This is one of those lessons that was born out of necessity. Hopefully someone else can profit by it. The story has a happy ending, so you can put the tissue box away now and just enjoy the ride.

A bit of history before we go any further: Those folks that know me are well aware of my severe case of gearheaditis. I never met a two wheeler I didn't like, and anything mechanical is worth exploring. I've got more old bikes than my tolerant spouse cares for, while I continue to "stumble" upon worthy causes and push the boundaries of her love. I invariably have multiple projects going, all the while working as a mechanical engineer for a thermal vision company and selling screw kits for VJM's in my "spare" time. Which brings me to my latest endeavor – one 1965 Honda CB450 K0 Black Bomber. Belinda, as she's come to be known, came to me as the result of an irresistible eBay auction. She arrived a few weeks ago from California. She was running within the hour from unloading at my house. Not running very well, mind you, but she started and ran, nonetheless. This bike had sat in inside storage since 1975 and though she wasn't a perfect specimen, she wouldn't need a ground up resto job to be attractive once again. I did notice that in the short time I had her running, there was no RPM reading on the speedometer/tachometer gauge. I never tried to run the bike down the driveway so speedometer operation was never verified. A visual inspection of the tachometer cable revealed an outside jacket that screamed "broken cable" so I dismissed the problem for that moment. In the weeks that have ensued, I've done a lot of cleaning, polishing and refurbishing. The carburetor slides were stuck, which explained the poor running, and sure enough, both the speedometer and tachometer cables were broken at their input ends!

The speedometer cable was one of the first replacement parts to arrive, and I went happily about installing it. As a matter of course, I always attach the gauge end first with the cable retracted (when possible) a few inches. After getting the nut tight I feed the inner cable back into the gauge with a turning motion to engage the gauge drive properly. It was a bit disturbing this time however, as the cable engaged and refused to turn any further! Seems the gauge was frozen solid. A quick investigation proved the same condition held true for the tachometer. Oh yeah, More Work!

After removing the gauge from the headlight bezel without any improvement the decision was there in front of me, go grovel before the gods of eBay, wallet in hand, looking for a replacement, or attempt something I had never done - the dissection of a perfectly beautiful looking, but nonetheless dysfunctional piece of forty year old Japanese (Fuji Electric) instrumentation. Well if I was going to have to buy another one anyway, I might as well see the innards of this beast.

My assessment of the situation was that the grease or other lubricant had hardened in the narrow clearance area between the outer threaded nozzle that attaches the cable jacketing and the inner drive mechanism that contains the square recess the inner cable engages. If I could perhaps engage the square drive with something stronger than the inner cable I might break it free and be done with it. I found that one of my smaller threading taps had the same square dimensions so I double nut-ed it and stuck it in the drive. Try as I might, neither gauge would budge with the largest oomph value I was willing to apply to the wrench. Engineers usually call this torque, but in this instance oomph was what I was giving it. The meaning of this early failure was that I must take the unit apart to the point where I could do some soaking and cleaning. Let the disassembly begin!

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![Image of disassembled speedometer and tachometer]

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This was done slowly and carefully using an ordinary slot screwdriver. I went around the perimeter about four times before I attempted to separate the halves. This is tedious, but determines the condition of things when they go back together. It took a bit more prying to separate the halves, but shortly they yielded to my efforts. After things are apart you can use a pair of pliers without any teeth and flatten and bend the metal just a bit more to ease the reassembly process. Don’t make the side completely vertical again as you’ll have trouble bending things back over. With this step behind you, one can now remove the innards from the housing. On the back side of the housing are eight small screws. There are two pairs of four screws. One set of four can be seen jutting through holes in the housing - leave these alone for now. The set you want to remove are the other four (two for each clock). The CB450 gauge had slotted screws while my CB77 unit had Philips heads. Remove these and set them aside. One of the screws had an electrical lead attached to it. This is the case ground for the lighting. Since the unit is rubber mounted this must be replaced or the gauge lights will no longer work. The instruments can now be extracted from the housing.

