Driveway Mechanic

Servicing the VDO Mechanical Clock

by James Mahaffey, Peachtree Section

From the mid-1950's through the mid-1970's, each Mercedes-Benz car was equipped with an electrically-wound VDO mechanical clock. These clocks, marked "VDO KIENZLE", are exceptionally well-made and long-lived, some having run for decades without service. The Kienzle was replaced by the VDO Quartz-Zeit, with a quartz oscillator movement, and factory replacement clocks for Kienzle-equipped cars are likely to have this newer movement fitted into the old-style case. Although the accuracy and stability of the VDO Quartz-Zeit are superior to those of the Kienzle, for the sake of authenticity a failed mechanical clock can usually be restored to like-new condition.

The Kienzle mechanism is basically a 19th-century pocket-watch movement with a modified Borg-type winder that rewinds the clock spring every two minutes using an electromagnet. There are two movable electrical contacts. The upper contact is on a short-throw lever above the electromagnet; the lower contact is on a spring-loaded flywheel. In the unwound condition the two electrical contacts come together, completing a circuit through the electromagnet. The magnet pulls down sharply on the upper contact lever, throwing the other contact piece out of the way, breaking the circuit and winding against the spring. The spring's force is imparted to the escapement through a ratchet pawl attached to the flywheel. When the spring runs down, the contacts touch, and the process repeats.

In the original Borg design, the most fragile part was the flat helical mainspring. In the VDO variation, the flat spring was replaced by an indestructible coil spring, in tension, wrapped around a drum coaxial with the flywheel. The mainspring will not break, but the VDO clock has three usual failure modes: burned electrical contacts, a blown internal fuse and lubrication failure. Detectable wear on bearings or gear teeth is rare.

Disassembly

The clock can be fully serviced with minimal disassembly. After removing the clock from the car, remove the three nuts holding the plastic dust cap in place with a 5-mm socket wrench; see Figure 1. The cap is extremely fragile. Wipe out any soot that may have accumulated in the cap with a tissue and set it aside. If a plastic ring surrounds one nut, this is the warranty seal, indicating that the clock has had no previous service. Chip away the ring, using miniature diagonal cutters.

Locate the electrical contacts. They are probably touching, but if not, start the balance wheel manually, and let the movement run until the contacts come together. Insert the tip of a relay-contact cleaning tool between the contacts and stroke them until they appear clean under magnification. Figure 2 shows the contact cleaning process.

Cleaning and degreasing the clock present a problem. The usual clock and watch cleaning solutions will not work in this case because the clock contains various perishable components, including lacquered magnet wire, plastic, rubber, phenolic and carbon steel. The clock mechanisms are usually contaminated with curious black particles, presumably the product of lubricant and rubber products burned in the spark between the electrical contacts—and vaporized portions of the contacts themselves. The best way to clean the works is to suspend the clock in a soap-and-water solution for a few minutes, rinse under running water, drain and blow dry gently with a heat gun. Figure 3 shows the clock being cleaned in dishwashing detergent.

As soon as the works have cooled from drying, lubricate them with a fine grade of clock oil. Transfer the oil to the bearings in very small droplets, using a needle or a piece of wire as shown in Figure 4. Apply very slight amounts of oil to the gear teeth. Do not oil the jewelled balance-wheel bearings.

Suggested Modification

The internal fuse consists of a solder bridge between two bronze lugs at the base of the electromagnet. Normally the bronze piece that acts as the positive-power conductor is bent away from the phenolic back-plate so that it contacts the bronze lug at the magnet base, with the two soldered together. The spring action of the power-conducting strip puts the fuse in tension, and if it blows, the strip will spring back against the phenolic plate. Solder with a melting point of 248°F is specified by VDO to restore a blown fuse.

An alternative to restoring the fuse is to install a circuit modification consisting of a silicon diode and a capacitor. This will suppress the high-voltage spark that occurs at the gap between the contacts as they fly apart. (This is self inductance. When current in the magnet dies because the contacts part, the magnetic field collapses, inducing a reverse current which makes a destructive spark across the contacts.) Solder a 1N4002 diode or equivalent across the fuse lugs with the cathode (striped end) toward the coil; see Figure 5 for the exact position of the diode. Solder the positive side of a 1-microfarad 35-volt tantalum capacitor to the magnet frame on the back plate of the clock, and connect the negative side to ground, under the nearest 5-mm nut, as shown in Figure 6.

