

## Note

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### A NINETEENTH CENTURY THERMOBALANCE

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In the middle of the nineteenth century “thermobalances” were used in France for commercial purposes. With these balances, the change in weight of a sample arising from controlled heating could be measured. The purpose of this heating was to determine the dry weight of textiles, especially that of precious silk. The unspun silk delivered for sale normally contained approximately 10% water, but this percentage could be much higher after transport by ship. In order to determine the net weight of the silk, samples were taken from the bales of silk and dried in the “thermobalance”.

Such devices were probably used in the 1850's in several European cities which were trade centers for silk. The “thermobalances” described here were employed in Marseille. However, the written records evaluated here apply partially to Lyons. The following report is based on incomplete research in the archives of the Marseille Chamber of Commerce and on oral communications with employees of this institution, whom we thank for their cooperation. The construction and mode of operation of the devices have changed during the course of the approximately 100 years they have been in use, as has the measurement procedure. Since these changes have not normally been documented, certain questions concerning the construction and operation of the first “thermobalances” could not be answered definitively.

#### THE THERMOBALANCE

From Lyons, it has been reported [1] that the drying of silk samples prior to 1854 took place in a container surrounded by a stream of hot air at a constant temperature (Fig. 1). Drying by means of this indirect sample heating (according to Talabot) took about 4 h. Persoz proposed in 1852 a direct stream of the hot air over the sample (Fig. 2), whereby the drying time was shortened to about 30 min. In 1853, the Chamber of Commerce in Lyons ordered two dozen devices functioning upon this principle from the Rogeat company in Lyons. Identical appliances (dessicateur Talabot—Persoz—Rogeat) were obtained and put into use by the Chamber of Commerce in Marseille, probably in 1858–1859, since an ordinance dated July 4, 1859 [2] prescribes their use. Figure 3 shows such a thermobalance. The dimensions of the apparatus were total height 170 cm, height of the “furnace” 117 cm, greatest diameter about 70 cm, diameter of the drying com-

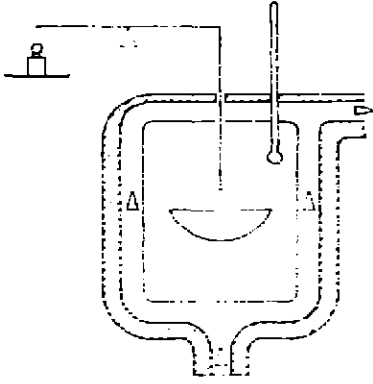


Fig. 1. Drying of textile samples prior to 1854 in a nearly closed container (according to Talabot).

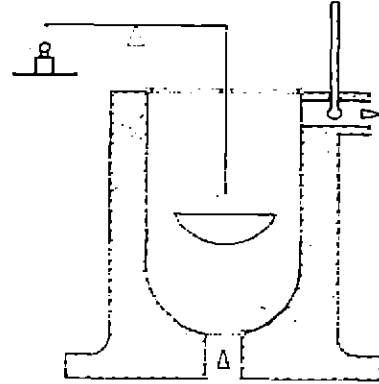


Fig. 2. Drying of textile samples by a direct flow of hot air around the sample (according to Persoz).

