

# AMERICAN OPTICAL COMPANY

1921 WELLSWORTH LENSOMETER



© Carl Zeiss

ASME HISTORIC MECHANICAL ENGINEERING LANDMARK



OPTICAL  
HERITAGE  
MUSEUM

Proudly Sponsored by ZEISS

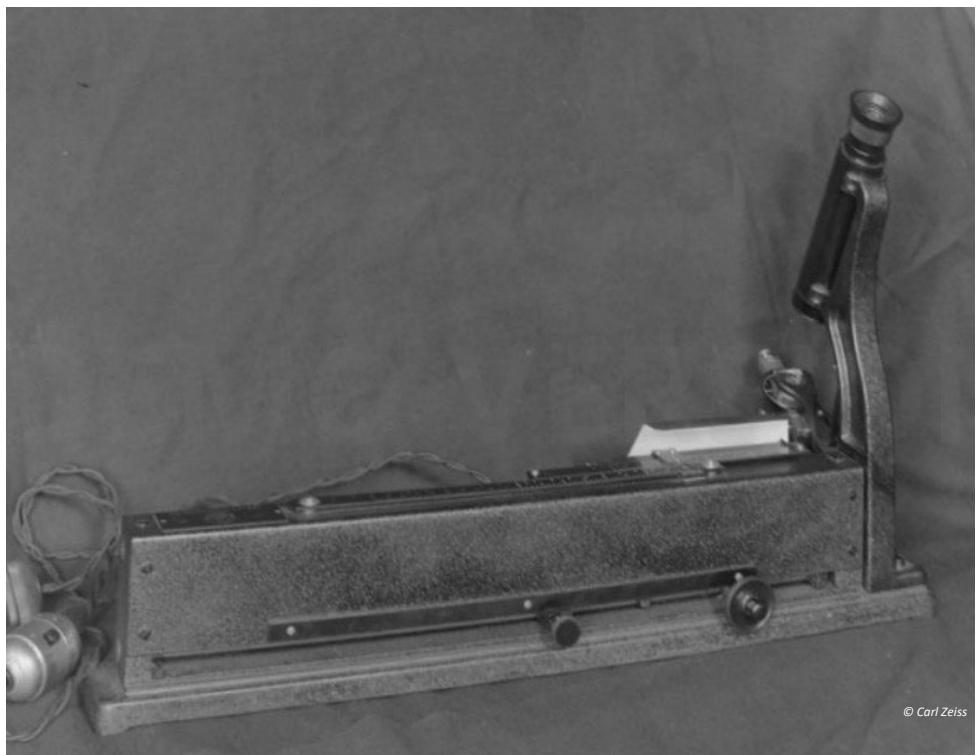


Seeing beyond

## What is a Lensometer?

Lensometer is an American Optical trademark (generic term - focimeter). It is an instrument used primarily by optometrists and opticians to determine the optical characteristics of lenses, such as power or focal length. It can be used both to identify and to verify eyeglass prescriptions. It can also be used to ensure lenses are correctly mounted in frames and to properly orient and mark uncut lenses prior to grinding into finished products. Since more than half of adults in the developed world wear prescription eyeglasses, a substantial segment of the world's population wears a product whose accuracy and uniformity are at least partially due to the Lensometer.

