serve as a check on the records of the standard instruments of the Service properly exposed. The kiosk records should also prove useful to the local press, and, as giving actual *street* weather conditions, they should be of considerable utility and of more than passing interest and convenience to the general public.

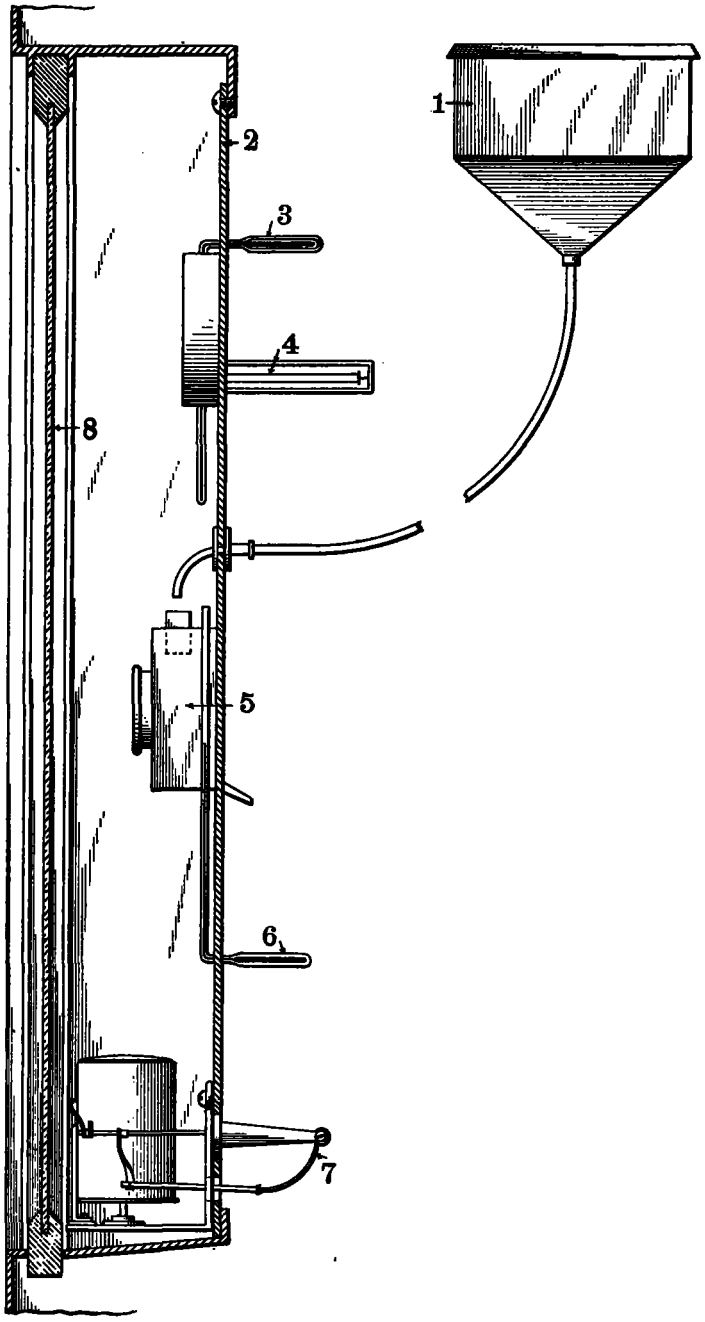

FIG. 2.—Arrangement of instruments in kiosk. Side view. 1. Rain-gage receiver. 2. Iron back plate. 3. Bulb of the Six maximum-minimum thermometer. 4. Frame and hairs of hygrometer. 5. Tipping-bucket dial indicator. 6. Bulb of exposed thermometer. 7. Thermograph bulb. 8. Plate glass in sash.

SUGGESTED REFORMS IN METEOROLOGICAL METHODS.[1]

By M. E. J. GHEURY, F. R. A. S. Dated Eltham, Eng., March 4, 1909.

I understand that discussion is invited concerning Professor McAdie's suggested reforms in meteorological methods. Being a strong supporter of the metric system I would heartily support any reform that would bring this system into use: but, however, in this case, a very careful consideration of meteorological requirements, apart from others, should be undertaken before introducing any special modifications in the present methods of obtaining data as to the various climatologic factors. With this in view I beg to point out a few facts.

Thermometer scales.

