# HISTORICAL NOTICE.

## Early Mention of Areometers.

Compiled by A. Bourgougnon.

Towards the end of the fourth and the beginning of the fifth centuries of the Christian era a celebrated woman, Hypatia, born in the year 370, taught the doctrines of Neoplatonism in the school of Alexandria. She died in 415, massacred by the fanatic followers of St. Cyrille.

To Hypatia the invention of areometers has been attributed. As her writings were destroyed with the burning of the library of Alexandria, this assumption is based upon a letter which she wrote to one of her pupils, Synesius, a Greek writer, who afterwards became bishop of Ptolemais, in 410, and died in 431.

The letter of Hypatia has been translated by F. Hoefer, and is found in his *Histoire de la Physique et de la Chimie, Paris, 1872.* It reads as follows :

" I am so ill that I need an hydroscope. I wish that you would " have one made in copper for me. It is a pipe of a cylin- " drical form, having the shape and the length of a whistle. On " its length it carries a straight line cut across by several small divis- " ions by which we can tell the weight of the waters. At the end is " a cone having the same base as the cylinder. This instrument is " called *Baryllion.* When placed in water by the pointed end it " stands perpendicularly ; the divisions cutting the longitudinal " line can be counted, and therefore the density of the water " be known." *

None of the commentators of the letters of Synesius could give an explanation of this instrument.

Benoit Castelli (born at Brescia in 1577, died at Rome, 1644) consulted the celebrated Fermat on this subject.

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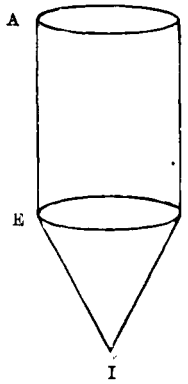
* Synesius. Epist: XV.

The following is the explanation of the great mathematician, as reported by Castelli in his *Traité de la Mesure des eaux Courantes*,† and found also in Fermat, *Opera Varia*:‡

"This instrument recorded the density of waters to be used by "sick persons, the physicians having observed that the lighter "were the best; the expression ροπη (weight) employed by Sy- "nesius shows it clearly. This word does not mean here *libra-* "*mentum*, as was thought by P. Petau, but weight or density, "called by the Latins *momentum*. As the balance could not give "exactly the difference of weight or the density of waters, the "mathematicians invented, according to the principle of Archi- "medes (*De his quæ vehuntur in aqua*), the instrument described "in the letter of Hypatia. The following is its figure :




A F is a copper cylinder. A B the upper part, always open. E F, the lower part, closed by the cone E I F, having the same base as the cylinder. A E and B F are two straight lines cut by several small divisions. If the instrument is placed in water, point down, and adjusted so as to stand in an erect position, it will sink to a certain point, which will be marked by one of the transverse lines, and it will sink differently in different waters, as will be easy to demonstrate."

Prior to Hypatia, Rhemnius Palemon, a Roman grammarian, contemporary of Tiberius, had given in his poem, *De ponderibus et mensuris*, a very detailed description of areometers and the rules to be followed in their construction.

This author attributed their invention to Archimedes.

The description of Palemon is as follows : ‖

"Ducitur argento, tenuive ex aere cylindrus,
"Quantum inter nodos fragilis producit arundo.

† Rome, 1628.
‡ Toulouse, 1679.
‖ Leyden, 1587.

" Cui cono interius modico pars ima gravatur,
" Ne totus sedeat, totnisve supernatet undis
" . . . . Hoc cujusque potes pondus spectare liquoris
" Nam si tenuit erit, majori immergatur unda ;
" Sin gravior, plures modulos super esse notabis," etc.

And reads thus :

A very thin cylinder of silver or copper is made, having its length equal to the distance separating the knots of a frail reed ; its lower part is so loaded with a small, cone-shaped weight as to prevent it from sinking entirely or floating horizontally. With this instrument the weight of a liquid can be known; if it is light, a large part of the cylinder is immersed; if it is heavy, a greater number of divisions are observed above the liquid.

The physicists of the Eighteenth Century, Fahrenheit, Nicholson, Baumé, must have employed these directions to construct their areometers, although they did not give their origin.