Connect the clock to a 12-volt DC power source to test it before replacing the dust cover. If the movement is sluggish, some bearings may be dry, but it should loosen up as oil works into the bearings. Use a jeweler's screwdriver to turn the adjusting shaft protruding through the back plate—clockwise to slow the movement, counterclockwise to make it run faster. Check and adjust running speed for a day or two before reinstalling the clock. The two access holes in the back of the dust cover are normally covered with white plastic tape.

Buff the chrome bezel with white rouge before reinstalling the clock. Scratches in the transparent plastic crystal may be reduced with a moderate polishing compound, as in automobile wax or toothpaste. If the clock is mounted in the instrument cluster, it is rim-lit at night by the instrument lighting, but if it is mounted separately, it has an on-board bulb, which may need replacement. The only bulb that will fit is a special bayonet-base unit with an 8.5-mm envelope, now available as the Thorn 37R, part no. 0022T4W.

Sources

The relay-contact cleaning tool is available from Jensen Tools, 7815 S. 46th St., Phoenix AZ 85040; 602/968-6231. Clock oil is available from S. LaRose, 234 Commerce Place, Greensboro NC 27401; 912/275-0462; a 16-cc bottle, part no. 064005, costs $2.95. The 255°F solder has been impossible to find in an alloy without indium, which will exchange with the bronze in the soldering lugs with time, causing the melting temperature to drift. A 255°F bismuth-lead solder is made by Arconium Specialty Alloys in Providence, RI, but the minimum order is $325. Thanks to Bernie Tekippe of Classic Clocks in Atlanta, Georgia for his advice.

My observation while working along video and article recommendations:

1. Video
   - I am not sure if described “any rectifier diode” and 22µF electrolytic capacitor would work; I tried such set and the diode was fried
   - Verbal description of capacitor connections is wrong (opposite poles described)
   - Soldering point of positive pole of capacitor seems better to me than the one from Fig. 6 (associated with article on Benz World)

2. Article
   - I am not sure if pictures I found are those original from the article
   - Article suggests tantalum 1µF capacitor and 1N4002 diode – this set is working for many hours so far, looks like it is good
   - Fig. 6 – I am not sure if it is originally from the article, I found it associated with article on Benz World forum; it shows different type of capacitor than described and it shows wrong polarity of capacitor connection
   - Soldering point for capacitor + (- on the picture) is on the moving part; I do not know how would it work

Also: the power supply between the looms needs to be soldered very securely. I noticed that the points in the winding mechanism are sticking when power supply is insufficient – the part that kicks the flywheel does not have enough power to really push the flywheel and points stay together.

