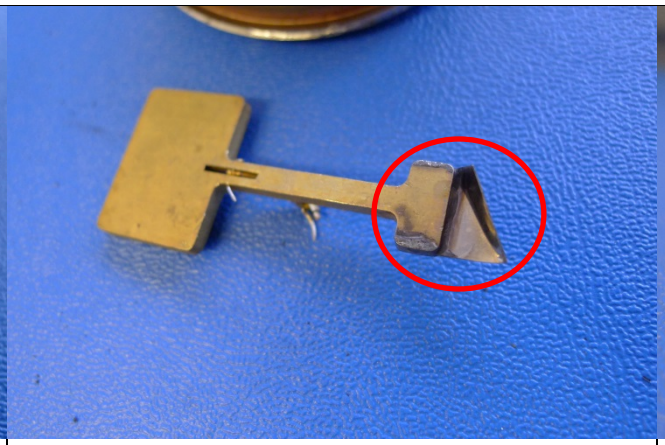

Photo 26- balance plate assy, torn, 1 of 2

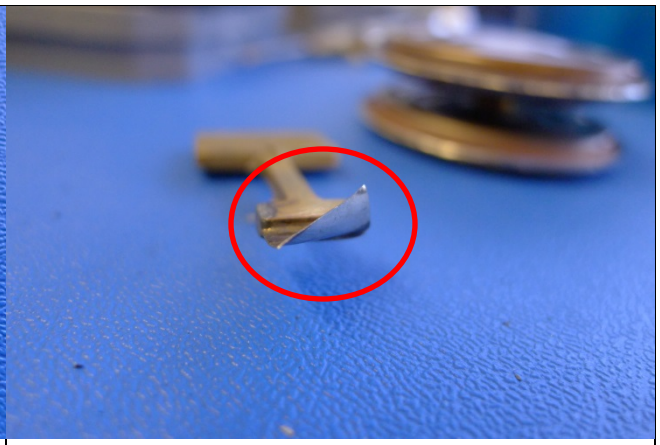

Photo 27- balance plate assy, torn, 2 of 2

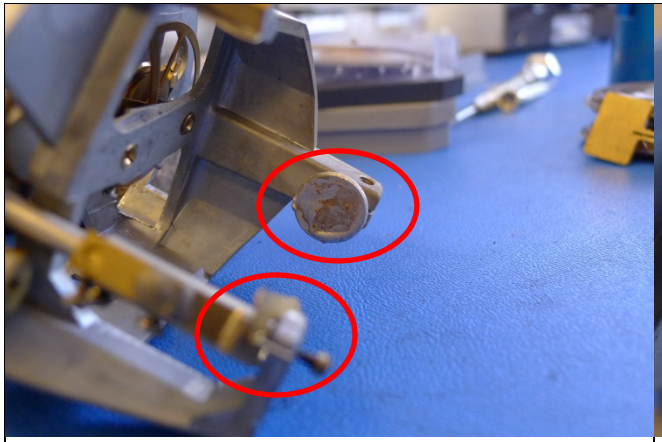

Photo 28- mech frame without diaph assy 1 of 2

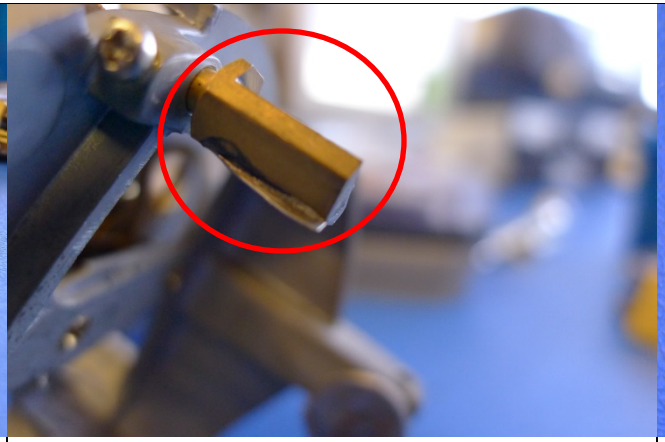

Photo 29- mech frame without balance plate assy

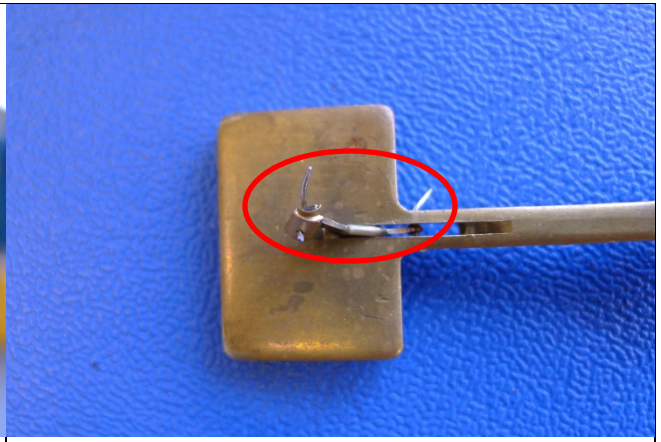

