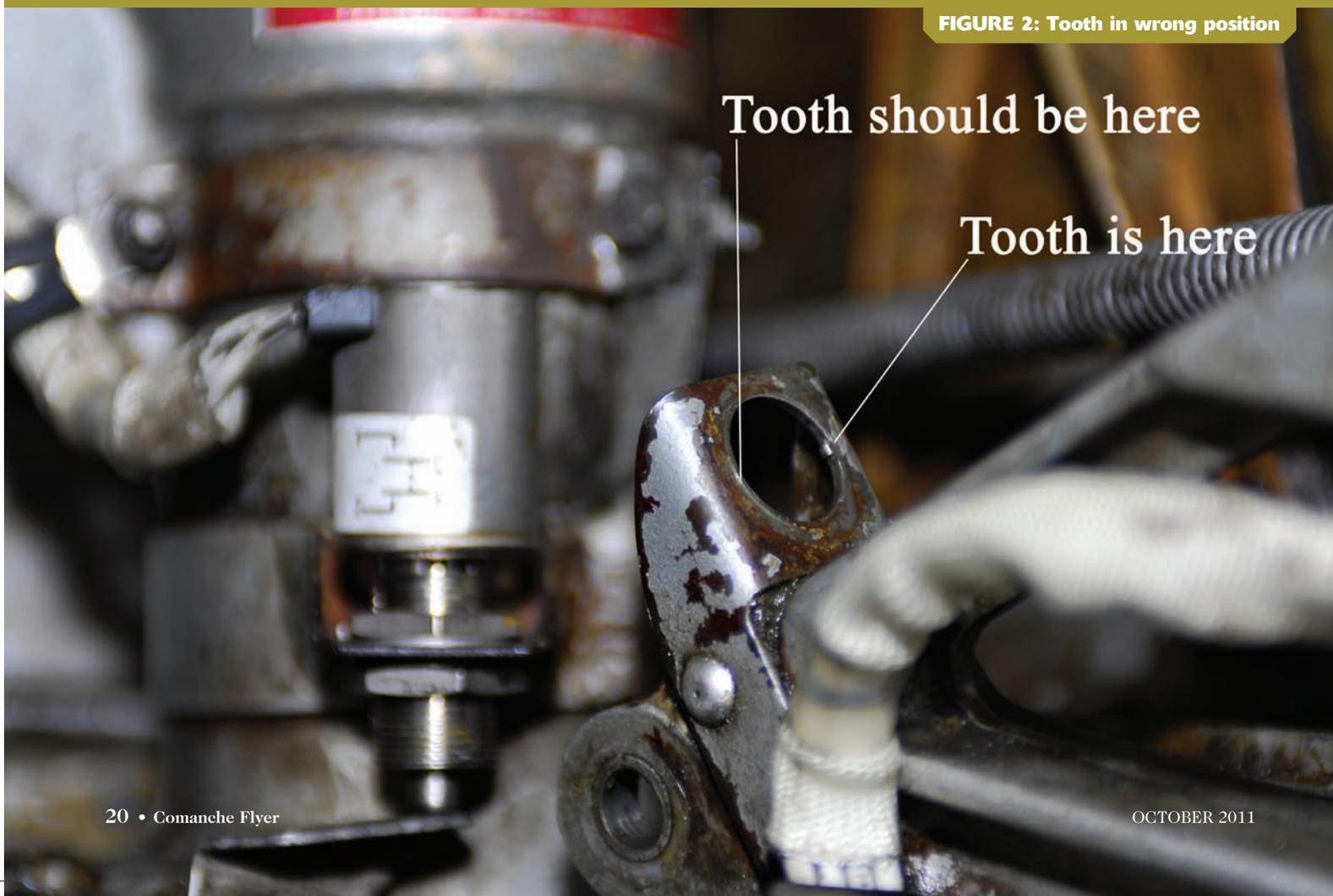


A Cautionary Tale: Incorrect Factory Installation of a Main Gear Down Limit Switch in a Twin Comanche

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FIGURE 2: Tooth in wrong position



Harness should be coming out of switch here, not from the other side



FIGURE 1: Aberrant harness

Several months ago, I replaced the landing gear switches and wiring harnesses in my PA-30. A couple of weeks later when I was inspecting a friend's Twin Comanche, the positions of those parts in relation to the various components of the gear retraction mechanism were still fresh in my mind. Almost immediately, I noticed that the left main gear *down limit* switch was not mounted correctly. The loop of cable that emerges from the switch itself was directed toward the front of the airplane and that configuration put it into direct contact with the assist spring.