While the centigrade scale of temperature is more rational than the Fahrenheit scale, the latter has the advantage that the magnitude of the degree of temperature is small enough to avoid subdivisions for ordinary meteorological purposes, where a greater exactitude suggested by the use of a decimal division of the degree is, to a certain extent, illusory. Decimals can therefore be dropped; and this, together with the fact that the negative sign is only needed in exceptional circumstances or regions, tends to give tabulated temperature data a simplicity which is lacking in similar tables involving the use of the centigrade scale, the magnitude of the degree on the latter being too great not to require subdivisions of some kind (and the most convenient is certainly the decimal).

When such a competent authority as M. G. Eiffel states as desirable the alteration of the centigrade scale so as to have 100° at melting ice and 200° at boiling point, with binary subdivisions, giving therefore almost exactly the degree Fahrenheit as unit and a similar graduation, it would be rash to throw overboard a scale of temperature which has the very advantages found lacking in the rival scale, besides that of being familiar to many. The beautifully simple rule given in the MONTHLY WEATHER REVIEW for 1907, p. 438, which does away with the doubt whether one must or must not add or subtract 32, enables reductions to be performed with such a rapidity and ease as to make the labor of conversion negligible.

Barometer scales.

As to Professor McAdie's proposal to take 760 millimeters as 1,000, the *normal* atmospheric pressure, and to express the height of the barometer as a percentage of this normal pressure, the obvious objection is that this normal pressure is only approximate, and may be altered when a more extensive study of the pressure over the whole globe shall be made. As a matter of fact each place has its own mean barometric pressure, and to adopt as standard a general normal pressure may be very misleading. Professor McAdie has evidently overlooked the existence of regions of *permanent* high and low pressures on the globe, for which such a notation would be very objectionable since it is based on an average barometric height which may be, for such a region, quite abnormal instead of normal.

I remember that in 1897, being south of Cape Horn, with an exceedingly low glass, we remained hove to for three days, waiting for a gale that never came. Had the pressure been expressed by 976, say, or 24 below normal, our captain would have had an excellent excuse for what was otherwise misplaced caution, as the weather was beautiful and my isobaric chart for the season showed that the low pressure was but slightly below the normal.

Moreover, we not only can not say for certain that the average barometric pressure taken all over the globe is 760 millimeters, but we can not say that it is constant and that it has been always at that point or will remain always so. We would have, by taking 760 millimeters, this very great evil of a fluctuating datum mark in our scale of barometric pressure.

The general public, in my opinion, if it does not realize the exact physical meaning of the barometric height, knows pretty well the general inference to draw from a rise or fall. I have had often to answer the inquiries of cultivators (who could have hardly made a correct inquiry by writing!) as to the behavior of my barometer during hay-making time. This, I consider, is a far more important notion, since we know that an

[1] See Monthly Weather Review, November, 1908, 36: 372–374.

isolated barometric observation, whether above or below the normal, *has no value whatever* and becomes useful only when taken in reference to others.

As a last and quite secondary remark, may I point out that the example of reduction of wind velocity selected by Professor McAdie could not be more unfortunately chosen. Every one who has to deal with velocities of that order knows that 60 miles per hour is equivalent to 88 feet per second, and it does not require any time or labor to see that 6 miles per hour is 8.8 feet per second. I am no expert and very poor at mental arithmetic, yet I can, in the twinkling of an eye, reduce the decimal to inches and decimals without pencil and paper, since (to illustrate the mental process followed),

$$\frac{8}{10} \text{ feet} = \frac{8\times 12}{10} \text{ inches} = \frac{96}{10} \text{ inches, or 9.6 inches,}$$

so that the speed is 8 feet 9.6 inches per second; but 8.8 feet is much preferable. Of course it is easy to select cases where this reduction is not so readily made. I think the chief objection to stating the velocity of wind in miles per hour, at any rate when the wind pressure is concerned, is that the latter being expressed in pounds per square foot, the same expression contains *two different* units of length, namely, the foot and the mile, being therefore irrational.

ADOPT THE KELVIN THERMOMETER SCALE AND THE METRIC SYSTEM.

By HENRY HELM CLAYTON. Dated Blue Hill, Mass., February 12, 1909.

I have read with interest the suggestions made by Prof. A. G. McAdie in the MONTHLY WEATHER REVIEW for November, 1908, p. 372. I wish very much that our Weather Bureau could see a way to adopt the metric system; but I believe it would be a misfortune if it should also adopt with it the centigrade thermometer scale. This scale is poorly adapted to meteorological work. In our climate [New England] nearly half the readings would be above and half below 0° C. This would be a constant source of confusion and mistakes. Each time the temperature fell below zero the observer would need to invert his method of reading. The normal method of estimating subdivisions in a vertical scale is to read the whole number on the scale and estimate the tenths upward. Thus if the thermometer reads 1.2° below zero the tendency is to read the 2° on the scale [next below the top of the mercury column] and estimate the tenths upward [to the top of the mercury column], thus making the reading —2.8° instead of —1.2° as it should be in reading downward. My experience convinces me that mistakes of this kind are not uncommon. Again it is confusing and a source of error to have two sets of values only distinguishable from each other by the presence or absence of a minus sign.

