

Account of a self-acting thermometer, adapted for the regulation of temperature / [George Cumming].

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Cumming, George, 1781?-1863.

Publication/Creation

Chester : T. Griffith, 1830.

Persistent URL

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Account of a SELF-ACTING THERMOMETER, adapted for the Regulation of Temperature, whether in Public Institutions, or in Private Dwellings, Manfactories, Conservatories, &c. &c.

BY GEORGE CUMMING, M. D.

HAVING, many years ago, been led to form a favourable estimate of the influence of regulated temperature in the treatment of disease, I naturally became anxious to realize some self-acting instrument for the better effecting my purpose.

In the *Library of Useful Knowledge*, treatise "Thermometer and Pyrometer," there is a description of a "Statistical Thermometer" of my invention in 1808; but the instrument therein described is so inferior to one contrived in 1814, that I am induced to publish an account of the same, in the hopes of seeing it, among other improvements, introduced at the Chester Infirmary.

In favour of the present instrument, I have only to observe, that it is simple, cheap, and efficient, the difference of 1° of heat being fully sufficient to put it into action; and, in point of simplicity and cost of construction, it may be made and fitted up by any clock-maker or other good mechanic, at a charge not exceeding three pounds.

Of the value of "Warm Air," as an agent for the heating of Public Institutions, there cannot be a doubt; and as for the arguments commonly advanced against the introduction of the practice into private life, they may fairly be referred to the want of provision for *permanent ventilation*, the desideratum, in this department of domestic economy, being to secure "change of air," at every degree of temperature, found to be conducive to health and general comfort.

The author, therefore, derives much pleasure in the anticipation that unity of temperature, with *purity of air*, may readily be commanded in any building, room, or apartment, by the instrument which he now has the honour to introduce to the notice of his professional brethren and of men of science in general. Thus it will be found, that when the temperature of the air is *too low*, ventilation will be carried on by drawing the quantity required to keep up *efficient* combustion, in the Stove or Cackle, from the building, room, &c. &c. to be heated; while again, as soon as the Regulating Thermometer shall indicate 60° , or any other pre-determined degree of heat, in what way so ever induced (whether singly by the Stove, or by the united influence of the sun, or of a crowd of people, or of both) the lowest progressive movement of the instrument will serve not only to check the production of heat by the Stove, but farther, allow the escape of the relatively heated air into the atmosphere, till that the declining temperature of the apartment, say by 1° , shall cause a conversion in its action, or in other words, permit combustion (and with it continued ventilation) to proceed as formerly.

With these remarks, the author has only to state that a patent was taken out, by Mr. Kewley, for a "Balance Thermometer," for regulating the temperature of hot-houses, in 1816; and, moreover, that in the *Transactions of the Horticultural Society*, vols. V. and VI. comparatively inferior instruments are described by J. Williams, Esq. and Mr. G. Mugliston, for answering the same purposes. Under these circumstances, therefore, it affords the author particular satisfaction to be able to publish an account of an improved Self-Acting Thermometer under the high sanction of the name of the late Dr. Young:—

London, Welbeck-Street, 12th June, 1824.

SIR,

Upon considering the conditions requisite for the construction of your Thermometrical Register, I find that it is exempted from any material effect of Barometrical changes, whenever the space filled with mercury is equal to the space occupied by the dilated air above it; and, it seems to be likely to be most advantageous that the mercury should occupy about half the height of the tube, which in that case must become a cylinder containing twice as much as the Barometer which counterpoises it.

Dr. Cumming, Chester.

I am, Sir,

Your very obedient Servant,

THOMAS YOUNG.

The investigation stands thus:—Suppose the instrument to be in equilibrium; the height of the mercury in the one tube being 30 inches, and the other x inches: then, if the atmospheric pressure be increased from 30 to $30+p$, in order that it may remain in equilibrium, the additional elevation of the column x must be in the same proportion to the whole as p to 30, and it must become $x+\frac{p}{30}x$. But the pressure of the column of mercury, and the elasticity of the air above it, are always together equal to the height of the Barometer; and, in the first instance, the elasticity must have been $30-x$, in the second $30+p$, $(x+\frac{p}{30}x)$; the difference being $p-\frac{p}{30}x$, which is to $30-x$ as p to 30: and, if the cavity varies in the same proportion, the conditions will be fulfilled. Now, the charge of height being $\frac{p}{30}x$, it is evident that if the content of the cavity, as measured by the length of the same tube, be also x , the variation must be in the required proportion."

