SCIENCE:

A Weekly Record of Scientific Progress.

JOHN MICHELS, Editor.

TERMS:

Per Year,	Four Dollars
6 Months,	Two "
3 "	One "
Single Copies,	Ten Cents.

Published at

TRIBUNE BUILDING, NEW YORK.

P. O. Box 3838.

London, England, - - - - 150 Leadenhall St.

SATURDAY, JANUARY 21, 1882.

STANDARD TIME.

At present there are said to be more than seventy distinct "railroad times" in the United States; in some single cities there are as many as four, differing from each other by amounts varying from five to twenty minutes. This state of things of course involves confusion and inconvenience to travellers, and all Americans travel. In some cases it has been the cause of serious disasters.

It is beyond doubt, then, that there would be great advantages in a uniform standard of time for the whole country. Can they be secured without too much counterbalancing inconvenience and expense? We believe they can, and without any very great difficulty.

A *single* standard for the United States (and still more, for the whole world), while in many respects highly desirable, would be exposed to the fatal objection that it would bear no relation to the true local time determined by the Sun's position. Now this local time is what we must necessarily live by. Nature compels us to work by day and sleep by night; to rise in the morning and retire at evening. A time-standard which does not recognize this cannot be practically convenient, and will never be adopted. Suppose, for instance, that Washington time were made the standard for the country; at San Francisco every thing would be three hours out of joint; and though undoubtedly, such good people as live there, and always stay at home, could, after a while, become accustomed to having noon come at 3 o'clock by their watches, and other things to match; yet there would probably be some grumbling first. Changes so radical are always hard to accomplish. But, what is worse, whenever the San Franciscan journeyed, or changed his residence, he would have to unlearn all his time-relations, and begin again.

In fact, if a uniform time-standard were adopted over the whole world, all allusions to the time of day in literature now existing, such statements of the hour as are involved in almost every accurate description of an event, would become unintelligible except by a process of translation.

The late Professor Pierce proposed a plan, which, while securing most of the advantages of the uniform standard, avoids its worst difficulties. It is to adopt, not *one* standard for the country, but a series of standard, (*four* would be needed) agreeing exactly in their minutes and seconds, but differing by entire hours. We should then have Atlantic time, Mississippi time, Mountain time, and Pacific time. Since the minutes and seconds would be everywhere the same, telegraphic signals from a correct clock would be directly available for regulating the time wherever received; the difference of one or more entire hours could never cause confusion. And yet the standard time at any place need never differ more than thirty minutes from the true local time. This amount of difference, though of course in itself undesirable, is not so great as to be intolerable in view of the attendant advantages. We hardly notice the discrepancy of fifteen minutes between sundial and clock, which occurs at certain seasons of the year, in consequence of the Equation of time.

As to the time to be chosen for the standard of minutes and seconds, unfortunately there is not yet an agreement among our astronomers. Naturally enough many think it should be Washington time, just as in England, Greenwich time is used. So far as landsmen are concerned it is really a matter of almost no importance what time is selected, but with the shipping interest it is different. Almost all nations use Greenwich time on the ocean; and for this reason it would probably be best to lay aside national prejudice, and make our Atlantic time differ from Greenwich time by just five hours; this would agree with the correct local time for a meridian passing between New York and Philadelphia. The meridian of Mississippi time (six hours from Greenwich) would then pass between Chicago and St. Louis, that of mountain time would run near Denver, and the Pacific meridian near San Francisco.

The meridian theoretically dividing Atlantic from Mississippi time would nearly bisect the State of Ohio. In a case of this sort the legislature would be likely to adopt one or the other of the two times as the standard over the whole State; so that in practice the boundaries between the standards would probably follow State lines.

The establishment of some such system need not be very difficult or long delayed.

The Signal Service proposes to receive by telegraph, from such observatories as choose to co-operate, their respective time-determinations; to combine them, and then to transmit the resulting standard-time daily to every important place in the country; besides this, at every port they would drop a time-ball, at some exact hour of Greenwich time, so that navigators would be able to rate their chronometers.

At present we have a number of more or less extensive and accurate time-services run by different observatories. But the signals sent out are more or less discordant, not unfrequently to the extent of one or two entire seconds, for the simple reason that no clock can be depended on for any length of time unchecked by star observations; and such observations are sometimes prevented by cloudy weather for several days together. Since it would seldom happen that the observatories in widely different parts of the country would all have bad weather at once, the Signal Service plan would obviate the difficulty. The most serious objection to the proposal seems really to be that the observatories which now distribute time would lose the revenue they derive from the work, unless, indeed, as would be only fair, the Signal service should continue to pay them for their observations the same compensation they now receive.