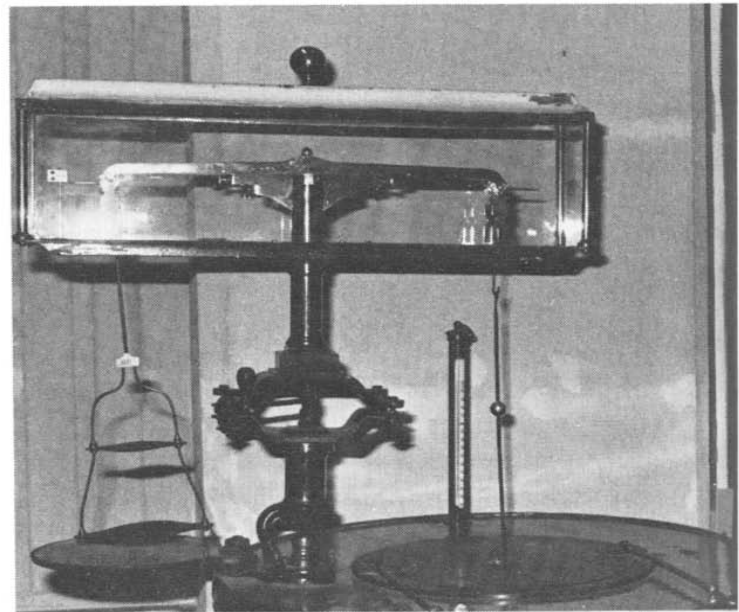
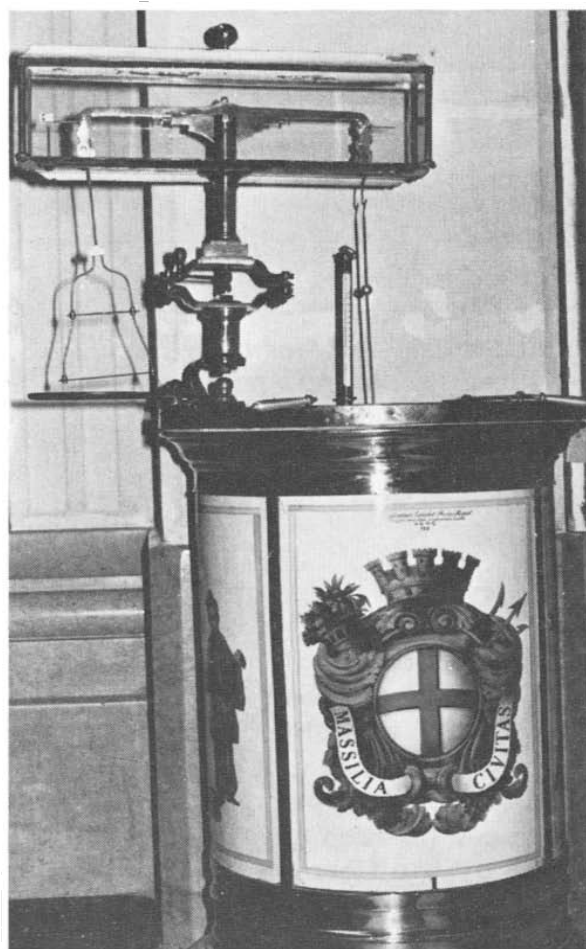


Fig. 3. (A) Thermobalance for drying of textile samples (dessicateur Talabot—Persoz—Rogeat). (B) Balance equipment.

partment about 40 cm, and the height of the latter about 80 cm.

The method of heating the thermobalances was changed during the period of their use. At first, all devices were supplied with hot air by one central furnace. The exact adjustment of the drying temperature presumably took place by means of a throttle-valve in the hot air feed pipes. The temperature was verified randomly by the Chamber of Commerce. Later, each thermobalance was equipped with its own electrical heating system [3].

#### SAMPLE EXTRACTION AND MEASURING PROCEDURE

The details of sample extraction, drying and calculation of the net weight of the silk were prescribed by law [2]. The moist silk bales were weighed exactly and samples were taken at 30 different places and then combined into three samples of no more than 550 g each. These three samples were weighed immediately within a tolerance of 0.01 g. Two of the samples were then dried; the third was held in reserve. For drying, the sample was put into the thermobalance in a wire basket where, after taring, drying was begun at a temperature of 135°C. It is probable that the sample was tared several times during drying in order to determine the end of the process. For this purpose, the hot air supply had to be interrupted for a short time. After drying, the final weighing showed the net weight of the sample. If the measurements of the two samples agreed to within 0.5%, the mean of the two measurements was used to compute the net weight of the silk bale. If there was a difference of between 0.5 and 1.0%, the third sample which had been held in reserve was dried and the mean of the three measurements computed, provided the third measurement did not vary by more than 1.0% from the first two results. If there were differences of more than 1.0%, all three samples had to be dried again in different appliances and the mean then determined was finally valid.

Since it was not possible to produce a given change of temperature with time, these devices are not "thermobalances" as we would understand the term today. Nonetheless, they are an example which shows that the change in weight of samples during the application of heat could be measured accurately 125 years ago. In a wider sense, this was a thermo-gravimetric method which was developed for commercial purposes, whereby the essential details of the measurement procedure were prescribed exactly.

#### REFERENCES

- 1 Procédé Talabot—Persoz—Rogeat, in A. Perret (Ed.), *Monographie de la Condition des Soies de Lyon*, Lyon, 1878.
- 2 *Chambre de Commerce de Marseille, Bureau Public de Conditionnement des Soies à Marseille, Règlement d'Administration et de Service Interieur*, Approuvé par M. le Préfet des Bouches-du-Rhône, le 4 Juillet 1859.
- 3 *La Condition des Soies, Laines et Textiles de Marseille*, in *La Journée Économique*, Marseille, 27 Nov. 1931.