History of the scale – Part 3

... Scales and weighing through the ages ...

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In Part 2 we will also be looking at how the centre beam balance works on the analogue principle as well. A greater or lesser weight in the scales results in a proportionally larger or smaller movement of the pointer.

Gottfried Wilhelm Leibniz
**** 01.07.1646 / † 14.11.1716***

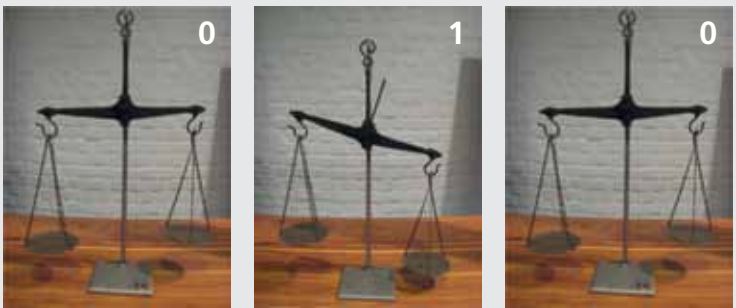
From the centre beam balance known for thousands of years and Gottfried Wilhelm Leibniz to the latest digital technology.
Gottfried Wilhelm Leibniz (* 01.07.1646 Leipzig, † 14.11.1716 Hanover) deduced a system of calculation that uses just two numbers, 0 and 1, from the division of weights on the analogue, centre beam balance. A brilliant idea for the human race, or perhaps not? But how did Gottfried Wilhelm Leibniz, living in Wolfenbüttel near Brunswick, discover the binary system with just 0 and 1 that is still in widespread use today and forms the foundation of computer technology?

Let's take a closer look at the centre beam balance without any weights on it: the pointer is clearly pointing to 0. If any weight is placed in the scale of a centre beam balance, the pointer shows "just one position", and that is then the number 1. If the weight is removed from the scale, the pointer returns to the position 0. It is an incredible achievement that Gottfried Wilhelm Leibniz was able to work this out from looking at the centre beam balance. As far as I'm concerned there is no doubt that he really changed the world with his discovery and that this is the greatest invention of the modern era. Today, not only computers, scales and satellite navigation systems work using the binary system, but also almost anything and everything that has to do with data. And of course all the current weighing scales and data systems at Bizerba.

Grave in Neustadt Church, Hanover

Leibniz died out of favour in Hanover on 14 November 1716 at the age of 70 - his funeral was only attended by his secretary. He was buried in the court and town church of St Johannis in the Neustadt district.

It may be that a similar fate befell other important and less important researchers and mechanics from the Swabian mountains, because their outstanding work remained largely unknown to the people in their home region and the surrounding areas. But that will all be revealed by my future research. Assistance and support are being kindly provided by Heinz Weisser from Bizerba and



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Philipp Matthäus Hahn and the pendulum scales

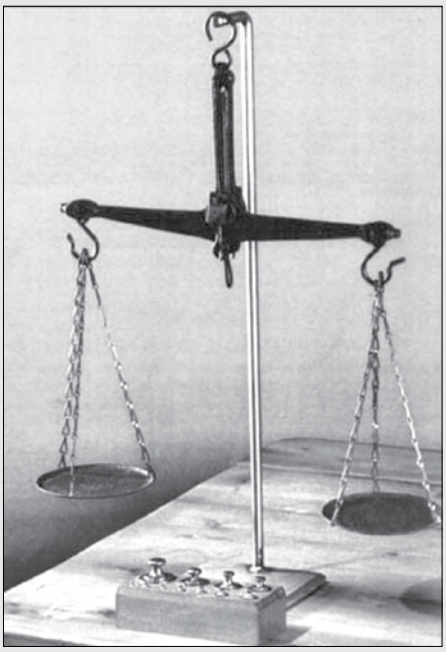
Philipp Matthäus Hahn came to Onstmettingen for the first time in 1756. There he became friends with Philipp-Gottfried Schaudt, who was the same age.

Both were exceptionally curious about the natural sciences and enthusiastic about technology.

The brilliant leadership of Philipp Matthäus Hahn together with the active assistance provided by Schaudt and the Sauter brothers resulted in clocks, calculating machines and pendulum scales. But on this occasion we would like to take a closer look at the first pendulum scales designed and built as a simple household scale by the team mentioned above.

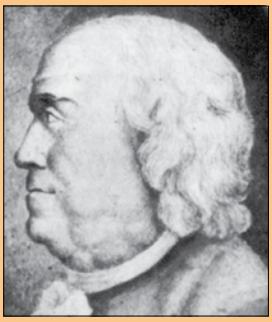
So how did the development work begin on these pendulum scales, which are so different from the centre beam balance in terms of their physical properties? The centre beam balance (Fig. above) shows the result of the measurement when the beam is horizontal and the pointer is vertical. This type of scales therefore has one single point of equilibrium. The off-centre pendulum scales by contrast (Fig. below) reach a new equilibrium each time depending on the weight that is placed on it. The pendulum scales therefore have an infinite number of points of equilibrium. In other words: "In contrast to the centre beam balance the pendulum scales measure mass not by means of compensation with another mass, but via the deflection, which can be read off on a scale. The pendulum scales therefore calculates the result itself, automatically."

