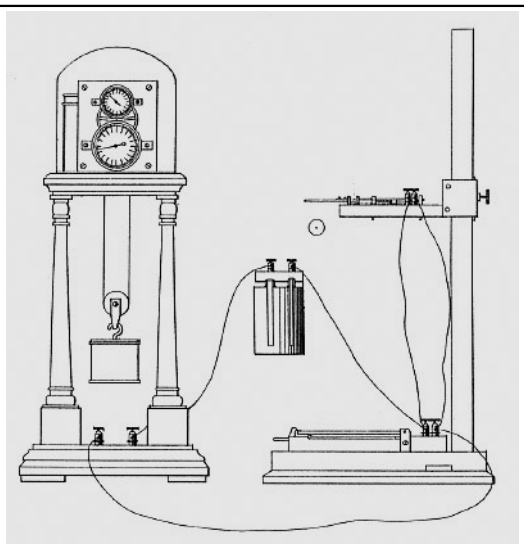
The Hipp Chronoscope.

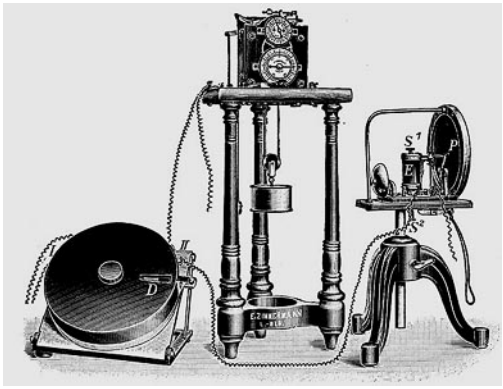
Thomas Schraven

The Hipp chronoscope is one of the most important scientific instruments of late 19th and early 20th century psychology. Following similar devices constructed by the English physicist Charles Wheatstone (1802 - 1875), the German clockmaker and mechanic Matthäus Hipp (1813 - 1893) presented his version of this electromagnetic precision timer in 1848. After Wilhelm Wundt (1832 - 1920) recommended the application of Hipp's chronoscope in the first edition of his path-breaking text book Grundzüge der physiologischen Psychologie in 1874, the "time viewer" was widely used in the emerging community of experimental psychologists.



Hipp chronoscope, 1865

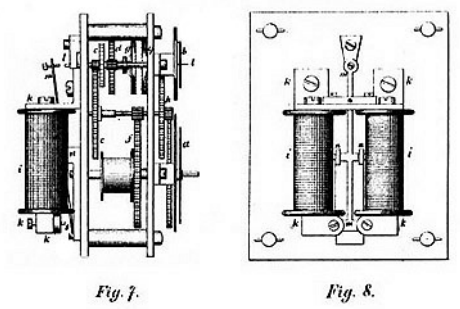
The main purpose of the chronoscope was to measure reaction times in human test subjects.



Psychological experiment with Hipp chronoscope for investigating perception, association, and memory according to Ranschburg (1923)

The history of the Hipp chronoscope is, however, not limited to psychology. Initially, the instrument was applied in physical and ballistic experiments. In addition, the name "Hipp chronoscope" was not exclusively used for the precision time measuring devices produced in the workshops of Hipp, initially located at Reutlingen (South-West Germany), then at Bern, and, eventually, at Neuchâtel (both Switzerland). Starting in 1890, instrument makers in Germany and other countries offered Hipp chronoscopes of their own production. A well-known example is the firm of E. Zimmermann (Leipzig, Berlin). Other suppliers bought chronoscope clockworks at Hipp's Neuchâtel factory and completed them with stands or other accessories and sold them under their own labels. Today, some 110 chronoscopes from Hipp and various other firms can be found in public museums and collections, and some 20 more are kept in private collections.

In 1848, Wilhelm Oelschläger (1816-1902) presented a new precision timing device to the German public: the "Hipp chronoscope." Oelschläger was the headmaster of the high school at Reutlingen in South West Germany with a special interest in clocks and clock making. His horological interests brought him together with the clockmaker Matthäus Hipp who had his workshop in the same town. Oelschläger's article Das Wheatstone'sche Chronoskop, verbessert vom Uhrmacher Hipp in Reutlingen briefly describes the Wheatstone chronoscope and quotes incorrect results of short time measurements done with this instrument. Subsequently the Hipp chronoscope is introduced, followed by a report about the exact results of time measurements. Hipp's main improvement with respect to Wheatstone consisted in separating the clock movement from the movement of the dials. First, the movement of the clock was set in motion mechanically. Only after it had reached its constant working speed was the measurement started by engaging the dials through electromagnetism.