Link to video: https://www.youtube.com/watch?v=zaoUMLz8vBc

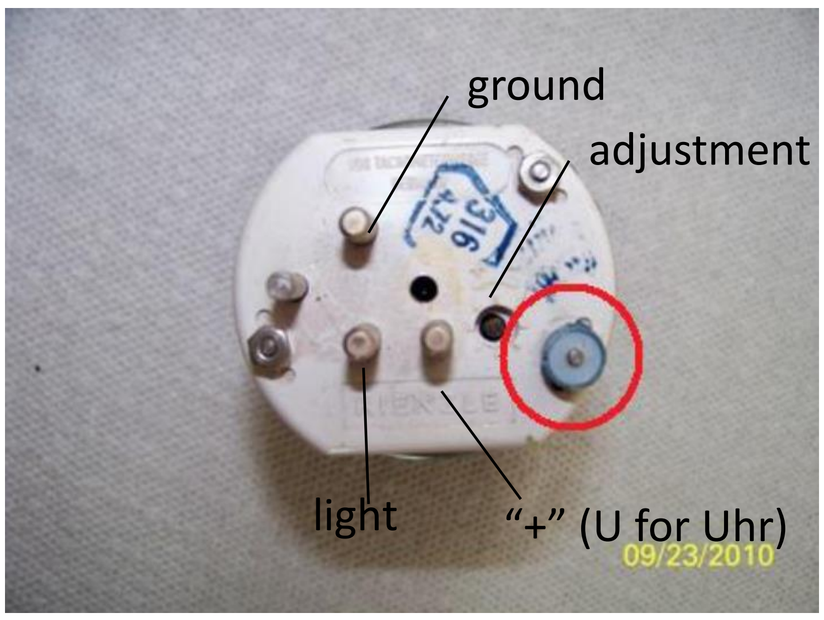
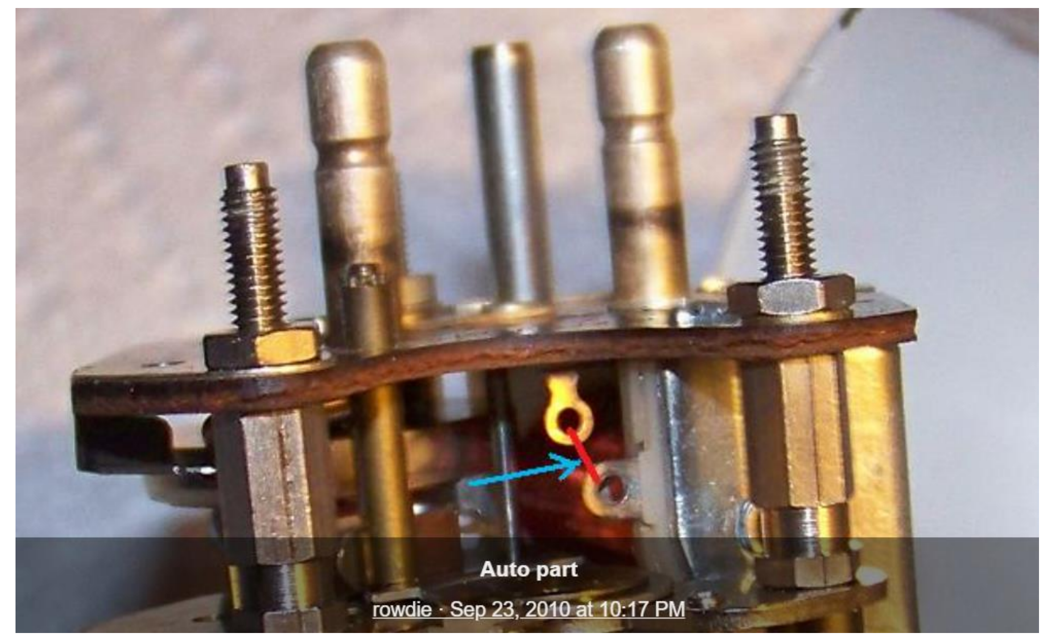


Fig. 1, Article. Marked red is factory seal.



Power supply (+). Upper loom is directly connected to positive pin, bottom one to coil. “+” is on the magnet frame and flywheel!!! But “-” is on the clock frame and screws!!!!