This principle of Hahn's pendulum scales was used 161 years later in the first German pendulum scales with sliding reference weights, which was manufactured by Bizerba in 1924 in Balingen/ Zollernalbkreis.

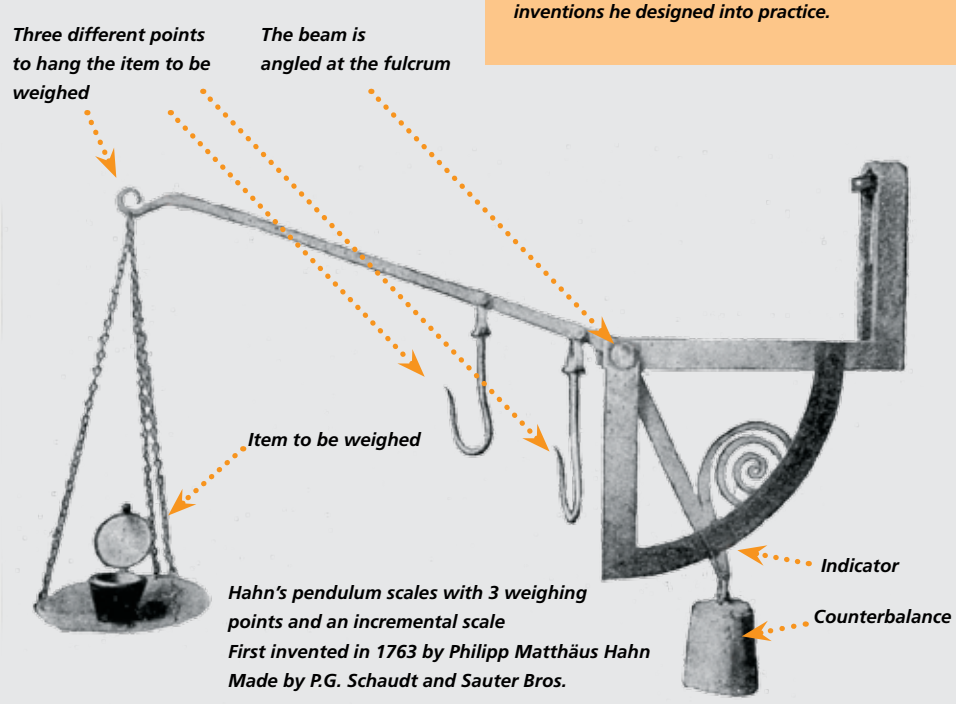


Centre-beam balance

P. M. Hahn (25 November 1739 in Scharnhausen; † 2 May 1790 in Echterdingen) was a German parson and engineer.*



*Philipp-Gottfried Schaudt, German schoolmaster and mechanic, * 11 October 1739 in Onstmettingen, † 21 June 1809 ibid. Schaudt was the congenial assistant of Philipp Matthäus Hahn and in the whole of his life never left his birthplace in the Swabian mountains. Without him, Hahn would on his own admission never have been able to put the devices and inventions he designed into practice.*



Hahn's pendulum scales with 3 weighing points and an incremental scale
First invented in 1763 by Philipp Matthäus Hahn
Made by P.G. Schaudt and Sauter Bros.

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Andreas Bizer
Bizer Balingen became Bizerba
** 2 Sept 1839 † 7 Dec 1914*

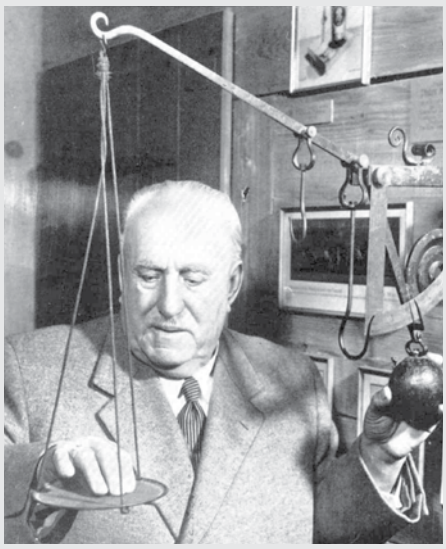
Bizerba, a major new star in the weighing firmament ... The pioneers of the early years and the great expansion!

In 1866 Bizerba became involved in the ongoing history of weighing scale development. This was the year that Andreas Bizer established a workshop in Ebingen to manufacture and repair scales. In 1868 he moved the workshop to Balingen. In this section we would like to talk about the main milestones on the way from this simple engineering workshop for scales to the modern, high-tech company of today, the star in the weighing firmament.

After setting up his company Andreas Bizer concentrated mainly on producing counter scales of the Roberval Balance type. During this period he gained considerable experience of non-self-indicating scales. These are scales which require the operator to manipulate weights or poises during the weighing process. In 1871 Andreas Bizer was appointed a master calibrator in conjunction with the introduction of the metric system of weights and measures.