## Evolution & Development of the Wellsworth American Optical Lensometer Prior to 1921 Introduction to the Marketplace



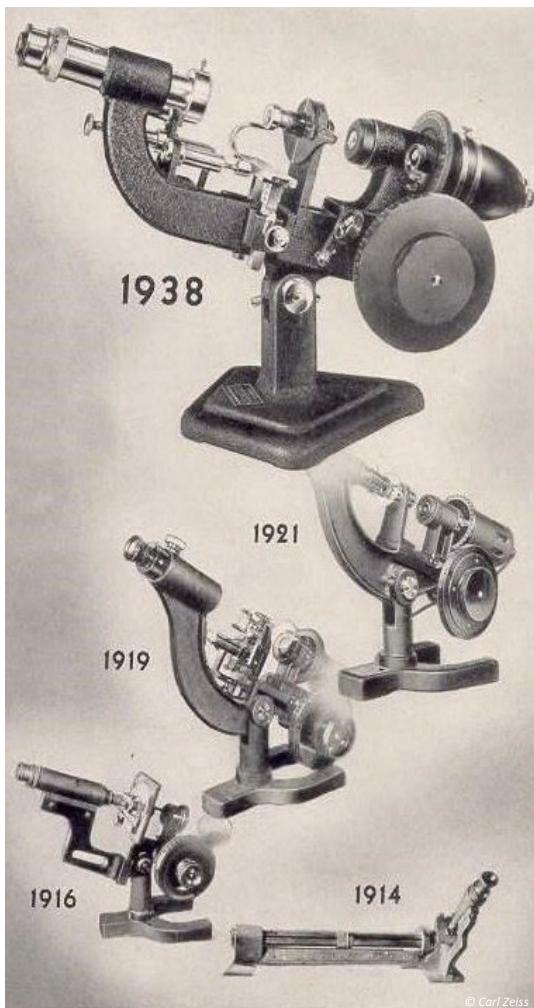
© Carl Zeiss

*1914 American Optical Lensometer which predated the first device sold in 1921*

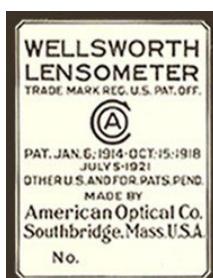
The first Lensometer to be successfully marketed on a commercial scale and widely used in optical dispensaries was the Wellsworth Lensometer, produced by the American Optical Company (AO) and introduced in 1921. Wellsworth was a trade name widely used by AO between 1900 and 1929.

Devices to determine the power of a lens had emerged as early as 1876, but the first practical instrument permitting direct readout was developed by Charles Troppman in 1912. His device, however, was primarily a laboratory instrument. In 1913 Troppman's company (F. A. Hardy Co.) merged into AO. Work had begun on a Lensometer at AO around 1910. The addition of Troppman and his patents put the company's work on a fast track. AO's first model was the 1914 unit pictured above.

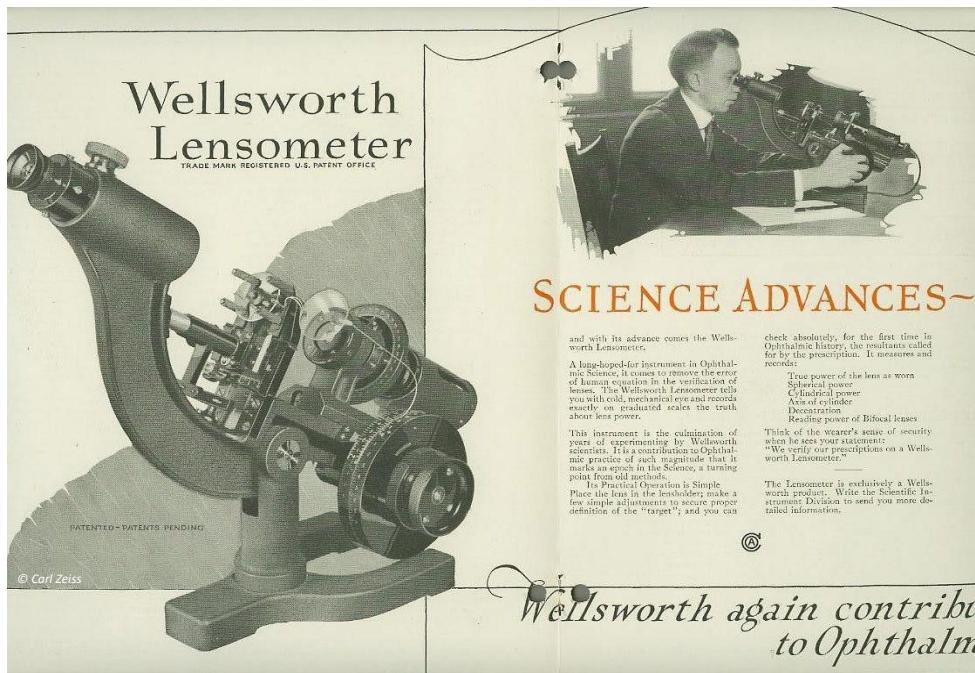
## Lensometer Development 1914 - 1938



In 1916 AO hired Edmund Tillyer to head its research efforts, and in 1918 added Dr. Estelle Glancy to the team. AO's research facility refined Troppman's design, worked out the theoretical underpinnings of the instrument, and slowly transformed Troppman's laboratory device into an easy-to-operate instrument that could be manufactured cheaply enough to be marketed to opticians everywhere. The 1916 and 1919 models – stepping stones on the way to a commercial device – are pictured to the left. AO was ready to market a device by 1916, but delayed release due to WWI.



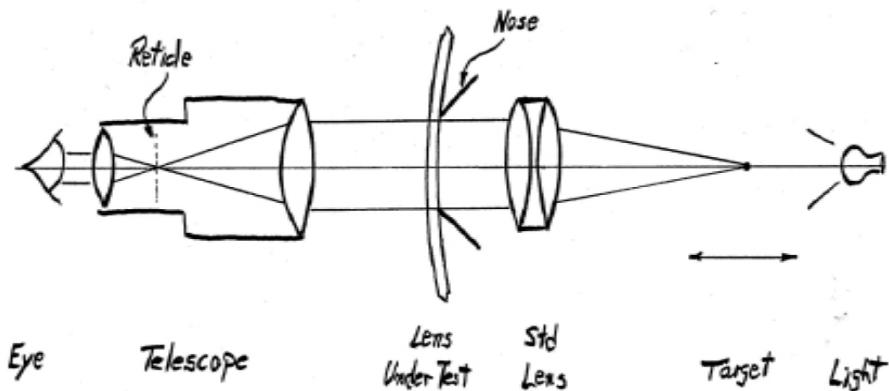
## Lensometer 1922 Magazine Advertisement



AO February 1922 Advertisement

### Lensometer Schematic

#### The Lensometer



and with its advance comes the Wellsworth Lensometer.