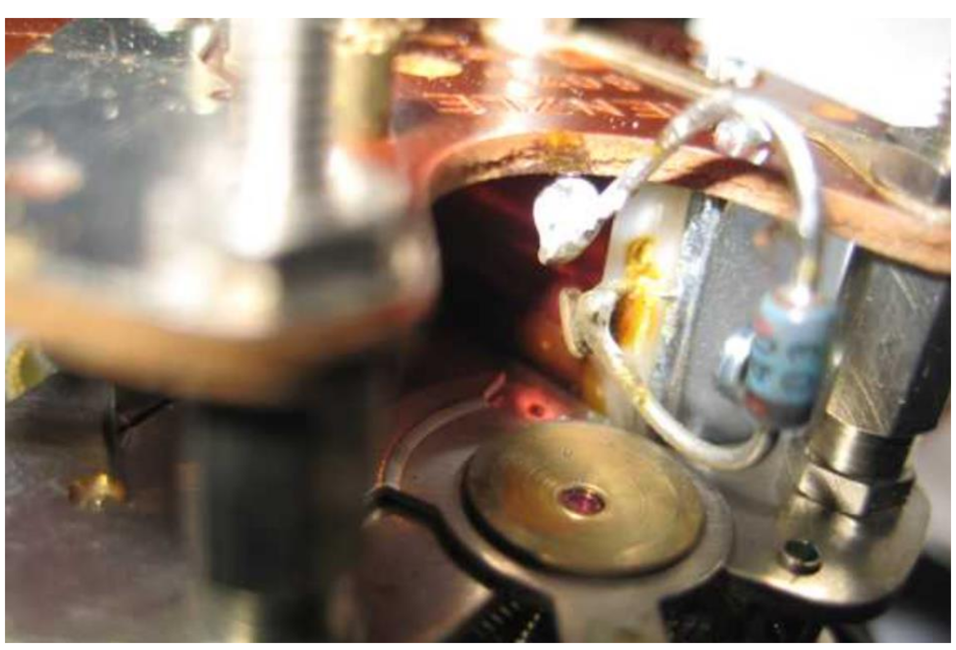
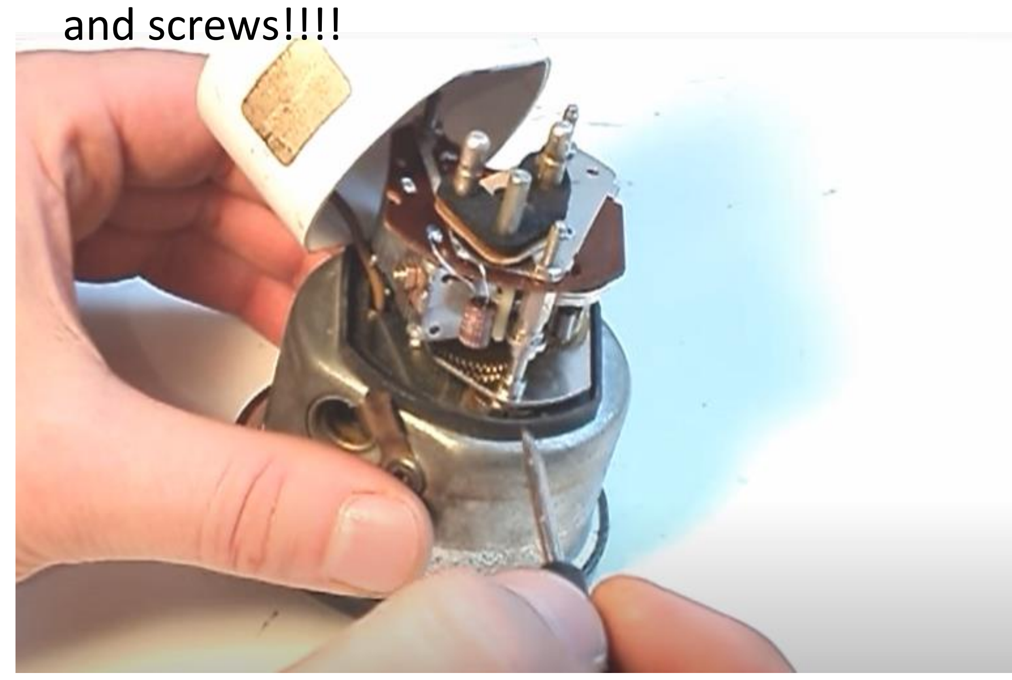


Fig. 5, Article – diode fitting – stripe down.



Capacitor soldering points from video: + to magnet frame hook, - to ground path. In my view better point for + than In the article. Verbal description in the video is wrong.