DESCRIPTION.

FIGURE 1. FRONT VIEW.—A. Air Thermometer (glass) 34 inches long and 1 inch in diameter. B. Barometer counterpoise to compensate the influence of variations in atmospheric pressure. C. Siphon Cistern for maintaining a level on both sides of the instrument; and it is to be observed, that the portions of the tube which dip into the mercury should be of equal substance, and in cases where philosophical accuracy is required, a correction, by experiment, may be made for the varying immersion of the tubes, produced by the oscillation of the instrument. D. Register Plate. E. Pulley, upon which the moving power A. and its counterpoise are suspended.

FIGURE 2. SECTION.—A. Thermometer. B. Register Plate. C. Pulley. D. Mercurial Cistern. E. Descending Air Flue, for keeping up combustion in the Stove whenever the temperature of the room or apartment falls below the degree to which the instrument is graduated. F. Ascending or regular Ventilating Flue, to be connected if possible with the Smoke Chimney of the Stove, so that when the fire is *damped* this Flue may act with effect; the Under or Fixed Plate of the Register being so divided or counterchanged, as to its openings, that when the upper half is open the lower one is shut, or *vice versa*. G. Horizontal division for giving direction to the process of ventilation, whether carried on by means of combustion or by those of a Metallic Tube placed in the Smoke Chimney. H. Sliding Hand-Register for establishing, in particular cases, a system of *accelerated* ventilation. K. Warm Air Flue; but it need hardly be observed, that the apparatus may be fitted up in different ways, so as to suit the taste and varying views of individuals: when fitted up, however, in the way described, it will form a striking example of *self-adjustment* in the way in which the strength of the fire, in the Air Stove, is regulated.

That the principle of the Thermometrical Regulator is applicable to the construction of instruments for meteorological purposes, will readily appear. Indeed, finished drawings (including a Barometer) of a Thermometer, Hygrometer, Photometer, and Anemometer, capable of registering their own indications by the aid of clock-work, at any given time, have been prepared for publication for several years.

The Hygrometer, however, being at present a favourite instrument with the author,* he avails himself of the opportunity to repeat, that as changes in the "Aqueous Atmosphere" must exercise an influence upon the general economy of nature, "Who is prepared to say that, as a healthy man consumes 130 cubic feet of air daily, the manageable relations of heat and moisture, as indicated by the Hygrometer, might not be beneficially applied to the treatment of disease, as well in private life as in public institutions; or that, were an increased share of attention paid to the study of atmospheric phenomena, the causes, or *constitution of the air*, regulating the rise, type, and progress of disease (a subject deeply involved in obscurity) might not happily be developed?"

