

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ERA23LA037

MATERIALS LABORATORY

Factual Report 23-070

October 16, 2023

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A. ACCIDENT INFORMATION

Location: Spartanburg, South Carolina
Date: October 23, 2022
Vehicle: Piper PA-28-235, N8580N
Investigator: Adam Gerhardt (AS-ERA)

B. COMPONENTS EXAMINED

Magneto and gears

C. EXAMINATION PARTICIPANTS

Specialist Adrienne Lamm
National Transportation Safety Board
Washington D.C.

D. DETAILS OF THE EXAMINATION

Figure 1 shows the left magneto gear, left and right idler gears, the crankshaft drive gear with separated dowel pin, and the crankshaft drive gear bolt submitted for examination. The left magneto gear was missing one gear tooth and the left idler gear was missing four adjacent gear teeth. All the teeth on the right idler gear were intact. The crankshaft drive gear teeth were also intact, but the dowel pin had separated and was still assembled to the gear. The shaft of the crankshaft drive gear bolt was bent near the start of the threads and the last threads were flattened, and the end face of the bolt was smeared. The red bracket and red arrows in Figure 2 indicate the separations on the various components.

The fracture surface of the separated left magneto gear tooth is shown in the bottom image of Figure 3. The fracture surfaces of the left idler gear are shown in the top image of Figure 3. Secondary smearing damage (green arrows) obscured portions of all the fracture surfaces. The visible fracture surfaces had features consistent with overstress separation.

The end face of the crankshaft drive gear bolt is shown in Figure 4. The end face was completely obscured by secondary smearing damage and no discernible features were noted to determine if any of the bolt had separated and was missing. As shown in Figure 5, the fracture surface of the crankshaft drive gear dowel pin was in-line with the outer flat of the flange and was mostly unobscured, with only a small area of secondary smearing damage. The visible fracture surface features on the dowel pin were consistent with shear overstress separation.

The magneto was also submitted for evaluation and is shown in Figure 6. The cables that attached to the sparkplugs had been cut to facilitate removal. The internal

components of the magneto were frozen, and the camshaft would not rotate. The impulse coupling housing and the adjacent magneto housing flange were both cracked and pushed away from the main magneto housing body, as indicated by the red arrows in Figure 6. The cam securing screw was present with the lock tab still intact.

The magneto was disassembled. With the impulse coupling removed (shown in Figure 7) the breaker cam could be very slightly rotated, one of the locking pins was observed in place but separated (white dotted circles) and the underlying plate could be moved laterally. In addition, a portion of the coil was visibly out of alignment and gouges (red arrow) were observed on the housing surface underneath the plate. The gouges were in-line with the mating magnet.

The camshaft, plate, and magnet were subsequently disassembled. Once exposed, the crack in the magneto housing flange was observed to progress through a full chord of the flange and a portion of the flange separated, as shown in Figure 8. Extensive damage was observed on the housing surface underneath the magnet. Multiple rotational gouges were visible in-line with the mating magnet. Several circular imprints (red arrows) were observed on the surface, likely contact marks from the plate locking pins. All the damage was consistent with secondary damage from multiple impacts to the magneto.

The remaining components inside the magneto were also disassembled and examined. The cam securing wedges were intact and fit snugly as expected. The polymer distributor gear and mating polymer cam gear were both intact with no separated teeth. The conductor strap was coupled securely. Once disassembled, the internal bearings could be rotated freely by hand.

Submitted by:

Adrienne V. Lamm
Materials Engineer



Figure 1. Macro photos of the gears and bolt submitted for examination.

