and for churches, workshops, theaters, and other spacious rooms, there is perhaps no mode of illumination better adapted than the new light. And, since the flame, when directed upon a solid, earthy body, it produces an emission of luminous, instead of caloric rays the objection that it would heat, the room in which it is burned, fails to the ground. But, in another point of view, the new light is far preferable to any other form of artificial light—we mean in regard to health. According to experiments recently undertaken by Dr. Zoch, in Germany, the quantity of carbonic acid produced by a common gas flame in a room of the capacity of 2,540 cubic feet, may rise to the proportion of three parts to the thousand—a quantity generally supposed to be possible only in hospitals, prisons, and garrisons; and what shall be said when it is considered that, in an ordinary parlor as many as three burners are kept constantly lighted for five and six hours and with an inferior quality of gas at that? With respect to the oxy-hydric light, since the product of combustion is simply watery vapor, no vitiation of the air can possibly take place.

As regards the application of oxygen for the production of heat, it may be stated that hydrogen, when being inflamed with oxygen, generates the highest heating effect known, with the exception of that of the electric discharge. This is due to the rapidity of the combination of these gases. Some years ago, by the construction of a close furnace of lime, and the use of the oxy-hydrogen blowpipe, MM. Deville and Debray were able, not only to volatilize many of the supposed fixed impurities in commercial platinum, but with about forty-three cubic feet of oxygen they have succeeded in melting twenty-five pounds of platinum in less than three quarters of an hour, and casting it into an ingot, in a cake mold. And much larger quantities of platinum have more recently been fused by the same means. According to Brand and Taylor, silica and all metals are fused, and some of them entirely dissipated in vapor by the intense heat produced under these circumstances.

The temperatures of various flames are, according to Prof. Bunsen:

Oxy-hydrogen flame	14,541° Fah.
Hydrogen	5,898° "
Carbonic oxide	5,507° "
Coal gas	4,262° "

There remains no doubt that oxygen will soon play an important part in various branches of metallurgy, and those fully conversant with its properties, predict for it not less conspicuous uses in other branches of art.

"HOW TO OBSERVE THE SUN."

[BY J. N. FARRAR, D.D.S.]

On page 310, current volume, I noticed an article alluding to a former one on page 189, "Storms on the Sun," for the purpose of showing simultaneous "electric disturbances" about our planet, which gives further hints of a simple and good method for obtaining a comparative correctness of statistics of the solar disturbances noticed through a telescope, by means of reflecting them upon a screen. I will quote two paragraphs:

"Believing that a simple means of observing and accurately recording solar phenomena could induce amateurs as well as professionals, to keep such records, I respectfully propose the following method, which I never have heard of being thus used by any one before. Take an astronomical reflecting telescope with a Huyghenian eye piece, into a dark room, direct it on the sun through an aperture, push in the eye piece until it is between the object glass and its principal focus, now place a fine white screen at some distance from the eye piece and focus sharply, a large, clear, well defined, erect image of the sun is thus obtained, which may be enlarged or diminished at will, arrange the aperture, increasing or decreasing the light, until the finest details are visible. The sun can now be examined without darkening glasses, and by several persons at once.

"For uniformity of record I would suggest the adoption of one regular size, say a circle inscribed within one square foot divided into square inches; the space being numbered from right to left, and from top to bottom. The exact position of any disturbance observed could thus be easily ascertained and recorded."

The idea of reflecting solar spots, etc., upon a screen, is excellent but not new. While attending the Elmira Astronomical Observatory, at Elmira, N. Y., during the spring of 1862, and desiring to make some solar observations, this plan was adopted for most of them, but was not original with me. The writer is under the impression that this process is old.

I made a long series of observations on the sun at this time, and with considerable effort made a different sketch of the sun's appearance every day, when the weather would in any way permit, and at exact time. My reflected representation of the sun was about ten feet in diameter, and my pictures were made one foot in diameter. The central spot or nucleus was made with black ink, the penumbra with lead pencil, while the faculæ were represented with white crayon. It must be understood that straw colored paper is essential for the best representations.

The disturbances of the solar photosphere are very interesting to young students, and are becoming more interesting with all astronomers, as the time approaches for the great expected display of spots of 1871, when, from all accounts, the sun is to become quite "speckled," or at least great magnetic disturbances are looked for.

Sometimes (though rarely) no spots are visible on the sun, again, one may be seen, at other times quite a large number may be seen scattered all along the equatorial belt of 70 degrees in width. Spots outside of this belt are very rarely seen. The disturbances of the luminous portion of the solar atmosphere, if I may be allowed to use the term, are noticed upon the screen in curly streaks of bright light, in irregular shapes, resembling waves on a lake during a sunny, windy day, and particularly plain near and around the spots, resembling much the tumult and circular waves round a place where a large stone has been dropped into a pond of water.