Figures accompanying Oelschläger's description of the the Hipp Chronoscope

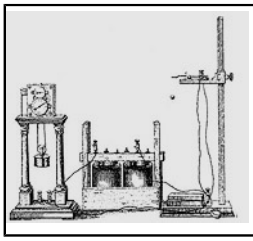
One year later, Oelschläger published a second article on the Hipp chronoscope. In Das Hipp'sche Chronoskop, zur Messung der Fallzeit eines Körpers und zu Versuchen über die Geschwindigkeit der Flintenkugel he gave a detailed description of the chronoscope. Oelschläger mentions that Hipp had improved the first version of his instrument and describes an instrument belonging to the chronoscope, the so-called "drop apparatus (*Fallapparat*)", which served to calibrate and control the instrument. Oelschläger suggested using the chronoscope in physical experiments concerning the time required by falling bodies and in ballistic trials measuring the velocity of projectiles.

One of the rare Hipp chronoscopes surviving from this period is kept at the Utrecht University Museum. In the spring of 1849, this chronoscope was delivered to the Physical Institute at Utrecht University. Along with the instrument, Hipp sent a drop apparatus and a handwritten letter with instructions. In his letter, Hipp claims that his chronoscope is able to measure the 500th part of a second. He also describes how to start and stop the time measurements properly. In addition, Hipp reports on test results from experiments with falling bodies he had conducted together with Oelschläger.

Utrecht University Museum

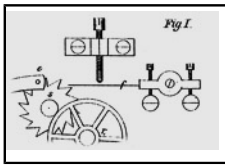
In the late 1840s and early 1850s, Hipp gave public lectures on the chronoscope and other electromagnetic devices of his production, e.g., a writing telegraph, in Munich, Vienna, Regensburg, and other cities. During this period, Hipp sold chronoscopes to physical institutes in England, Scotland, and Switzerland. At the same time, several publications about the Hipp chronoscope appeared in scientific journals. Physicists such as Adolph Poppe and Carl Kuhn discussed the precision of time measurements made with the Hipp chronoscope. Other descriptions of the instrument were published in introductory text books dealing with physics and applied electricity, e.g. Wilhelm Eisenlohr's Lehrbuch der Physik: zum Gebrauch bei Vorlesungen und zum Selbstunterrichte (1852) or Théodore Du Moncel's *Exposé des applications de l'électricité* (1853). In 1852, Hipp was offered a job as machine supervisor (*Maschinenwerkführer*) at the newly established *Swiss Federal Telegraph Workshop* in Bern. He was quickly promoted to chief of the entire operation. Although it meant shifting his focus from clock mechanics to telegraphy, he continued with his chronoscope trade.

The Hipp Chronoscope, 'model 75'



In 1860, Hipp left the *Federal Telegraph Workshop* in Bern and founded his own telegraph factory in Neuchâtel. The *Fabrique des Télégraphes et Appareils électriques* produced telegraphic apparatus, electric clocks, scientific instructments, and accessories of all kinds. Section B of the 1869 trade catalogue from Hipp's factory gives a brief description of the chronoscope listed as item "75." For more extensive information, the catalogue refers to an article published by Adolphe Hirsch (1830 - 1901) director of the Neuchâtel State observatory, in the physiological journal *Untersuchungen zur Naturlehre des Menschen und der Thiere* in 1865.

In his paper, Adolphe Hirsch reports on chronoscopic experiments concerning the speed of various sense impressions and nervous conduction. Hirsch had conducted these experiments in 1861 with regard to the so-called personal equation, i.e. the problem of individual errors in astronomical observers. To measure the "physiological time" of various test subjects (among them Hipp), he used the chronoscope. In the paper for the *Untersuchungen*, he gave a detailed description of the Hipp chronoscope.

