

engine room. I then gave orders to stop the experiments, and have the fires hauled and fire hose attached; but before the orders could be executed, the front part of the engine was enveloped in a sheet of flame. This occurred during broad day light; no lamps were used about the engine, and the boilers were in another room. Will some one inform me to what to attribute this fire if not to superheated steam?

A. F. NAGLE.

Mechanical Engineer, Providence Water Works.

REMARKS BY THE EDITOR.—This fire was probably occasioned by the presence of oil in the jacket or in the wood covering, or both, the increased heat being sufficient to excite the combustion. It is well known that oil and wood, oil and cotton rags, oil and various other materials will, under certain conditions, spontaneously ignite without being aided by artificial heat. But under other conditions they require to be assisted by a certain degree of exterior heat before they inflame. Such probably was the case in the present example. All engineers understand the importance of guarding well against fires from oily wiping rags or cotton. Care should also be taken to prevent access of oil to the jackets and wooden coverings of steam cylinders, pipes and boilers.

Although in most cases of spontaneous combustion in mechanical establishments, it will be found that oily matters were present and were the inducing cause, still it is well to remember that there are conditions in which substances will spontaneously inflame without the presence of oil. For example, charcoal may be so prepared, its water so completely expelled by heat, and its particles rendered so finely porous that it will absorb oxygen from the air so rapidly as to ignite spontaneously, with but very little assistance from exterior heat. Clean cotton, when sufficiently dried and its fibers placed in a favorable position, may if gently heated be made to inflame spontaneously. There have been well authenticated instances of spontaneous fires in cotton factories where clean cotton had been allowed to remain in proximity to steam pipes. As one example of this kind, we might refer to a fire which broke out in the picker room of the Utica Steam Cotton Company, Utica, N. Y., in January, 1872. There are various kinds of inflammable materials which, if they are arranged so as to furnish the proper conditions of porosity and temperature, will spontaneously ignite.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the items of meteorological information, for those of auroras, and for some of the computations in the following notes, I am indebted to students.

The places of the planets and the times of rising and setting are given approximately, the aim being to furnish to every-day readers such information as will enable them to recognize the principal planets.

M. M.

Position of Planets for February, 1873.

Mercury.

Mercury is very near the sun throughout the month. It souths at 41 minutes before noon on the 1st, and at 38 minutes after noon on the 28th. It rises on the 1st at 6h. 40m. A. M. and sets a little before 4 P. M.; on the 28th it rises about 7 A. M. and sets at 6h. 15m. P. M.

Venus.

On the 1st, Venus rises a few minutes after 9 in the morning and sets a few minutes after 9 in the evening. On the 28th, she rises about a quarter after 8 in the morning and sets a quarter before 10 in the evening.

At this time (January 20) Venus as seen through the telescope has the appearance of the moon at first quarter, or half moon.

Mars.

Mars is increasing in apparent diameter. He is near the star λ *Virginis* on the 1st, being a little above it when on the meridian. It passes below this star, and, on the last of the month, souths nearly at the same time with α *Librae*, but is above that star in altitude.

On the 1st it rises at midnight, souths 21 minutes after 5 in the morning and sets 20 minutes before eleven. On the 28th it rises at 10h. 58m. P. M., and sets at 9h. 16m. A. M.

Jupiter.

Jupiter rises on the 1st at 6h. 24m. P. M., and sets at 8 A. M. He rises on the 28th at 4h. 20m. P. M., and set sat 6h. 6m. A. M.

On January 19, the bands which cross the equatorial portion of Jupiter's disk were seen to be flecked by dark and light spots, brown and white, while a rosy tinge colored the belted region. The dark spots can be seen with telescopes of small power; the white spaces are seen only by the use of a good telescope.

Saturn.

February 1, Saturn rises at 6h. 20m. A. M., and sets at 3h. 44m. P. M. February 28, he rises at 4h. 48m. A. M., and sets at 2h. 12m. P. M.

Uranus.

Uranus is among the small stars of *Cancer*. February 1, it rises at 4h. 17m. P. M., and sets at 6h. 53m. A. M.

February 28, it rises at 2h. 26m. P. M., and sets at 5 the next morning.

Neptune.

Neptune, which cannot be seen without a good telescope, rises on the 1st at 10h. 15m. A. M., and sets at 11h. 9m. P. M.

On the 28th, it rises at 8h. 30m., souths at 2h. 58m., and sets at 9h. 26m. P. M.

Ocullations.

The star τ *Tauri* was occluded (the moon seemed to pass over it) on the 9th of January. The star disappeared at 10h. 38m. 59.4s

Sun Spots.

A very large spot can be seen at this time (January 20) on the sun. It has passed the center of the disk, but can be seen for some days.