I noticed, whenever I saw a good deal of facular disturbance, in any quarter, there generally followed spots in a few hours. This is so characteristic that it is easy to foretell the appearance of some larger spots, one or two days before they appear around the approaching limit, that is, before they appear in sight, as it is supposed all know the sun revolves on his axis once in 25·34 days, which continually brings new spots into view.

Some days scarcely any facular disturbance could be noticed on the ten-feet reflection on the screen, while on other days it could be distinctly seen covering the whole zone of 35 degrees each side of the equator.

On January 27th, the same season (1862) my brother, in company with myself, noticed the whole face of the solar orb covered with enormous disturbances of the photosphere, from pole to pole, and from limit to limit, entirely mottled with wave-like shades. On this occasion fifteen spots were visible, two of which were very large; undoubtedly a more powerful glass would have revealed many more. The faculæ on this occasion like most other days were more agitated and greater as they approached the equator.

The instrument used in these observations was Fitt's 8-in. Acromatic Equitorial Telescope, erected by Professor C. S. Farrar.

I used a prismatic eye piece to reflect the object upon the screen. Although these representations were very good and convenient, yet I found I could get a finer line and more correct idea from views seen directly through the telescope, by using two or three colored glasses between the eye and eye piece. This is, however, a dangerous plan, as the colored glasses sometimes break from intensity of heat, and the loss of an eye may be the result, as has been the case before. Great care should be exercised in viewing the sun directly through a powerful telescope.

The proposition of a checkered field upon which to throw the image of the solar orb seems to me good. The writer would kindly suggest in addition to the plan of the author of the article above mentioned, that the cross line check be made comparatively small and light, and be secured to the telescope, so that it will keep pace with the motion of the earth on its axis, and hold the whole picture upon the screen in juxtaposition, and not necessitate a constant adjusting anew of the telescope, as would be the case if the screen held the lines, having prepared everything in this manner, a comparatively accurate sketch of every visible disturbance can be conveniently made in a book, whose pages are correspondingly checked.

[For the Scientific American.]

THE MANUFACTURE OF LOOKINGGLASSES AND MIRRORS.

One of the most singular wants of man, but especially of woman, is to devise means to ascertain how her personal image appears. From the fountain, in which Narcissus looked at himself, to the bureau with lookingglass, many plans have been tried.

The first artificial mirrors were made of metal, and were discovered at a very early period, and must have been contemporaneous with the art of polishing flat surfaces.

At this date, lookingglasses are used every where—even as ornaments on horse collars, in Europe.

As ornaments, lookingglasses look beautiful, reflecting, as they do, daylight and artificial light, and thereby flooding sumptuous apartments with a deluge of light. They seem to enlarge small apartments. When not silvered, but simply polished and left transparent, they give to store fronts and windows a cleanly and bright appearance not attained by common window glass. Used between two parlors, they are one of their most beautiful applications. Since the wonderful invention of Daguerre, and especially, latterly, large quantities of small cast glasses are made for photographic purposes. As to imperfect glasses, not suitable for polishing, they are used to form walls through which light freely traverses to rooms which require to be lighted but closed; they may also be used for floors, roofs, etc., etc.

The use of lookingglasses has increased wonderfully, and this increase is owing, in great part, to a notable reduction of price, the consequence of an invention of Abraham Thérart, a French artist, who, in 1688, conceived the bold undertaking of casting glass as it was practiced with metals. This new manufacture made such wonderful strides that, three years afterwards, a company was formed to carry out this new manufacture; and, in 1691, the establishment was transferred to St. Gobain, where it is in existence to this day, and is manufacturing a very superior article. St. Gobain, by the beauty of its glasses, by their relative cheapness, and the ability of its managers, has retained the monopoly, almost exclusively, of the French market, and has, besides, maintained a rank abroad not to be excelled by others, notwithstanding the active competition of Belgium and England. This factory has six strong competitors in England, especially in lookingglasses used for windows. The oldest is located at Raven Head, near St. Helens, South Shields. The Thames Co., the British Co., and three other factories, two of them situated in Lancashire, and the last one at Smitherick, near Birmingham, with the two first named, manufacture more than two hundred thousand square meters per year. The most important factory of the Continent, after St Gobain, is situated at Sainte Marie d'Oignies, near Charleroi, in Belgium.