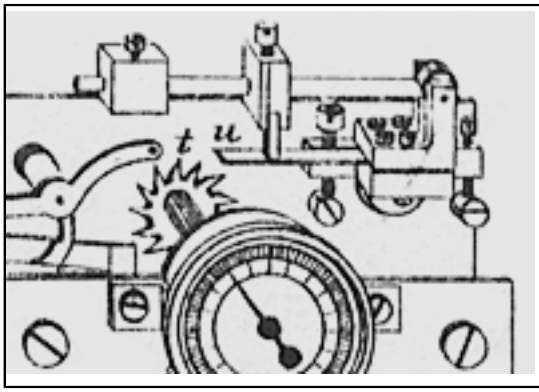


One main component of the instrument was an escapement ("Fig. I") consisting of a steel lamella f fixed at one side and an escape wheel s with 20 teeth. The lamella made 1000 vibrations per second and controlled the functioning of the clockwork. The characteristic noise of the working instrument could thus be checked against a tuning fork. The train for the hands was separated from the clockwork and had two dials, divided into 100 parts (fig.s III and V). The hand of the lower dial made one turn in ten seconds and indicates 1/10 sec. The hand of the upper dial needed 1/10 sec for one turn, thus indicating 1/1000 sec. An electromagnet at the back of the chronoscope pulled the dials into the running clockwork. A spring threw them out of the clockwork again when the measurement was stopped.

Today, six chronoscopes of model "75" still exist. All these instruments are of the same type and bear the signature "M. Hipp, Neuchâtel, Suisse" and a serial number. Without any visible modification, this version of the Hipp chronoscope was produced from 1860 to 1875.

The Hipp Chronoscope, 'model 88'

In 1875, Heinrich Schneebeli, a teacher of physics at Neuchâtel, published an article on a further improved version of the Hipp chronoscope. In Ueber die Anziehungszeit und Abreissungszeit der Elektromagnete. Annalen der Physik und Chemie, Schneebeli notes that the chronoscope was used in numerous physical laboratories. He adds a detailed description of the improved instrument.



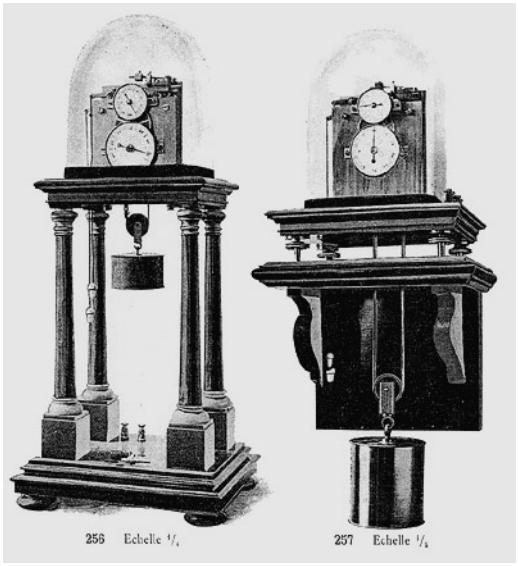
Hipp had introduced changes to the escapement and the electric part of his chronoscope. With respect to the escapement, Schneebeli writes that the simple screw to adjust the Hipp lamella *u* is replaced by an additional unit for calibration. Part of this unit is a lever with a little weight and a damper, to prevent self resonance. A more striking modification concerned the electric unit at the back side of the chronoscope. Instead of only one, the new Hipp chronoscope had two electromagnets. Between two pairs of coils a metal armature was placed. The position of this armature was adjusted with the help of two levers and springs. Initially, the chronoscope only allowed measurements in case the electric circuit was interrupted. The new arrangement of the electromagnets made it possible to measure time with an opened and closed circuit, thus multiplying possible laboratory set-ups. It was this version of the Hipp chronoscope that was widely used in psychological laboratories.

88. *Chronoscope* pour mesurer de petites fractions de temps; il sert, par exemple, à la détermination des temps de chute des corps, à la mesure des équations personnelles, de la vitesse nerveuse, de la vitesse initiale des projectiles, etc. On trouve la description détaillée dans l'ouvrage cité ou dans le mémoire: « Expériences chronoscopiques pour mesurer la vitesse des sensations, par A. Hirsch, Bulletin de la Société des sciences naturelles de Neuchâtel, 1863 » et dans les Annales de J. C. Poggendorf, page 618, de 1875. — L'instrument indique les millièmes de seconde. — Il existe dans un grand nombre de cabinets de physique.

Description of the chronoscope in Hipp's 1877 trade catalogue

In section B of Hipp's 1877 trade catalogue, the new chronoscope figured as item 88. Today, 18 instruments of type "88" still exist. Nearly all these instruments are of identical construction. They bear Hipp's signature plus a serial number. A great number of these chronoscopes are located in collections and museums of psychological institutes.

