



MICROBALANCE TECHNIQUES

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Editors:

Prof. Dr. Jürgen U. Keller

Institut für Fluid- und Thermodynamik,
Universität - Gesamthochschule Siegen

Ing. Erich Robens

Institut für Anorganische und Analytische Chemie,
Johannes Gutenberg - Universität Mainz

The early history of balances based on electromagnetic or electrodynamic force compensation

Hans R. Jenemann, Schwedenstraße 7E, D-65239 Hochheim am Main

1. INTRODUCTION

Today, the term "electronic balances" is used for a great variety of mass measuring instruments, based on different principles and used in various fields of application like commerce, manufacture, household, techniques, and in laboratory. Indeed, the term "electronic balances" does not designate the weighing principle and is therefore misleading [1].

Reminding the equal-armed lever balance, the steelyard with variable levers, the spring balance, and the inclination balance: For all these balances the notation is in accordance with its principle of working. This is not the case, however, for the so-called electronic balances, because a purely electronic weighing does not exist. Electrons per se are not capable to perform weighings. The electronic in modern balances is only able to control and to automatize the process of weighing, which is only based upon electromechanical principles; the representation of the measured value is done in digital manner. The same applies to the storage and the processing of the data by electronic techniques.

There is a considerable number of the so-called electronic balances, which work according to different weighing principles. Their function, however, is always based on electromechanical elements: A mechanical effect caused by the mass to be weighed, such as the increase of a certain length within the weighing cell, produces an electrical signal, for example the alteration of an electrical voltage or an electrical resistance. This means that these modern balances are based on weighing principles which are already known for long time[2]. As examples may be mentioned:

- balances with a magneto-elastic force transducer,
- balances with a capacitive force transducer,
- balances with an inductive force transducer,
- balances with a piezo-electric measuring probe,
- balances with strain transducers,
- balances with electromagnetic or electrodynamic force compensation.

In all these cases the weighing result is indicated via an electric signal. The application of such electrical procedures was accompanied with many difficulties and thus, in the beginning these methods were seldom transferred to weighing instruments of daily use. The development in electronics during the last decades made it possible to receive weak electric signals faster, the procedure was less expensive and in most cases also much more precise than the classical application of purely electrical methods.

Author Jenemann, H.R.

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Abstract

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