If the Signal Service can obtain from Congress the small appropriation they ask for ($25,000) to carry out their plan, and if the railroad, steamboat and telegraph companies will adopt the standard time and use it *exclusively* in their business advertisements, the thing is done. The community will follow suit and hardly notice the change. C. A. YOUNG.

PRINCETON, N. J.

THE NEW YORK ACADEMY OF SCIENCES.

December 19, 1881.

SECTION OF PHYSICS.

Vice-president, Dr. B. N. MARTIN, in the Chair.

Thirty persons present.

A specimen of acicular hornblende in quartz was exhibited by MR. W. L. CHAMBERLAIN.

The following paper was read by Prof. W. P. TROWBRIDGE:

ON THE DETERMINATION OF THE HEATING SURFACE REQUIRED IN STEAM PIPES EMPLOYED TO PRODUCE ANY REQUIRED DISCHARGE OF AIR THROUGH VENTILATING CHIMNEYS.

To ventilate a room properly requires the frequent removal of vitiated air and the introduction of fresh or pure air, the quantity, by weight, of the air introduced and rejected being equal in a given time.

If the process be continuous, and the proper amount of air be admitted and removed every hour or minute, the only other requirements are that the entering air shall be pure, that it shall be properly warmed in cold weather, either before it enters the room or by the mixture and diffusion of warm and cold air in the room; and that the introduction and removal of air shall take place by gentle or inappreciable currents in such a manner that the pure air may be thoroughly diffused throughout the room before it is removed.

These simple rules are easily stated and comprehended. It is also well understood that to produce a movement of air requires force in proportion to the mass moved and the velocity imparted to it.

The problems which arise in ventilation consist mainly in determining the position, arrangement and sizes of the passages through which the air enters and leaves, and the proper adaptation of these passages to the forces which produce the movement.

On the correct solution of these problems, too often misapplied or misunderstood, successful ventilation depends.

The various modes of producing the movement of air for ventilation are:

First.—Ventilating chimneys or flues in which the movement is caused by the difference in weight between the heated air in the flue and the cooler air outside. This requires that the air before entering the flue shall be warmed, and the heat necessary may be that due to the heat of the room when fires are necessary for warmth; or the heat may be imparted by stoves in the base of the flues, by gas jets, or by steam heated pipes.

Second.—The movement may be produced by fans or blowers or by steam jets—the latter being seldom applied.

The object of this paper is to investigate the laws which govern the ventilation when the air is heated at the base of the flues by steam pipes, the air in its passage to the flue receiving heat by its contact with the exterior surface of the pipes. As far as I am informed these laws have not heretofore been developed, and, as this system is a very simple one, capable of very extended applications, it is hoped that the following analysis may at least lead to a full discussion of the subject:

Let it be supposed that the air in a room is to be renewed at the rate of (W) lbs per second. Suppose also that it is to be rejected through a flue whose cross-section in square feet is (A), and height in feet (H). And that it is to be heated by steam coils whose aggregate exterior surface in square feet is (S)

The following notations will be used:

W. Weight of air removed per second (lbs).
H. Height of flue in feet.
S. Exterior surface of steam pipes (sq. feet).
A. Area of cross-section of flue (or flues).
T_a. Absolute temperature of external air (found by adding to the thermometric temp. Fahr. the number 459.4).
T_c. Absolute temperature of air in the flue.
T_s. Absolute temperature of steam in the pipes.
D_a. Weight in lbs. of a cubic foot of the external air.
D_c. Weight in lbs. of a cubic foot of the flue air.
V^1. The theoretical velocity of the air in the flue.
V. The actual velocity.
r. The rate in units of heat per hour, per square foot of the surface (S) (and for each degree difference between T_s and T_a) at which the air receives heat from the pipes.
k A coefficient of loss of velocity such that $kV=V'$.
p The unbalanced pressure (upward) due to the difference of weight between the column of air in the flue and a corresponding column of external air.

Then,

$$p=H.D_a-H\,D_c \text{ or } p=H\,(D_a-D_c) \qquad (1)$$

This pressure may be represented by the weight of a column of flue air of a height—