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THE DAMPING OF BALANCES*

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Abstract

The paper gives a survey of the history of damping methods for balances. Representation on Egyptian drawings demonstrate that the person performing the weighing shortened the measuring time by holding the suspension cords and touching the beam. By means of delimiters, the Romans constricted the deflection amplitudes. In the 19th century, the movements of precision balances were damped with a brush. For analytical balances, locking mechanism were developed, often combined with levers lifting the weighing scales and the beam in order to relieve the knife-edges. Half-arresting was used to curtail weighings. Air damping was invented by Arzberger in 1875, and eddy current damping by Marek in 1906. In electronic balances, lag, lead and filter elements and absorptive attenuators are used. For digital balances, the fast-reacting nullification of eddy signals is applied.

Keywords: attenuation, balances, damping, history of technology, weighing

Introduction

Conventional balances, of either beam or spring type, are systems which can easily be stimulated to undergo mechanical oscillations. Enhancement of the sensitivity of a balance simultaneously intensifies its tendency to oscillate and extends the time for equilibrium to be reached [1]. Two types of mechanical oscillations can be observed: oscillation of the balance beam around its swivelling axis or in the direction of the helical spring axis (one degree of freedom), and oscillations of the pans (two degrees of freedom). The two modes of motion are connected, influence each other and cause complex indications [2]. After stimulation, within an extended period of time, the movements decline and the balance comes to rest due to friction in the bearings or in the spring material, and due to friction in the surrounding air (Fig. 1, graph b). Insufficiently damped balances in vacuo may oscillate ceaselessly, because some stimulating disturbances are always acting, and friction by the residual gas is insignificant (Fig. 1, graph a).

* Dedicated to Prof. J. A. Poulis on the occasion of his 70th birthday

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Remarks