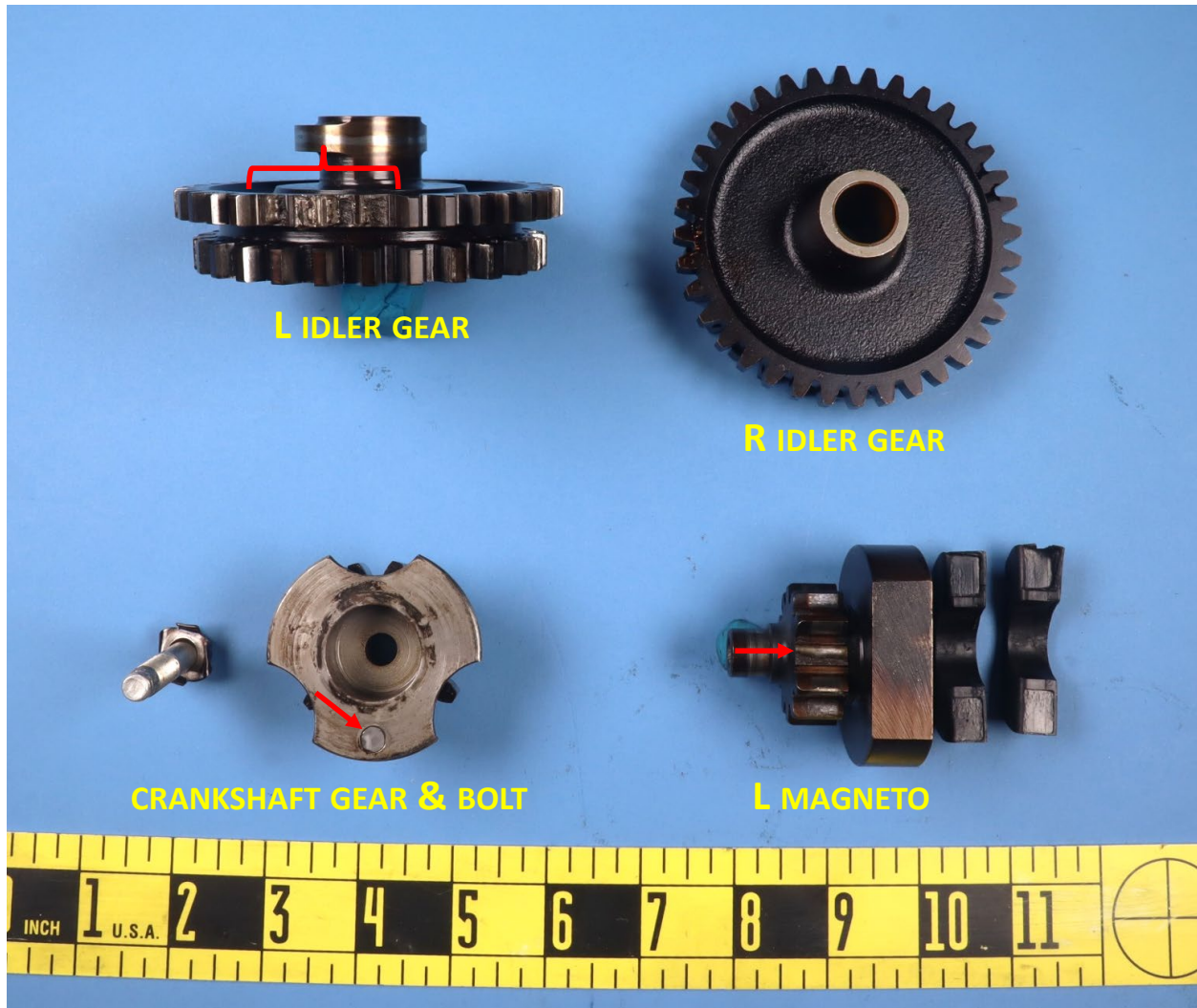


Figure 2. Macro photo showing the separated tooth on the left magneto gear (red arrow on right), the four separated teeth on the left idler gear (red bracket), and the separated crankshaft drive gear dowel pin (left red arrow).

