In “Science of Mechanics“, Ernst Mach analyzed Stevin’s proof of the law of the lever from an epistemological angle. Later, in his “Popular Scientific Lectures”, he singled out the impossibility of a Perpetuum Mobile as the empirical fact upon which Stevin based his deduction, in addition to the use of symmetry, which is typical for many lever and inclined plane equilibrium proofs of the time.

It is accepted, even by Mach, that the lower part of the chain is symmetrical about the vertical axis passing through the middle of the prism’s horizontal segment and hence, can be imagined away. We now ask why (or when) this is the case. The symmetry can only occur if the last two chain elements (or balls) have exactly the same height and are such that their connections to their hanging neighbors do not somehow touch the prism in an asymmetrical way. Consequently, not only must the position of the chain on the prism be carefully setup to achieve symmetry, but also the lengths of the segments must be chosen as a function of the length of the chain elements. Clearly, many combinations of do not work out. We claim, arguendo, that even when it occurs, the symmetrical configuration of the lower chain is unstable and always moves until it stabilizes in an asymmetrical one. This does not produce a perpetual motion and is therefore an allowed argument. An answer in the negative must be proved.

These points are clearly the reason for Mach’s remark that ‘the string of balls might be replaced by a heavy homogeneous cord of infinite flexibility’. But even so, the question persists. If we first consider as a model for such a cord, a chain composed of infinitely many elements, each formed by two balls connected by a rigid weightless bar, one ball resting on a segment of the prism, the bar being normal to that segment, and additionally a weightless string on the contact side, smoothing out the contact bumps caused by the balls. We immediately see that at the two corners where the lower part starts, the situation cannot be symmetrical. the angles of the prism are different, and hence the angles of the bars. This destroys the proof. An ‘infinitely flexible’ cord must deform differently at each side and this asymmetry, unless proven otherwise, carries over to the lower cord. Even if an elastic cord be admitted, the difference in deformation causes different ‘tensions’ at the corners and hence causes the same problem. A ‘cord’ of zero section radius would be a solution, but such a cord is massless and weightless, which is altogether pointless because then, the whole question of equilibrium does not even occur.

In conclusion, even if there was a way to salvage the symmetry of the lower chain, we have shown that it should not be readily accepted. Instead it should either be proved to be logical consequence, or declared an assumption.