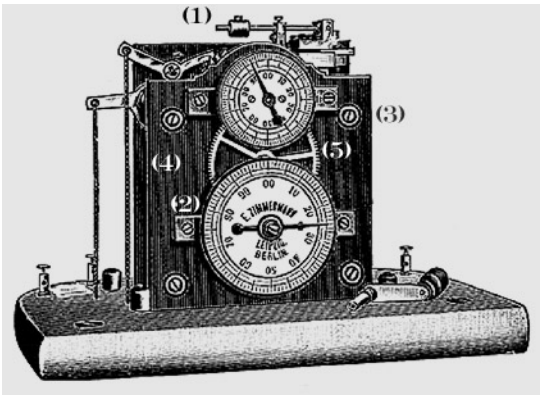
After psychologists such as Wilhelm Wundt in Leipzig (Germany), Gabriele Buccola in Torino (Italy), and Edward Titchener in Ithaca (New York) had recommend the use of the Hipp chronoscope, a veritable industry emerged to meet this demand in scientific instruments. Apparently, the trade in Hipp chronoscopes was quite profitable. In the beginning, the Hipp factory was the only supplier of chronoscopes. In 1889, Hipp entrusted the engineers Peyer and Favarger with the management of his factory. On May 3, 1893, he died in Zurich. Under the name of Peyer, Favarger & Cie, the two engineers continued the production of "type 88" chronoscopes. Their instruments were signed "Peyer, Favarger & Cie, Successeurs de Hipp, Neuchâtel Suisse (plus a serial number)."



Hipp chronoscopes as offered by Peyer & Favarger in 1902

After 1890, Peyer and Favarger developed further models of the chronoscope, e.g. with extended running time. In the same period, other firms started to offer Hipp chronoscopes. The list of these firms includes Karl Krille (Leipzig, Germany), James Jaquet (Basle, Switzerland), Max Kohl (Chemnitz, Germany), Spindler & Hoyer (Göttingen, Germany), C. F. Palmer (London, UK), Ch. Stoelting (Chicago, IL) and many more. The question is, however, whether or not all chronoscopes that were offered can be regarded as authentic "Hipp chronoscopes."

In fact, almost all of the mentioned firms were chronoscope dealers, not manufacturers. Krille bought his chronoscopes from the Hipp factory in Neuchâtel; Spindler & Hoyer made no chronoscopes but only special parts for them; Max Kohl signed the chronoscopes he offered, but the serial numbers on the clockworks reveal that he had purchased them at Neuchâtel. Besides Hipp and Peyer & Favarger, there were probably only three firms which produced their own chronoscopes: F. L. Löbner in Berlin, Strasser & Rohde in Glashütte, and E. Zimmermann in Leipzig. Taking the example of chronoscopes made by Zimmermann, in which some significant differences from the Hipp chronoscopes from Neuchâtel can be detected:



Differences between Hipp and Zimmermann chronoscope
Adjustment: the weight is a cylinder; Hipp used a cubic weight. (1) Signature: all instruments are signed Zimmermann. (2) Movement: Zimmermann used lots of different designs for the plates; plates were connected with screws and washers; Hipp used screws only (3); sometimes the plates have a special grinding; Hipp used polished plates only (4); often the gear wheels are punched; Hipp used gear wheels with legs only (5). Serial No.: Zimmermann = 2-3 digits, Hipp = 4-6 digits.

The successor firm of Peyer & Favarger, the FAVAG, continued to produce chronoscopes. In the late 1920s, FAVAG still offered Hipp chronoscopes similar to type "88" without any major modifications. Even after the second world war, FAVAG offered chronoscopes. These precision time measuring devices, called "synchronous chronoscopes," relied on a completely different technology, however. Synchronous motors for 110 or 220 volts replaced Hipp's lamella escapement driven by mechanical force.

As of today, 107 Hipp chronoscopes have been identified. Five of them are only mentioned in the literature. But signature, serial number, and/or description prove that these instruments existed. Unfortunately, nobody knows where they are kept. 17 of the still existing Hipp chronoscopes are in private collections. The majority of the other surviving chronoscopes are located in the collections and museums of psychological institutes. Only a few can be found in clock museums.

To protect all the old chronoscopes listed in the full version of this paper (see PDF-download, below), the information about their location has been shortened to a minimum. All scientists, psychologists, historians and other persons who need more detailed information for their research may obtain the desired information from Rand Evans, Henning Schmidgen, or the author.

Download full length paper: Thomas Schraven: The Hipp chronoscope. (PDF file 2.8 MB, 56 pages, with extended bibliography)

Update: On October 15, 2003, the police has given back the stolen chronoscope to the University of Bonn (more details). In the meantime, a few other chronoscopes have been discovered. The total of still existing chronoscopes is 118 now. Please, contact us if you have any knowledge of other unknown chronoscopes of the Hipp style.