Observing the bases of the drives revealed a lot of solid white grease, just as I had suspected. Gently probing with dental picks I removed most of this, but the units were still very frozen. I moved the needles and they were free and operated easily. The drive on these gauges is quite simple. If you can envision two short tubes one inside the other. The outer tube is connected by an axial shaft that goes to the cable input. When the cable turns this tube spins with it. The inner tube is also connected by an axial shaft. This shaft has the indicator needle attached to it. There is a very fine, calibrated, gap between these two tubes. When the cable turns from input, be it tachometer or speedometer drive, the outer tube spins with it directly. The air in the gap between the two tubes causes a drag and begins to pull the inner tube along with it. The faster the outer tube spins, the more drag there is and the further around it’s rotation the needle is pulled. That’s the end of today’s Physics lesson, but you can understand that if it’s just the air molecules making your gauge work, we’ve got a mighty precise little package here, and it won’t take much ham fisted shenanigans to make toast of the little bugger. My next step was to see if I could get the grease between the lower drive parts loosened. I found an old aluminum can/cup I had that fit things just right. I plunked the unit in and filled it to just above the lower drive parts with lacquer thinner.
The solvent could then work from the bottom up or the top down. I let the unit sit this way over night. In the morning I was able to just barely turn either drive by carefully grabbing the outer tube of each with my fingers. After an hour or so of turn and soak, turn and soak one pooped completely free and turned with ease. The second came along shortly thereafter. I was almost home. At the suggestion of one of the folks on our VJMC mail list (thanks Damon), I then substituted some spray carburetor cleaner for the lacquer thinner. While there was a bunch of crud in the lacquer thinner, the carb cleaner was the coup de gras, and the crud flowed out like, well….. like crud!

While the soaking steps were going on, I had fashioned a drive tool out of one of the old cable inners. I just cut the square cable end off with about an inch of the round cable attached. This I chucked into my variable speed, reversible drill. Most gauges turn clockwise, which means the input on the backside must be counter clockwise, so unless you have some odd gauges the reversible drill is a must. This tool can then be used to work the gauge through its operating range. Ramp the speed of the drill up through the range. Don’t just jam it full on. This will also give you an indication of the health of the rest of the mechanism. The needle should remain constant as you hold the drill at a particular speed. If the needle tends to bounce wildly about any point, you have additional problems with its function that will have to be addressed.

My last step before reassembling was to use my soak container one last time. Instead of having a solvent fill, this time I used a light oil (Marvel Mystery Oil) to make sure there was plenty of lubricant where all had been washed away. I even elevated the temperature of this "bath" with a 50 watt reflector bulb shining on it, to help the process along. After an hour of soaking, I removed the unit and wiped the excess oil from the external surfaces. I was now ready to attempt putting it all back together. I cleaned all the pieces and polished the chrome ring. It is especially convenient to do this while the unit is apart, you can access areas that are difficult when all the pieces are together. I also checked all the light bulbs and replaced any that either weren't operating or even looked marginal. The caveat here is to keep a light hand! You’ll be squeezing and hammering on the unit, so remember you hold disaster in your hand. I had a piece of plastic to use as a base, but a good piece of wood will do the job too. I placed the assembled gauge, face down, on this base and attached some clamps to hold everything in position. This would be a good job for an assistant's help, but can be done by one. At this point I was just trying to get the chrome ring back in position on the base. Even with opening the ring more while it was removed, it did not drop into place. With just light clamping pressure a little more prying was necessary to get things together.

Once the housing flange has passed the edges of the ring, you are now ready to fold the ring back over the flange, thus holding everything together again. I tightened my clamps until the base was in its previous position inside the flange. I then used a long drift punch and a 4 oz. Ball Peen hammer to gently fold the ring material back over the base flange. As the process to remove the flange, slow and easy is the watch word. I made at least three trips around the perimeter going just part
way each time. Go easy and get the feel for the effect of a particular force of hammer blow. It’s much better to make five trips around than to shatter the glass cover with a heavy blow.

I added one last step of dubious value, but I’m anal retentive so assess the value of this step for yourself. I used a small C-clamp and worked my way around the perimeter, one last time. The effect of this was to add one last level of flatness to the pryed up ring, and to make sure the halves were clamped together as good as can be.

OK. You’re done! Put the gauge back in your bike, connect the electrics and cable and go off for a well deserved ride. Remember – watching the road and traffic takes precedence over eyeballing the wonders of your repaired gauges in action. As a follow-up I plan to get an old defunct gauge and tear it down those last few steps where all the inards are laid bare. So keep on the look out for that article to appear here, at a date in the future.

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