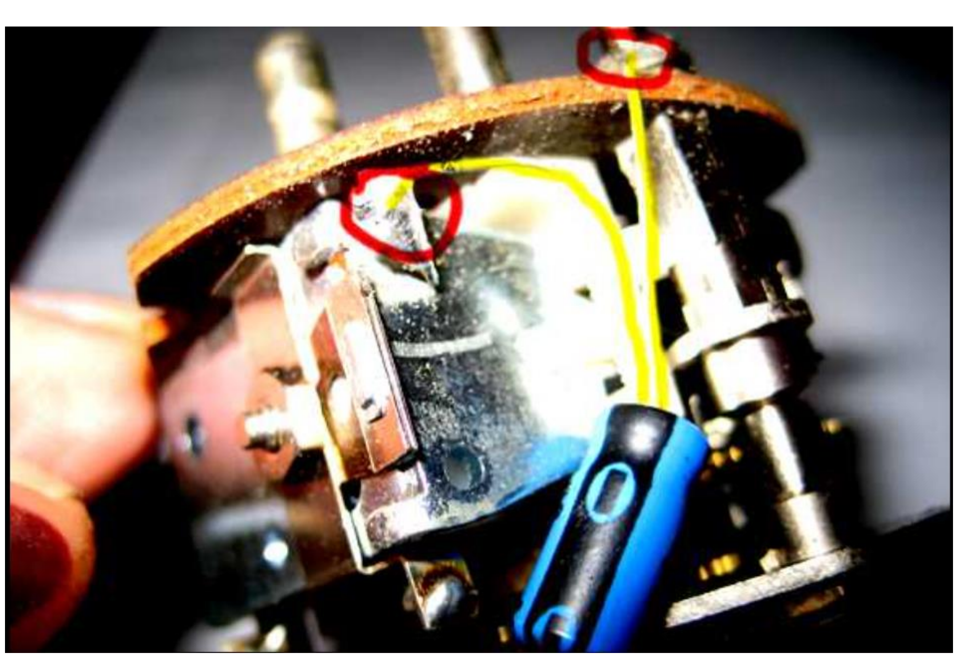
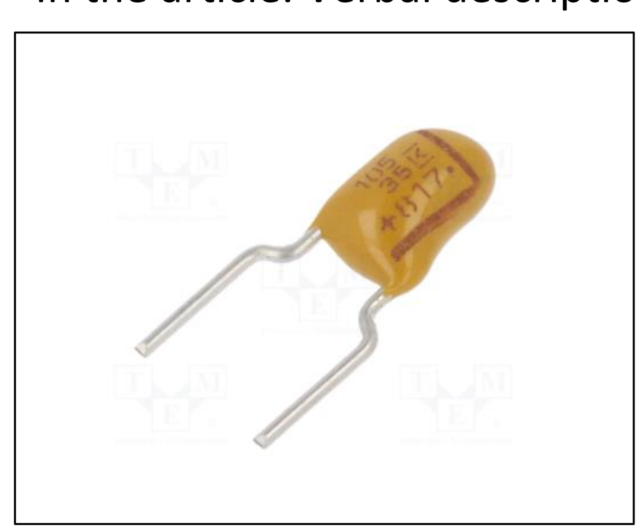
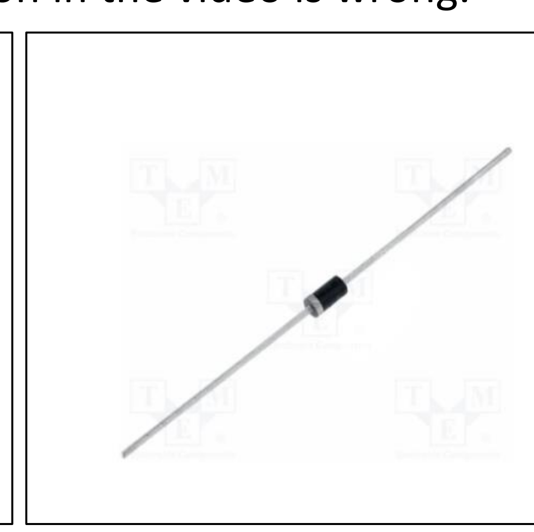


Fig. 6, Article (probably). Capacitor type and polarity are wrong. I am not sure how the positive soldering point would work, it is soldered to a moving part. I did it as per the video proposed one.



Tantalum capacitor. We use 1µF capacity. Note polarity description. “+” is on the leg that is slightly Sticking out and it is marked +. Size is about 5mm.



1N4002 diode. It is about 100V diode.