In the western wing of the observatory is the transit instrument, built for it by Troughton & Simms, of London, in 1868. It rests on piers formed of single blocks of stone, which repose on foundations built up from the bed rock of the hill. As stable as it is possible to make its supports, the power of such an instrument is so great that the almost inconceivably slight jar induced in one of the great masses on which it rests, by a tap of the fingers, is magnified sufficiently to cause a tremor, through these tons of stone, which is visible when it is directed to a star. To prevent the footsteps of any person moving near it, therefore, from causing a displacement, which, though otherwise quite invisible, would impair the accuracy of its observations, the floor is built so as not to touch the supporting piers.

Every portion of its construction demands the highest class of skilled labor. The axles of such an instrument are required to be as nearly as possible mathematical cylinders of equal size, and are ordinarily turned with a diamond; and a corresponding care is employed in the finish of all its parts. The sidereal clock was built for the observatory by Frodsham, of London, and the mean time clock by Howard, of Boston, whose work does not suffer by the comparison. A chronometer by Frodsham and other instruments are also supplied.

Time from these clocks is now distributed by electricity through Pittsburgh and through nearly all the railroad system of Pennsylvania.

A part of the work done in observatories consists of measurements of extreme accuracy of the positions of the heavenly bodies by means of clocks of unusual exactness, not differing in principle from good "regulators," such as our watchmakers keep for reference, but of a more thorough finish, and proportionally exact performance. The measurements are made by these, together with the transit instrument just described, in whose focus is a series of lines formed by stretching at regular distances threads of the finest cobwebs, and which are illuminated artificially at night; so that when the instrument is directed to the heavens, they appear like black lines drawn over the bright background of the sky, and across which the stars are seen to pass. As the motion of the earth carries these threads steadily and swiftly by from star to star, the *time*, that elapses from the crossing of one of them by the thread to its passage over another, may evidently be made to measure their apparent *distance*, and for such measurements observatories engaged in star investigations will evidently need time of the greatest exactness for their own purposes, quite independently of any wants outside. It is not the least of the practical uses of an observatory that this time can now be applied by electricity to the convenience of the community in regulating public and private clocks, and enhance the public safety by communicating unity and exactness to those of our railways.

The precision, with which such instruments as these described are employed for the purely scientific demands of modern astronomy, is surprising. "Exact to the very second" would be considered as expressing the highest possible accuracy outside of an observatory; but there an error of a far smaller amount in the place of a star would be considered as a gross one. The probable error of the position of the stars measured by clocks in the way already indicated, is, as a matter of fact, within such a limit, and does not in some cases exceed one one-hundredth part of a second of time. Such minute intervals are really as non-existent to all ordinary use as the infinitesimal motions we have spoken of above are to our unaided senses; and many will be disposed to question not only the utility of such minuteness, but its possibility. But not to stop to explain the utility, the possibility can at once be demonstrated: If we follow certain wires which lead from the clocks to the other extremity of the building, we shall find there, among other instruments which we pass without description, one—the chronograph—where each swing of the pendulum is caused to write itself down through electricity, which, with every beat, pulsates along the wire and moves a recording pen above a sheet of paper travelling under it with absolute uniformity, by peculiar and beautiful mechanism. Here the time is measured by the foot like a ribbon, and the space corresponding to the hundredth of a second made visible.

From the mean time clock, go other wires, which pass outside the building to the telegraph connecting it with various points in Pittsburgh and Allegheny, and thence to the stations of the Pennsylvania Central and other roads.

At Altoona, Harrisburg, Philadelphia, Erie and other important stations, are little silvered bells through which the wires pass and are made to connect with the tongue, so as to cause it to ring with a single stroke when the electric current is interrupted at any part of the long circuit of wire which stretches all over the State.

We cannot give an exact explanation which would be clear to any but an electrician, but the general reader will get a good idea of what we want to describe by supposing himself to follow these wires from any distant city up to their end in the clock at the Allegheny observatory. Here they terminate in small plates of gold. These rest in light contact, and will be separated by the slightest motion of a jewel with which they are connected.

This jewel is struck every second by the tooth of a wheel, which, by moving it, pushes apart for an instant the gold points, and interrupts the current. At the instant the current is broken here, it ceases to pass through the distant bells, and so is broken and renewed every second in the day and night at points stretched over more than a thousand miles of road. At certain hours of the day the railroad telegraphs suspend other business to allow the observatory clock to be thus heard, ticking as it were in the furthest corner of the State. Of course every station gets *identically* the same second of time, the hour and minute being distinguished by a simple contrivance.