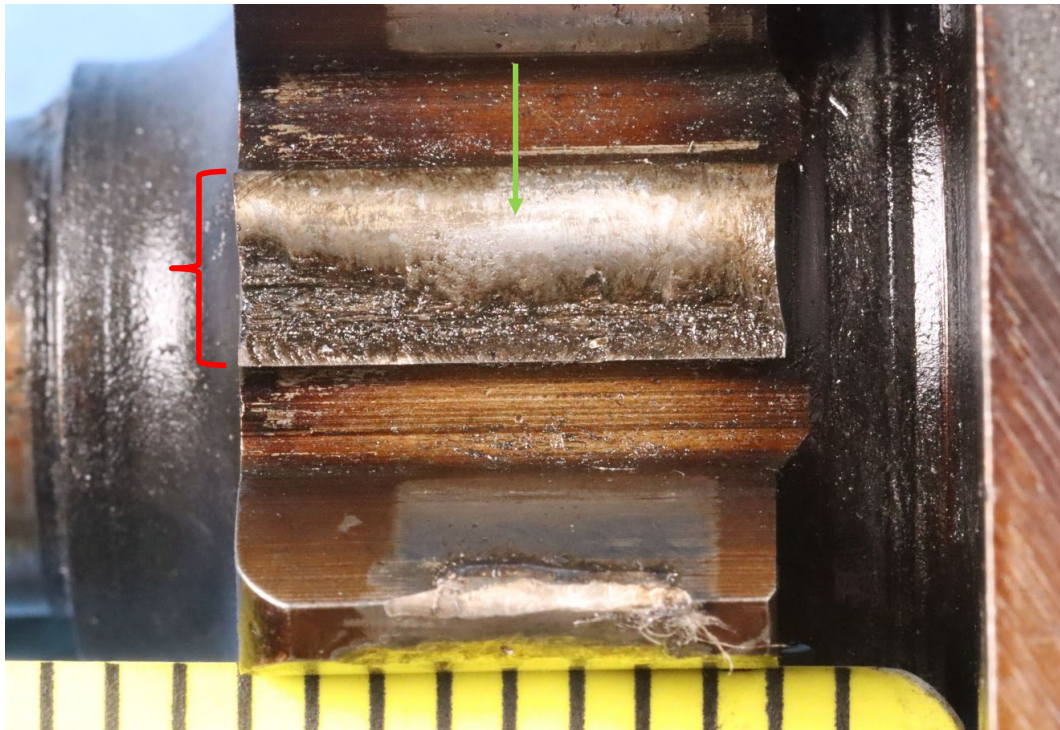
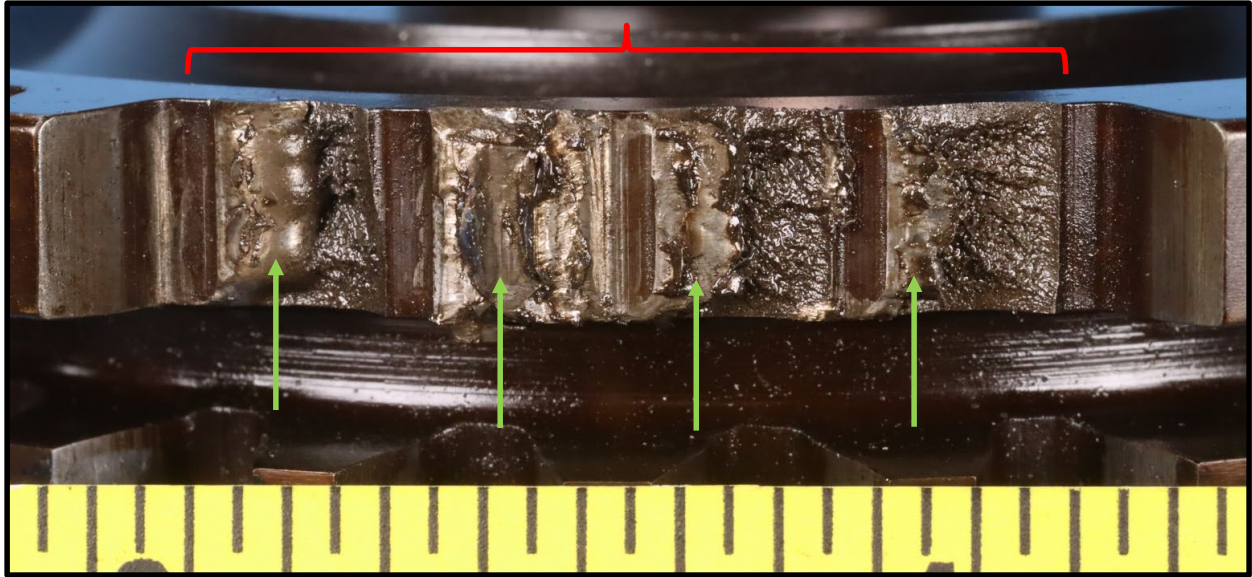