The assist spring is the coiled spring that on one end attaches to a standoff bracket at the top of the drag link. On the other end, the spring attaches to a bracket arm that is mounted on the inboard side of the strut housing. The proximity of this spring to the down limit switch requires one to orient the cable in an aft direction to avoid contact between these two components (see Figure 1).

Although the silicone sleeve that surrounds the wiring harness was still intact, I could see where the spring had been rubbing against it. Obviously, this is not a desirable situation. I took the bolt out of the upper drag link connection to the bearing rod end and then removed the bolt that goes through the side brace stud. In no time the switch was removed from the bracket on the drag link. My suspicions were confirmed. This aircraft had two RIGHT upper drag links.

Let me back up and explain. The large triangular part that is the upper drag link is, with one minor exception, identical on both the right and left landing gear on Comanches. There is a stamped metal bracket riveted to the drag link that holds the down limit switch. The brackets themselves are very slightly different in that they have a small tooth or tine in the switch-mounting hole which interfaces with a small slot or keyway in the threaded portion of the switch, and thus orients it correctly with regard to the wiring that emerges from the top of the switch. Both right and left brackets, once mounted on the drag link, have that tooth at the back of the hole or toward the tail of the plane. This feature alone determines whether you have a right or left upper drag link (see Figure 2).



FIGURE 3: Correct configuration

If, on the assembly line at Piper, an assembler were to pick up an incorrectly tagged right upper drag link while working on a left main gear, he might not notice it unless he made a very close inspection. If he then mounted this wrong part on the landing gear, it would lead him to install the down limit switch aberrantly as well. I suspect the orientation of the tooth in the bracket was placed there for just that purpose, i.e., to assure the harness was oriented properly and thus kept out of harm's way in rubbing against the assist spring. Thus, if the assembler didn't notice the first mistake, it virtually guaranteed that he would make the second mistake because the "idiot-proof" bracket will permit the switch to be installed only in one direction (see Figure 3).

Now that it is established that Piper occasionally made a mistake in assembling one of our airplanes, you might wonder how this 1968 model Comanche made it through over 40 annual inspections without anybody catching the misrouted wiring

installation. I wondered too, and came to the conclusion that the "tyranny of the status quo" may explain it, i.e., it has been that way for a very long time and nobody has questioned it; ergo it must be correct.

Now what does one do about this problem? I figured there were at least four potential *solutions* to the dilemma:

1. Buy a new upper drag link from Piper. I am not sure that they are still available and, if so, I would bet they are very expensive.
2. Buy a used part from an airplane salvage yard. This alternative is likely to be less expensive. However, buying a replacement upper drag link may be overkill when we can probably rework the old one
3. File down the tooth on the bracket and weld a tiny bead 180 degrees away on the opposite side of the bracket whereupon I could shape a new tooth with a file to engage the switch keyway, and in so doing effectively make this into a left upper drag link.

4. Simply file down the tooth on the bracket. Then orient the switch and wiring correctly, and tighten it down with a star washer and nut. This last solution did not require removing the drag link from the plane.

I opted for choice number four. I ended up calling Matt Kurke to get a second opinion on this problem. He told me that he had also seen this situation, and he agreed with me that there was essentially no downside for choosing that solution. He said that it was what he would have done.

If there is a moral to this cautionary tale, it probably is this: Don't take for granted that everything in your aircraft was installed correctly at the factory. Unfortunately, such problems can "hide in plain sight" and escape decades of inspections. 🙄