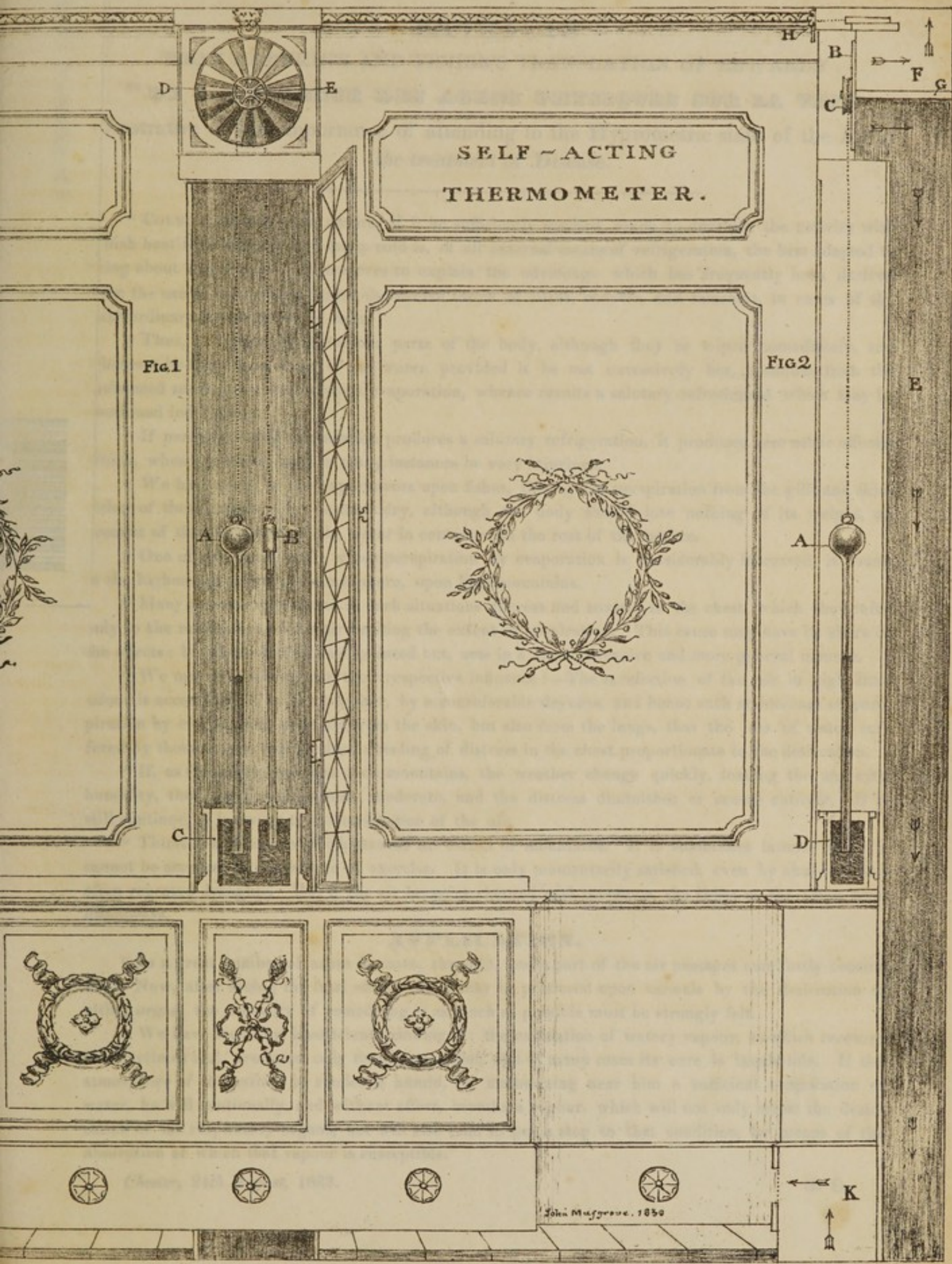
To the Horticulturist a Thermometrical Regulator, after the manner of the above, and Self-Acting Hygrometer, would appear to be invaluable;† and, in reference to the improvement of the former instrument for his purpose, a good mechanic would find little difficulty in communicating to it the power, by the aid of an eccentric pulley moved by clock-work, to give a maximum and minimum degree of heat (say to a range of 30°) to hot-house plants, in strictest analogy to the laws of nature.

To construct a Self-Acting Hygrometer, take two similar Air Thermometers and suspend them in mercury, from the arms of a balance (or pulley on a knife-edged centre), then cover the balls with muslin or fine linen, so that drops of water falling, by capillary attraction, upon *one* of the Thermometers may cause the Balance (in dry air) to preponderate, the difference of temperature produced by evaporation, thus becoming the measure of the dryness of the air, and therefore by connecting the instrument with a lever, for opening a small valve in the bottom of a cistern of water, would allow the same to trickle out upon the floor, &c. of the hot-house as wanted, the instrument being graduated to act whenever the moisture of the air, night or day, shall fall below a *given degree* on the scale of any good Hygrometer; and, as a general rule, it may be observed, that in tropical climates the dew-point seldom falls more than 5° below the temperature of the air, whereas in our hot-houses it will often be found 20° and under: hence the destruction of many valuable plants by the necessity of frequently applying water to their roots to make up for the undue rapidity with which evaporation proceeds, as well from the soil in which they are planted as from the leaves of the plants themselves. "Some idea," observes Mr. Daniel, "may be formed of the prodigiously increased drain upon the functions of a plant, arising from an increase of dryness in the air, from the following consideration. If we suppose the amount of its perspiration, in a given time, to be 57 grains, the temperature of the air being 75°, and the dew-point 70, or the saturation of the air being 849, the amount would be increased to 120 grains in the same time if the dew-point were to remain stationary, and the temperature were to rise to 80°; or, in other words, if the saturation of the air were to fall to 726.

* See Account of a New Hygrometer,—Quarterly Journal of Science, &c. June, 1828.

† See Daniel's Essay on Climate, considered with regard to Horticulture, 1827.

Chester, April, 1830.



SELF-ACTING
THERMOMETER.

FIG. 1

FIG. 2

THE
THERMOMETER



THE
THERMOMETER