Figure 3. Close-up photos showing the fracture surfaces of the separated tooth on the left magneto gear (red bracket, bottom image) and the four separated teeth on the left idler gear (red bracket, top image). The green arrows point to secondary smearing damage obscuring the fracture surfaces.



Figure 4. Close-up photo showing the end face of the crankshaft drive gear bolt.

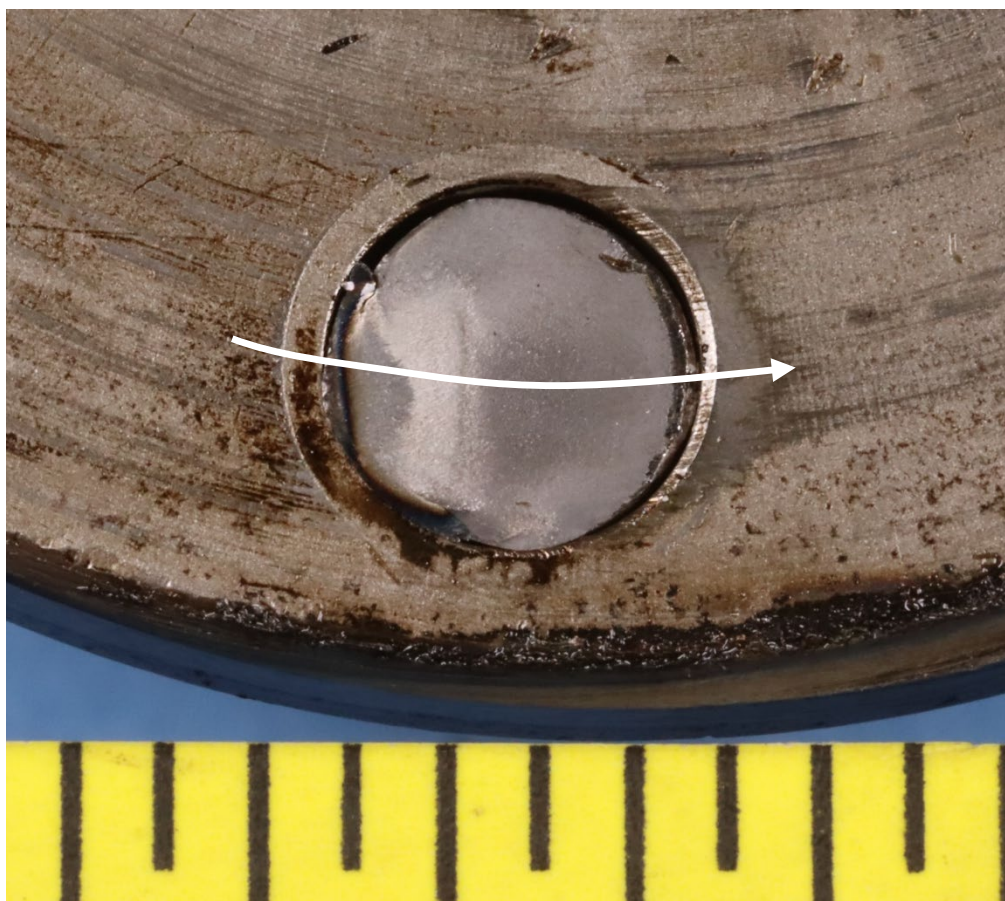


Figure 5: Close-up photo showing the fracture surface on the crankshaft drive gear dowel pin. The fracture surface had features consistent with shear overstress separation in the direction indicated by the white arrow.