This system was arranged by Professor Langley, the director of the observatory, after personal examination of those used in Europe; and it somewhat differs from any employed there, chiefly in the direction of a greater simplicity in its details. It is believed to be already (with the exception perhaps of that from Greenwich) the most extended system of control from any observatory *in the world*, and it is apparently only beginning to be used as it will be hereafter.

When it is adopted by the Western roads, there will be *one time* on them from the Atlantic to the Mississippi, in place of the different systems which cause a change of time with every road one rides over. That will be *Pittsburgh* time, if the city sees fit to put the clock on the New City Hall and those of the fire alarm into this great circuit.

Its use at Pittsburgh began some two years ago, in 1869, when Messrs. J. B. McFadden & Co., a well known firm of watchmakers and jewelers in Pittsburgh, applied to the observatory to enable them to obtain by electricity its time for the benefit of their customers, proposing for this purpose to put up a line of telegraph. Such a line was subsequently erected, and for the general benefit of the community, the observatory undertook to supply, upon payment of the proportionate costs incurred, any watchmaker or jeweler in Pittsburgh or the adjacent cities with the time in this manner. The actual costs of the observatory in this matter were not expected to be met by any possible return, it being enabled to do this by the gift, of the special instruments required, from a generous friend who desired to enable it to confer a public benefit.

Observations are taken every fair night throughout the year, with the exception of the Sabbaths, and every pains that interested attention can bestow, to render the system as useful as it is general, is given.

A great many beautiful accessory instruments have been recently built to order for the observatory, by the best European makers.

An honorable exception is to be made in favor of the time distributing apparatus, which was supplied chiefly by Messrs. E. Howard & Co., of Boston.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

To Smoke or not to Smoke.

To the Editor of the Scientific American:

Having read the two articles, published in your most valuable paper, entitled "To Smoke or not to Smoke," and being much interested in the subject, also being encouraged by your willingness to give both sides of a question a fair hearing, I submit this in corroboration of the article published page 375, last volume of your paper.

If the proof in the article just referred to is not sufficient to convince any one that smoking is injurious, let such a person ask, of as many smokers as he can, the effects of smoking upon them; and invariably the answer will be that it hurts them and they wish they had never smoked (the concluding sentence of all smokers), but they have not mind enough to leave it off.

The communication of V. B., published on page 388, in which he would prove smoking to be beneficial rather than detrimental, is ingenious, but, in my estimation, proves but very little in favor of smoking. Now a practical test, in this matter as in all others, is better than the supposition of V. B. that tobacco may be beneficial to man, although it kills a rabbit. because some other poisons fatten animals of one species and kill those of another.

I am a young man who has smoked for several years, and I wish to make known its effects upon me. It has injured my eyesight, and also my memory; and at one time, my nervous system was nearly prostrated. I left off the habit (by the advice of a physician), for several months, and I rapidly gained until I felt quite well. My eyes did not trouble me as before and my weight was much more than ever before; but my appetite was so strong for it, that, no sooner than I found myself well, I again took up the habit, and I gradually fell away in flesh; my eyes began to trouble me again, and my nerves began to shake. I again left it off, and, as before, I gained rapidly. When I saw the communication of V. B., I thought I would give it another trial, the result being the same as previously obtained.

V. B's. article tends to encourage young men in the practice of this habit, and it is to and for the young men that I write. My love for it was such that I have tried every means to prove to myself that it was not injurious to me, and so I caught at the ideas of V. B., taking more rest as advised by him. And the evidence of nearly all the smokers of my acquaintance is substantially the same as here stated. One thing more in reference to V. B. I think his comparison of the practical application of the weed out of place; we cannot arrive at anything definite by comparing two different nations in different countries. There are other reasons more potent to be ascribed for one nation being so much in advance of another. The Germans might be even more powerful than now without the use of tobacco, and the Chinese, in a still worse state; so the test applied to different nations proves nothing. Granted that it was not injurious, it is still useless and expensive, and had better be discouraged in young men than encouraged. V. B. expressed a wish to hear what the laymen say; in this letter he has the evidence of one. I hope you will not reject the evidence of a young man, in case of so much importance to the interests of young men.

E. F. S.

Cheap Method for Oxygen.