It is not uncommon to see in newspapers where matter must be printed hurriedly, and even sometimes in books, a temperature given without the minus sign. Thus a temperature of fifteen degrees below zero may be printed as 15° without the minus sign, hence, giving an entirely erroneous idea of its value. With the adoption of the centigrade scale the Bureau would need to be constantly on its guard against such errors. Again with half the values in a column of figures plus and half minus the addition for the purpose of obtaining means is very troublesome and would undoubtedly increase the time and cost of the work.

Hence I am led to renew a suggestion which I made ten years ago in Nature[1] namely that when the metric system comes into use by the English-speaking peoples, as it must in time, the Kelvin thermometer scale be adopted with it instead of the centigrade scale.

In the Kelvin scale the freezing point of water is 273° and the boiling point is 373°. It is a scale based on well-ascertained physical phenomena such as the rate of expansion of gases, the conductivity of metals, etc. It is a scale which enters into many of the mathematical formulas used in meteorology and it is a scale which is coming more and more into use for recording very low temperatures such as the freezing points of air and of hydrogen. So that if the centigrade scale were adopted there would still be two scales in use.

The only serious objection that I can see to the adoption of the Kelvin thermometric scale, is the increased number of figures required in recording and printing meteorological observations. But this is not so great as it appears. Printed columns of figures in degrees centigrade must, as a rule, reserve room for the printing of three figures to the left of the decimal point. It takes as much time and room to write —15° C. as it does to write the equivalent 258° K.

The adoption of the Kelvin scale with the metric system has already been recommended by a committee of the British Association (June, 1904) and if it should be adopted by the U. S. Weather Bureau either alone or in agreement with the English Meteorological Office, it would undoubtedly come into general use and become a universal scale, forever free from the troublesome below zero values.

[1] Nature, September 21, 1899, 60:491.

EXPRESS ALL BAROMETRIC MEASUREMENTS BY ORDINARY GENERAL UNITS OF FORCE.[1]

By Prof. Dr. W. KOEPPEN, Hamburg. Dated February 7, 1909.

[Translated by C. ABBE, jr., April, 1909.]

In the MONTHLY WEATHER REVIEW for November, 1908, Prof. A. G. McAdie, the well-known official in charge of the California Section of the U. S. Weather Service, makes a very noteworthy proposal. He recommends that the Weather Bureau should, as soon as possible, adopt the centigrade (not Celsius) scale and the metric system in measuring temperature, wind, rain, and snow; but he goes further and suggests that the Bureau should cut loose from the accident of the employment of mercury in the barometer and adopt as unity the mean standard pressure of 760 mm.=29.92 inches, calling it 1,000 for convenience sake.

The unification of the measures and scales of the meteorological world, through the adoption of the metric and centigrade systems by England and America, as suggested by Professor McAdie, is an advance most heartily to be desired. So extensive an observing system can not, however, be expected to change its present scales until persuaded of the perfect fitness and adaptation of that which is to be substituted. And it is not to be denied that our mode of expressing air pressure is still deficient in these lines.

Professor McAdie's proposal to adopt the pressure of 760 millimeters (which is already used in this sense as "one atmosphere") as the unit in all pressure measurements, would indeed bring about an undeniable advance were it not that this particular "normal pressure" or "Normaldruck" is a wholly conventional value. As is well known, the average barometric pressure even at sea level is very different for different places. Even this adopted value of 760 millimeters is only related to the metric system through a new quantity, the density of mercury. If this latter be eliminated, then the value 760 millimeters signifies a pressure of 1033.291 grams on 1 square centimeter if the gram is regarded as a unit of force. Physicists, however, recognize that it is more rational to conceive of the gram as a unit of mass, rather than a unit of force, and to take as unit of force the product gram × acceleration of gravity, i. e., value of 980.65 centimeters which is for latitude 45° at sea level. Thus a barometric reading of 760 millimeters, under normal gravity, corresponds in the C. G. S. system to 1,013,303 units. One

[1] Published simultaneously in Met. Zeitschr., May, 1909, 26:198–201.