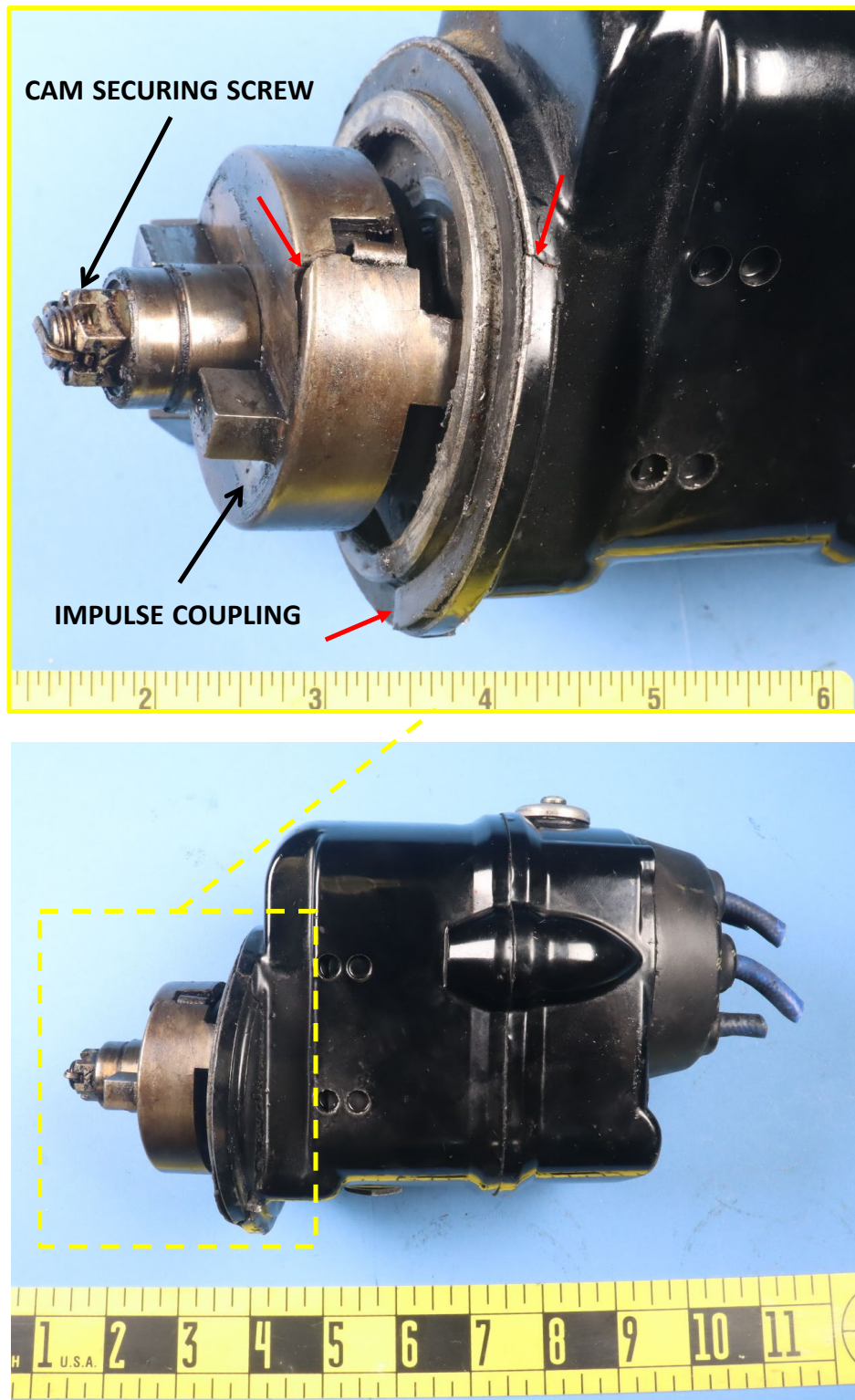


Figure 6. Macro (bottom) and close-up (top) images of the magneto submitted for examination. The red arrows point to cracks visible in the magneto housing flange and the impulse coupling housing.