To the Editor of the Scientific American:

I think those interested in the production of cheap oxygen will find the following process of obtaining it cheaper than any other heretofore applied means for obtaining it in large quantities, except the German method of getting it by compressing air over water until the latter absorbs the oxygen thereof and drawing it out by means of suction or a vacuum, this being too slow and requiring too cumbersome apparatus for industrial use.

It is well known that certain substances like charcoal, oil of turpentine, etc., have a property of absorbing large quantities of ozone from the atmosphere; (this accounts for the bleaching action of bone black in refining sugars.) My idea is to force the air that has been ozonized by artificial means into a chamber or vessel filled with some such absorbent, giving the air so forced sufficient compression to cause the ozone to penetrate the mass of the absorbent, and, after the absorbing material is sufficiently saturated therewith, to draw it out by an exhaust apparatus, pass it through some caustic alkali, like caustic potash, to remove the remaining nitrogen, as nitrogen in presence of ozone will combine with such alkalies and form nitrates; the remaining ozone is then heated to a sufficient temperature to reconvert it into oxygen, and the process is through; the only thing remaining is to collect it in a receiver.

Naphtha exposed to ozone under pressure will become oxidised to such a density that it can be made perfectly safe for burning in lamps, even safer than the adulterated kerosene sold in the shops.

New York city. C. F. DUNDERDALE.

Remarkable Explosion.

To the Editor of the Scientific American:

On the 22d Dec., while employed in making tools in the establishment of Mr. Perkins, in Norwalk, Ohio, I met with an accident of so singular a character as to excite the most lively curiosity as to its cause.

I was about to temper a common reamer or rimer, by plunging it into sulphuric acid. The moment the heated steel came in contact with the acid, an explosion took place, throwing the acid in all directions, accompanied by a report equal to that made by a well loaded shot gun. The acid was thrown against the ceiling, about sixteen feet high, and over my clothing, face, and left arm, causing very painful sores, and threatening me with a loss of eyesight. The vessel containing the acid was a wide mouthed crockery jar, and there was about two gallons in it at the time. The jar was not broken, but the reamer was blown away from me, and was found much sprung, or twisted. I have used this acid very frequently, and have seen many others use it for tempering purposes; but this is the first instance, that I have ever heard of, of an explosion occurring. Indeed, the same lot of acid was afterwards used for tempering, without any indication of a blow up.

I send you this imperfect description of the occurrence, hoping that some of your correspondents will explain the mystery. So many persons are using this acid for tempering steel, that any danger attending its use should be pointed out and understood. The lucky escape I had, from being made blind for life, prompts me to ask you to call attention to this point in your widely circulated and eagerly read columns.

Norwalk, Ohio. GEORGE A. STANBERY.

[We think a possible cause for the explosion may have been the generation of hydrogen during the oxidization of some metallic fragments, introduced into the tempering pot through accident or design. This gas, mixed in the proper proportions with the air above the acid, would form a violently explosive mixture.—EDS.]

Photo-Mechanical Printing Process.

Captain Waterhouse, Assistant Surveyor General of India, describes in the *Photographic News*, Vol. XV. p. 556, a very simple method, of printing with ordinary printing ink from gelatin plates, that he has recently invented. He dissolves one ounce of gelatin in six ounces of hot water; then dissolves ten grains of tannin and thirty grains of soap, each in one ounce of water; mixes the two together, and adds them to the hot gelatin solution, very gradually, stirring all the time. The whole solution is then filtered through a coarse cloth into a jug, and, while still hot, is poured over the glass plates to be used. When the film of gelatin is quite set, the plates are turned upside down to dry. They are sensitized by being left for five minutes in a bath consisting of one ounce bichromate of potassa to twenty ounces of water. When dry, they are ready to be placed under a reversed negative. The time of exposure varies, from five minutes for clear line subjects to half an hour, or even longer if the negatives are very intense. Experience alone can decide. The back of the plate is next exposed to the sun for a few minutes to harden the gelatin, and it is then put in a dish of clear water, and washed till the whole of the bichromate is removed. The water is wiped off, and the plate is at once ready for printing from. After the plate is inked in, the superfluous ink is removed with a damp cloth, the paper is laid on, and pulled through the press in the ordinary way.

MR. WILLIAM SANDERSON, C.E., is engaged at present in making experiments with the object of trying how far it would be possible to utilise water power on the Himalaya Mountains in connection with the light mountain tramways.

THERE is no rule of health more important than "keep the feet dry and warm, and the head cool." An old story, but worthy of being often repeated.