Photo 30- bent link on balance plate assy

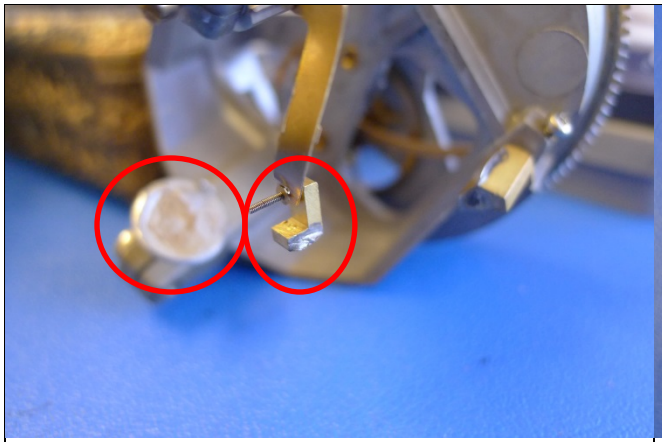

Photo 31- mech frame without diaph assy 2 of 2

Photo 32- diaphragm solder joint side 1

Photo 33- diaphragm solder joint side 2

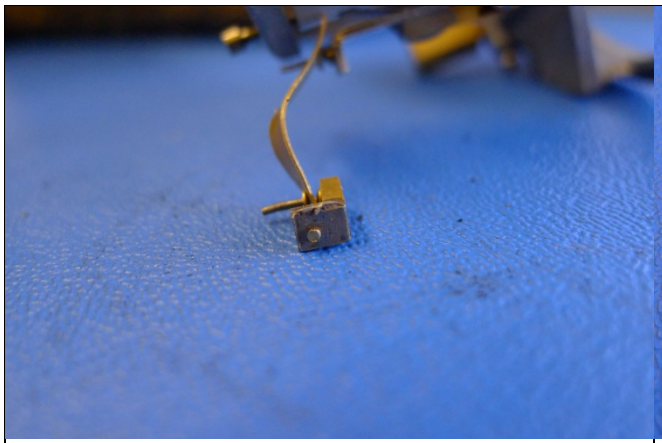

Photo 34- link, bent

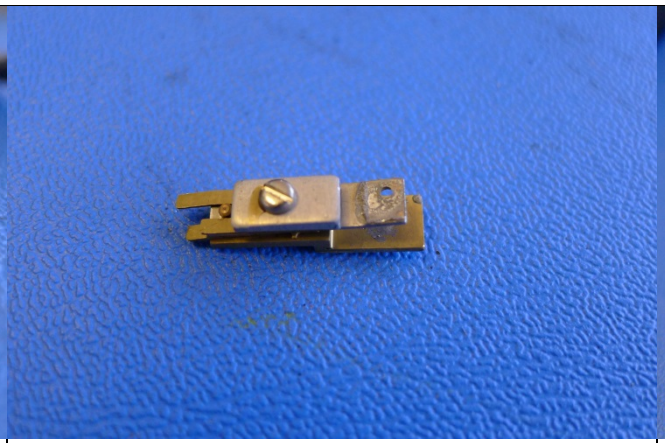

Photo 35- bimetal assy detached from diaph assy 1 of 2

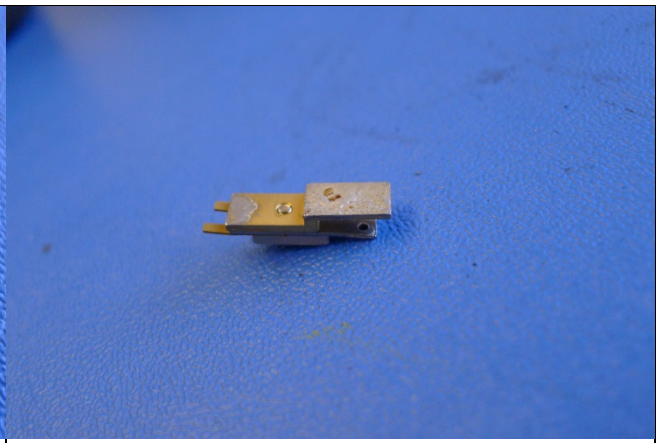