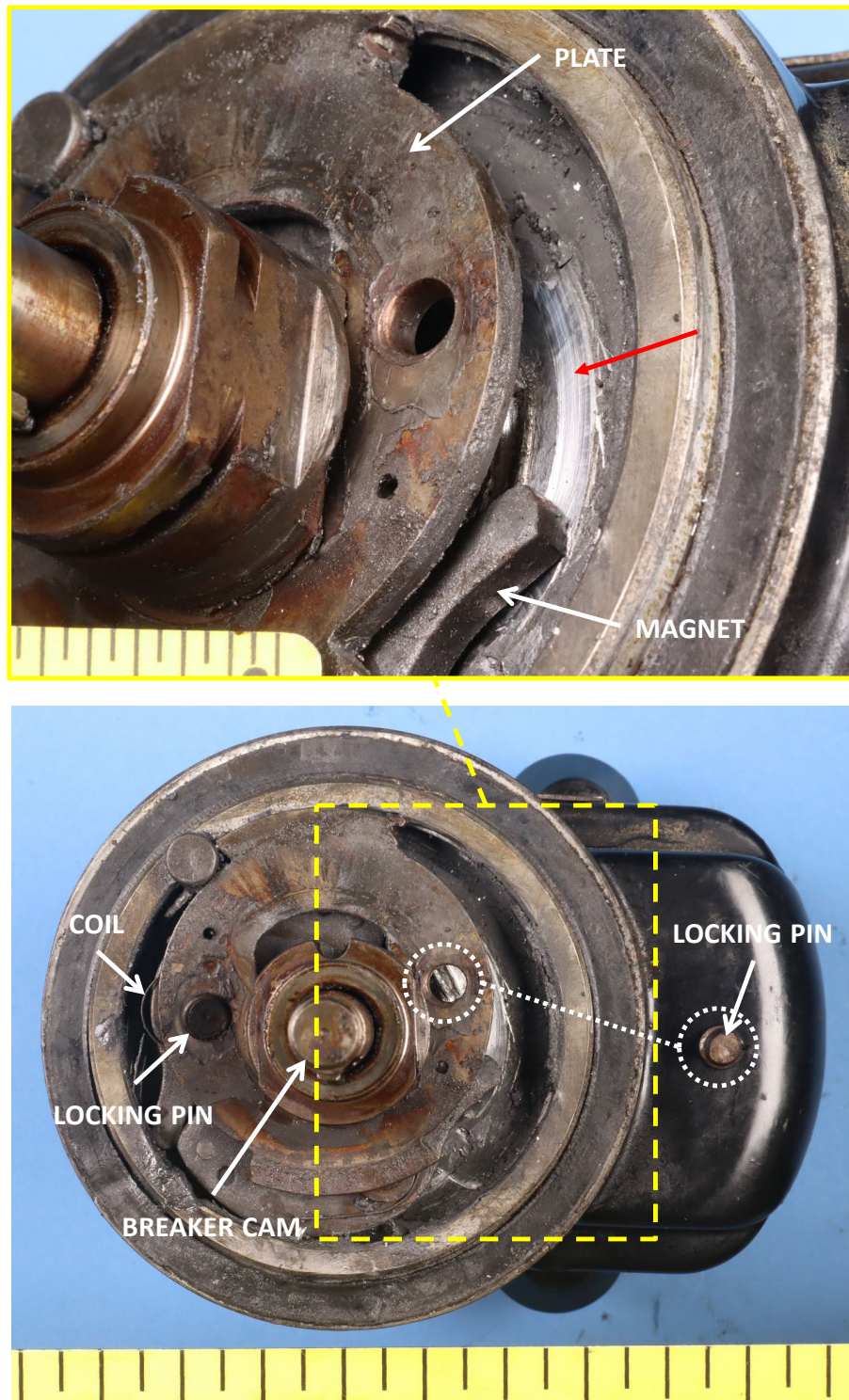


Figure 7. Close-up photos of the magneto with the impulse coupling disassembled. One of the locking pins was found in place but separated (white dotted circles; removed from position for photo). Underneath the plate, the side of the coil was visible, and gouges (red arrow) were observed on the housing surface in-line with the magnet.