Of course Andreas Bizer was aware of the invention of the pendulum scales by Philipp Matthäus Hahn in 1763. This was the start of a period of rapid expansion which took the company from being a small scale-maker to the brightest new star in the weighing firmament. The pendulum scales were the cornerstone and the catalyst for Bizerba's unique success story.

The middle photograph shows the later Professor Wilhelm Kraut with the original of Hahn's pendulum balance scales, the principle of which was incorporated into the world famous pendulum scales first produced by Bizerba in 1924.

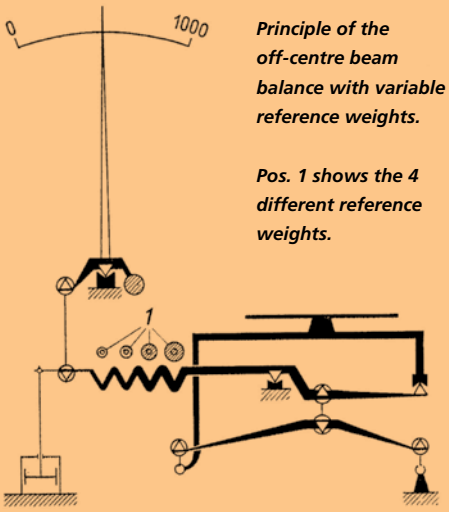


Prof. Wilhelm Kraut sen.
Son-in-law of Andreas Bizer
** 9 May 1875 † 26. Sept 1957*

The roll-out of the first off-centre beam counter scales in Germany

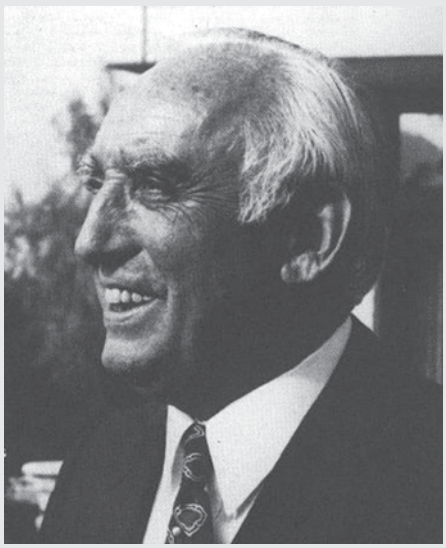
The picture shows the historic development of the first off-centre beam balances, which were produced successfully for many years. In 1924 the prototype of the off-centre beam balance with variable reference weights was built with a wooden casing. In the same year these Bizerba scales were given component-type approval for verification for the first time in Germany. The scales at the back is an early mass-production model. On the left is the highly successful model of the off-centre beam balance with sliding poise developed in 1954. By 1928 Bizerba had become the largest manufacturer of weighing scales in Germany.

The first family of Bizerba off-centre beam balances.



Principle of the off-centre beam balance with variable reference weights.

Pos. 1 shows the 4 different reference weights.



Wilhelm Kraut jun.
Honorary senator of University Tübingen
** 17 March 1906 † 13 July 1992*

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From the pendulum scale with variable weights to the optical price-indicating scales, Bizerba's flagship model.
The later versions of the pendulum scales with variable poise weights enabled the operator to read the weight and the corresponding price from a chart.

This process required the operator to read the weight and price data very carefully, as the chart consisted of a large number of figures and combinations.

The designers at Bizerba therefore set about developing scales with an optical price indicator, which were brought to market in 1952. The great advantage of these counter scales was that they showed the price and the weight directly beneath one another. It became much faster and easier for the operator to determine the correct price.

Pendulum scales with variable weights and price-indicating scale

Weight display
Price display

display (direct)

optional entry of basic price per kilogram.

Double-pendulum scales with optical price (OP)

OP scales in operation

This marks the end of the first chapter in the history of Bizerba, the new star in the weighing firmament. Bizerba's success story continues with the development of electronic weighing scales. But to keep things in the right order we will first take a look at the Chronos scales from Hennef a. d. Sieg dating from 1883, the first automatic weighing scales in the world.

It is to Prof. Wilhelm Kraut and his passion for collecting that the town of Balingen owes the genesis of the Museum for Scales and Weights in the Zollern castle. In 1943 he made his entire private collection available to the museum. The collection has since been extended considerably.

With a view of the Zollern castle in Balingen and the Museum for Scales and Weights we would like to conclude with the words of the Spanish cultural philosopher Jose Ortega y Gasset.

"Progress does not consist of destroying the past, but of preserving its essence, which had the power to create a better today."

To which we could add: "The future has a past!" This is particularly important because scales regulate and control flows of money and goods as they did thousands of years ago. They must therefore be kept permanently up to date with the latest technology. Without scales it would not be possible to organise an orderly economy, even in our computer-driven age. Scales are also a guarantee of consumer protection everywhere in the world. And ultimately we are all consumers.

In this spirit we wish the new managing shareholder Mr Andreas W. Kraut and the entire workforce of Bizerba good health, good fortune and success in the future. After weighing all the options, may their decisions always be the right ones!