Photo 36- bimetal assy detached from diaph assy 2 of 2

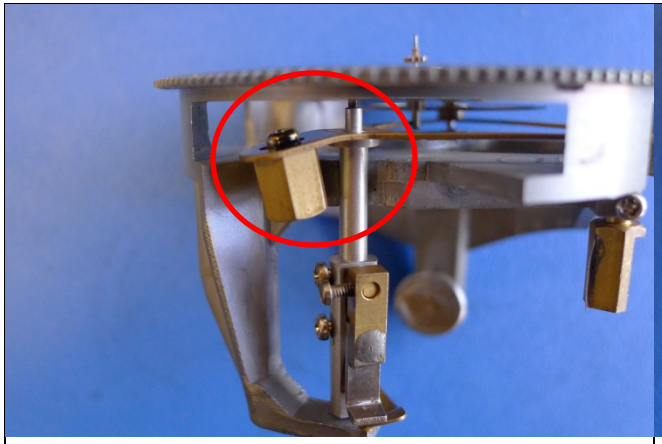

Photo 37- sector gear assy with bent sector gear

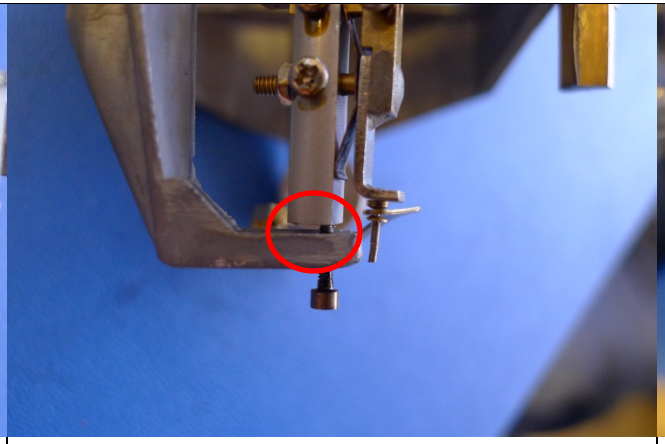

Photo 38- pivot, broken

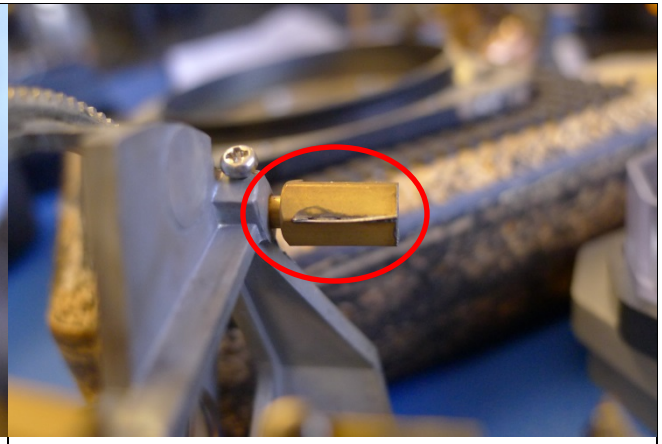

Photo 39- balance weight post, remained

Photo 40- piece parts in bags

Photo 41- mechanism in case

Photo 42- boxed as received

Photo 43- returned as received