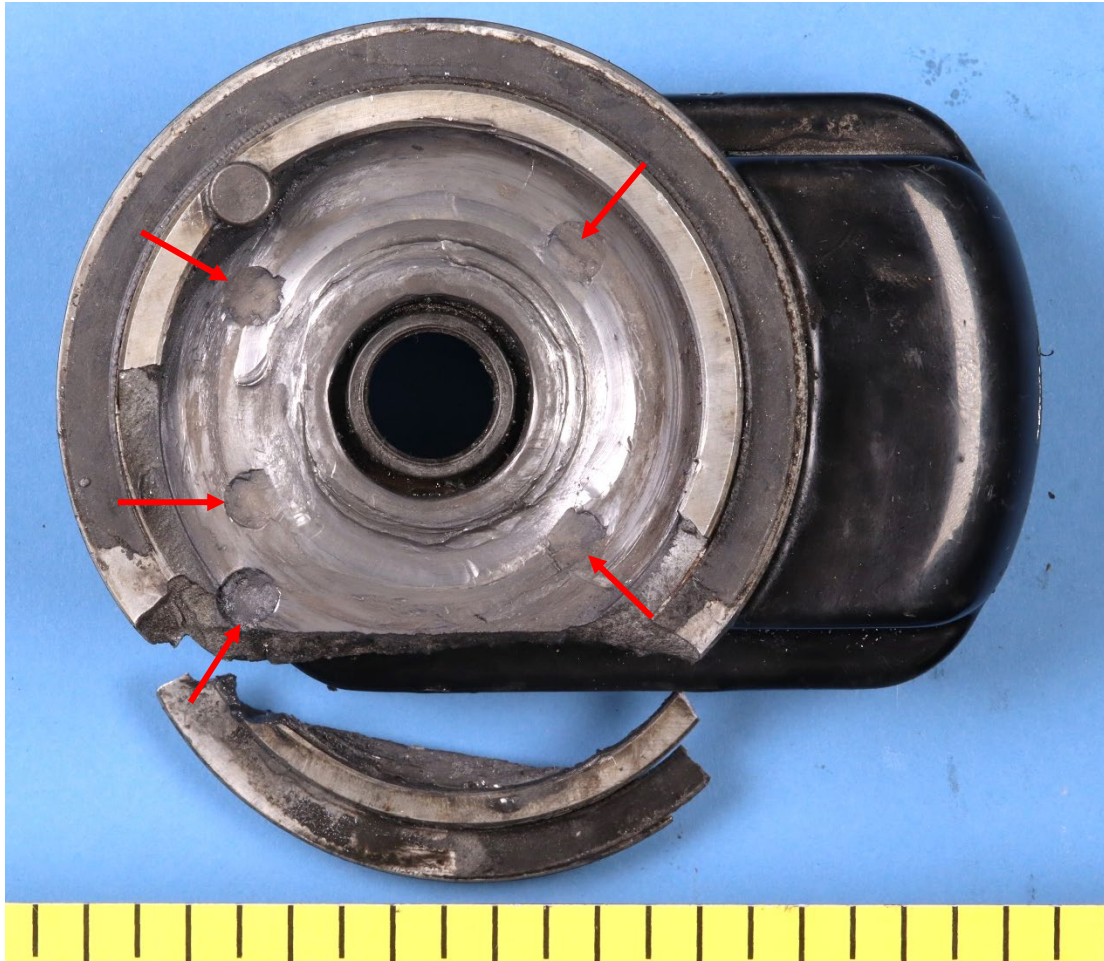


Figure 8. Macro photo showing the magneto housing surface with the camshaft, plate, and magnet disassembled. A portion of the magneto housing flange separated. Multiple rotational gouges and several circular imprints (red arrows) were observed on the magneto housing surface.