A long-loved-for instrument in Ophthalmic Science, it comes to remove the error of human judgment in the selection of lenses. The Wellsworth Lensometer tells you with cold, mechanical eye and records exactly what your eyes could not truth about least power.

This instrument is the culmination of years of experimenting by Wellsworth scientists in a continuing search for scientific practice of such magnitude that it marks an epoch in the Science, a turning point in the history of Ophthalmology.

Its Practical Operation is Simple. Place the lens under test in the frame, make a few simple adjustments to secure proper definition of the "target"; and you can

check absolutely, for the first time in Ophthalmic history, the resultants called for by the prescription. It measures and records:

True power of the lens as worn  
Spherical power  
Cylindrical power  
Axis of cylinder  
Diopter  
Reading power of Bifocal lenses

Think of the wearer's sense of security when he sees your statement:

"We supply your prescriptions on a Wellsworth Lensometer."

The Lensometer is exclusively a Wellsworth product. Write the Scientific Instrument Division to send you more detailed information.

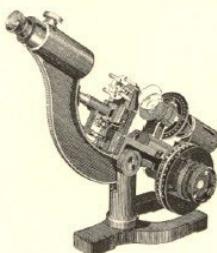


*Wellsworth again contributes to Ophthalmic Science*

## The Invention, from a 1921 Publication

By instantaneous adjustment the lens and frame enclosing the lens may be projected into the instrument's field of view upon the cross lines, to the end that the mechanical positioning of the lens is optically determined as well as the refractive properties of the lens itself.

The development of the Wellsworth Lensometer has been a difficult and painstaking task covering a period of ten years. It has passed through three stages, engaging the efforts of a staff under the direction of Mr. E. D. Tillyer, formerly of the U. S. Naval Observatory and Bureau of Standards, during the final five-year period. To Mr. Tillyer, now a member of Wellsworth Research Division, must be given the credit of discovering the method for making a lens register microscopically all its refractive qualities and for inventing a means of recording its qualities automatically, speedily and with precision.



© Carl Zeiss

## What Was Done before the Lensometer?

It is difficult today to appreciate the impact of the Lensometer almost a century after its introduction into optical offices. Prior to the Lensometer, optical professionals had no practical method to check if custom-made lenses produced to an individual prescription were of the proper power. Trial lens sets and other refraction methods preceded the Lensometer in opticians' offices, but verification of prescriptions using them was difficult.

The pre-Lensometer approach was trial and error. Patients tried various power lenses, much like what is done for reading glasses at the pharmacy today. This did not work well with non spherical lenses and, of course, gave less than ideal correction. Very early, glasses were even dispensed by age category, which again, resulted in a compromised correction for patients.

## Pre-Lensometer Trial and Error Eyeglass Selection



© Carl Zeiss

Promising much, giving relatively little, the itinerant Spectacle Peddler plied his trade in the early nineties. Today his wiles and guiles are only a legend.

American Optical Advertisement – 1940 Herbert Stoops painting depicted pre – Lensometer eyeglass fitting by Peddler in the 1890s.

### Importance of the AO Calibration Lens Set to the Lensometer

An important part of the development of the Lensometer was the addition of Edmund Tillyer to AO's staff. Tillyer had produced a complete set of accurate, standardized lenses for the National Bureau of Standards (NBS) that could be used to check the accuracy of any lens manufactured or distributed. The NBS calibration lenses in the Optical Heritage Museum collection are the only extant set known. AO hired Tillyer because of the expertise he had developed in producing the calibration lenses, and Tillyer would, in turn, use his standardized lenses to calibrate the focimeter, which AO trademarked as the Lensometer and began marketing to optical dispensaries on a large scale in 1921.

## National Bureau of Standards Calibration Lenses



AO Vision Magazine – March 1938 Publication



This is the AO primary true-power lens set calibrated by Edmund Tillyer when he worked at the National Bureau of standards prior to joining AO.

Each lens was measured for its refractive index. The lens curves were measured and then the resulting power calculated. Two lenses were re-certified in 1977 and had not changed. It is this set by which all AO Lensometers were originally calibrated.

## **Influence / Use Today**

The 1921 Wellsworth Lensometer in the Optical Museum's collections is the earliest known example of the first focimeter made commercially available on a wide scale to ophthalmologists and opticians. It quickly became a common fixture in optical offices across the country. AO's success encouraged other companies to develop and market focimeters of their own.