In 1860, St. Gobain alone manufactured two hundred thousand square meters; the six English factories, three hundred and fifty thousand meters; Belgium one hundred and ten thousand, and Manheim seventy thousand.

The lookingglass manufactures, in France, have a capital of 50 or 60 millions engaged, and employ 5,000 workmen simply on the manufacture of the glass proper, not including those employed on the separate branches of business depending upon it. This branch of manufacture has attained such a state of perfection, that, at this day, prices are 60 per cent lower than twenty years ago and 32 per cent lower than five years ago.

From experiments made, the following shows the relative position of French and Belgian manufactures.

To manufacture a square meter of glass, the following is required:

(In Sainte Marie d'Oignies, Belgium.)

To melt 118 kilogr., soft coal at 13f. 50c. tun	2f. 38c.
" polish 195 " " " 8f. 58c. tun	1f. 65c.
Total	4f. 03c.

(In St. Gobain, France.)

To melt 180 kilogr., soft coal	3f. 96c.
" polish 195 " " "	2f. 94c.
Total	6f. 90c.

If we complete the estimates of the last price by adding the price of the chemicals, the sand, the chalk, and the pot-making, and by adding the labor, we arrive at the following cost prices of one square meter:

Sainte Marie d'Oignies, Belgium	17f. 54c.
Ruquignies, France	20f. 34c.
St. Gobain	21f. 61c.
Cirey	23f. 97c.
Montlugon	21f. 61c.

By adding the interest on the capital invested, the last price is raised to 27 or 28 francs per meter, and is sold in Paris at an average of 34 to 35f.*

It is a well-known fact, that the United States, with its immense resources for this branch of manufacture, has not succeeded, yet, in producing a merchantable article in this line. What is wanting, then, to manufacture it successfully here? We have sands, beautiful and much superior to the European article, although England draws a large quantity of it all the way from Australia; we can manufacture our sodas in this country as cheap as in Europe; we have coal in plenty; we have the capital; therefore what we want is men capable of managing the work and skillful workmen. Ability and love of work are oftener wanting than capital. This class of men, however, is often left at the mercy of men unacquainted with the business, and oftentimes of bad faith, who can not, or will not, wait for the slow but sure profits of labor, and who simply take hold of the business as a speculation, as it were, caring nothing about the artistic excellence of their employés, but would part with them at any time if they thought they could make a dollar by it. These, I think, are a few of the reasons that discourage skillful men from coming to this country.

A manufacturer of lookingglasses would find it to his advantage to locate near the ocean, where he could receive his raw materials, and would be near large markets for his wares, and could, also, make up some of the materials used in manufacturing. Saint Gobain, in France, manufactures its own sodas, emery, colcothar, and tin sheets. They buy the tin in Amsterdam, from the Dutch Indian Company. This company only sells at wholesale. They get the mercury from Spain.

If we cite these facts, it is to establish a comparison between a factory located in Europe, and one in this country, and to show the advantages of a location on the ocean border. We will give an example of these advantages. Sodas might be made on the spot, and would thereby save a vast amount in freights, as soda is obtained from sea salt by transforming it into sulphate of soda, then the sulphate into carbonate. In this latter state it contains a large quantity of water—from 62 to 66 per cent—so that 100 pounds of this salt represents only 34 to 38 per cent of dry carbonate of soda. A factory, making this carbonate on the spot, would save the freight, not only of the pure carbonate, but, also, of the 6-10ths of water it contains.

We have, in some of the Southern States, sand suitable for glass-making, and, also, fire-clay suitable for making the pots (crucibles), which have not been tried properly, heretofore, but, by being properly mixed, would answer the purpose as well as the German clay that we import at a heavy cost.

We therefore say, unhesitatingly, that a lookingglass manufactory, well managed, must be profitable in this country.

Washington, D. C. J. P. COLNE.

WATCH-SPRINGS.—It has recently been discovered that the springs of chronometers and watches, which are constructed of steel, are frequently magnetic. Steel is at all times liable to become magnetized from causes beyond man's control. Watch-makers are advised to test their springs as to magnetism by placing them near to a very small and truly balanced mariner's compass. If the spring exhibits in none of its circumference any tendency to move to one pole of the compass more than the other, it may be considered free from magnetic influence; on the other hand, if the North pole moves to one part, and the South pole to the other, the spring is decidedly useless; for in whatever position the time-keeper may be placed with such a spring, it will be affected by the earth's magnetism.—*Septimus Presse.*

*A square meter equals one and one fifth square yards, nearly. A kilogramme is two and one fifth pounds avoirdupois nearly. A centime is one hundredth of a franc.—EDS.