In 2008, the Vision Council Lens Technical Committee undertook a study of the accuracy of commonly used devices for measuring lenses available on the market today. Interestingly, they found that modern commercial lensometers are no more accurate than the Wellsworth Lensometer introduced commercially 100 years ago.

## **The Optical Heritage Museum**

The history and many technical achievements of AO (founded in 1833) are showcased in the Optical Heritage Museum in Southbridge, Massachusetts, the city where AO originated. Among the museum's extensive holdings are not only the landmark 1921 Wellsworth Lensometer, the first widely used focimeter, but also the laboratory prototypes that preceded it and the improved models that followed. In 2006, AO was incorporated into the larger Carl Zeiss organization, and, today, Zeiss is the primary sponsor of the Optical Heritage Museum

Zeiss is one of the world's leading technology companies. It has a balanced portfolio that is geared toward attractive, future-oriented markets in optics, precision mechanics, and optoelectronics. For more than 170 years, Zeiss has been shaping technological progress, advancing the world of optics, and responding to its customers' requirements.

## **Further Reading**

Douglas A. Kerr, "The Focimeter—Measuring Eyeglass Lenses," *The Pumpkin*, Issue 5 (May 24, 2016): 1-34 (<http://dougkerr.net/Pumpkin/articles/Focimeter.pdf>, accessed August 9, 2019).

H. H. Styll, "History American Optical Company," typescript, December 1945 (<http://opticalheritagemuseum.org/pdfs/1945Dec4%20HistoryAOC%20Compiled%20By%20H.H.%20Styll.pdf>, accessed Aug. 28, 2019).

Charles Sheard and Edgar Tillyer, "The Lensometer, an Instrument for the Measurement of the Effective or Vertex Power of Ophthalmic Lenses," *Journal of the Optical Society of America*, 6 (Dec. 1922): 1030-1039.

## THE HISTORY AND HERITAGE PROGRAM OF ASME

Since the invention of the wheel, mechanical innovation has critically influenced the development of civilization and industry as well as public welfare, safety and comfort. Through its History and Heritage program, the American Society of Mechanical Engineers (ASME) encourages public understanding of mechanical engineering, fosters the preservation of this heritage and helps engineers become more involved in all aspects of history.

In 1971 ASME formed a History and Heritage Committee composed of mechanical engineers and historians of technology. This Committee is charged with examining, recording and acknowledging mechanical engineering achievements of particular significance. For further information, please visit <http://www.asme.org>.

### LANDMARK DESIGNATIONS

There are many aspects of ASME's History and Heritage activities, one of which is the landmarks program. Since the History and Heritage Program began, 276 artifacts have been designated throughout the world as historic mechanical engineering landmarks, heritage collections or heritage sites. Each represents a progressive step in the evolution of mechanical engineering and its significance to society in general.

The Landmarks Program illuminates our technological heritage and encourages the preservation of historically important works. It provides an annotated roster for engineers, students, educators, historians and travelers. It also provides reminders of where we have been and where we are going along the divergent paths of discovery.

---

ASME helps the global engineering community develop solutions to real world challenges. ASME, founded in 1880, is a not-for-profit professional organization that enables collaboration, knowledge sharing and skill development across all engineering disciplines, while promoting the vital role of the engineer in society. ASME codes and standards, publications, conferences, continuing education and professional development programs provide a foundation for advancing technical knowledge and a safer world.

### ASME OFFICERS

Bryan A. Erler, P.E., President

Thomas Costabile, P.E., Executive Director / CEO

## **ASME HISTORY AND HERITAGE COMMITTEE**

Herman H. Viegas, P.E, Chair  
Terry S. Reynolds, Vice Chair  
Lee S. Langston, Secretary  
Marco Ceccarelli  
Thomas H. Fehring, P.E., Immediate Past Chair  
Richard I. Pawliger, P.E., (Ret) Past Chair  
Robert T. Simmons, P.E., Past President

### Corresponding Members

John K. Brown  
Marco Ceccarelli  
Scott Davidson, P.E. (Ret.)  
Michael Iden  
Martin C. Ross  
Virginia Ross  
Steven Walton  
Robert O. Woods, P.E. (Ret.)

### Emeritus Members

J. Lawrence Lee, P.E  
Robert Vogel

## **ASME STAFF**

Mel Torre, manager, Corporate Communications  
Wil Haywood, Communications Specialist

## **ASME Worcester Section**

Dan P. Smith, PE, Chair  
William Medeiros, Nominator  
Kushi Sellahennedige, Researcher  
Eric Wilhelm, Researcher

## **OPTICAL Heritage Museum**

Dick Whitney, Carl Zeiss Vision, Manager, Industry Standards Customer Enablement