Aurora.

There was a fine aurora on January 7. It was first noticed about 6 P. M. At times during the evening, it extended from the northwest far around to the east, with red and greenish tints; and between 10 and 10.20 P. M., the flashes were brilliant, and followed one another with unusual rapidity.

Meteorological Items.

FROM DECEMBER 15 TO DECEMBER 31, INCLUSIVE.

Highest thermometer	2 P. M., December 2035°
Lowest	9 P. M., "	25.....-4°
Highest barometer	2 P. M., "	19.....30.53
Lowest	7 A. M., "	22.....29.11

Amount of rain very slight. Prevailing wind northwest, not violent.

FROM JANUARY 1 TO JANUARY 15, INCLUSIVE.

Highest thermometer	2 P. M., January 343°
Lowest	7 A. M., "	12.....-3°
Highest barometer	9 P. M., "	15.....30.64
Lowest	9 P. M., "	9.....29.55

Amount of melted snow and rain, 2.75 inches. Prevailing wind south, not violent.

PLUMBAGO, BLACK LEAD, GRAPHITE.

"Plumbago (black lead, graphite), its uses and how to use it; by Orestes Cleveland, President of the Joseph Dixon Crucible Company, established 1827. Jersey City, N. J. Published by the Company. 1873."

The above is the title page of a valuable little work, in which we find the following useful information concerning plumbago. Most of it is new to the public, and will be read with interest.

The purposes for which plumbago is valuable, the best methods of applying it, the properties and true character of the mineral itself, its sources, and the circumstances that surround it in the commerce of the world, the various grades and adulterations, are all points upon which great numbers, even of those who come in daily contact with it or use it, are by no means familiar, and many are wholly ignorant.

We have been forty-five years engaged in the manipulation of plumbago, being the oldest house in the trade in this country, handle more of it now than any other single establishment in the world, and have been successful in its application to different branches of industry; we may, therefore, offer information without being accused of not understanding the subject treated.

The black lead of commerce, and what is so called by the trade, in first hands, is found only in Europe, principally in Germany, that which comes to this market being wholly from that country.

The plumbago of commerce comes mainly from the island of Ceylon, in India, but is found in many parts of the United States, being mined successfully, however, only at Ticonderoga, in the State of New York. It is also mined to a small extent in the Ottawa region of Canada, though I believe so far without profit.

It is, therefore, known in trade as Ceylon plumbago. It is very refractory. I have experimented by subjecting, for two hours, a piece, with sharp projecting angles, to a heat that would melt steel, and on cooling found the sharpest points perfect; but it will exhaust if left on top of such a fire. It is found in veins in a pure state, is removed in lumps, and a selection of these forms the "prime lump" of commerce.

The formation most common in the pure state is that of laminated crystals, elongated at right angles with the sides of the vein, if not more than from four to six inches wide; but when the vein widens the crystallization often radiates from numerous centers, and the whole formation is very beautiful; the foliated variety is equally valuable and more brilliant, but rare in any quantity; the acicular form of crystal is not apt to be as pure in the lump, but is useful for most purposes; the granulated variety, the purest of all, is of little use for crucibles, but, with suitable manipulation, produces the finest grades for electrotyping and fine lead pencils, and is unequalled for lubricating. Pure plumbago is free from grit, when pulverized and rubbed between the fingers, and the polish produced in the same way is instantaneous and very bright, being like a darker shade of polished silver. It is found mixed with iron, rhombspar and other forms of lime, the rock and earth in which the vein is carried, and many other foreign substances injurious for all the purposes for which pure plumbago is needed; so that much care is necessary in purchasing the raw material for a given purpose. Lime, for instance, is fatal to plumbago for crucible making. The plumbago is mined in the interior of the island of Ceylon, and is brought down to Colombo in bullock carts. It is there selected into grades; so much as may be finely broken up is sifted, and the coarser part of this is called "chips," while the finer part is called "dust." The "dust" from prime lump is, of course, very different in character from the dust left from the poorer grades of lump, and all of it, whether lump or dust, after being handled and packed in barrels in Colombo, becomes so black and bright, by the poor particles rubbing against the good, that the touch of an expert is required to distinguish between the grades.

The German black lead is not refractory, and is therefore useless for any purpose that brings it in contact with the fire. It has no value for the crucible maker, or for stove polish, and is of but little use as a lubricator. It has a very low conducting power, even in its pure state, and the best quality that comes to market is far from pure. None of it comes in its original state as mined, but all of it is washed

and floated, and so the grades are produced. In fact, it resembles a weak black clay more nearly than it does true plumbago in nature as well as appearance. It is used often on account of its cheapness, when it would be cheaper to use the real plumbago even at five times the price.

As this is only intended for a preliminary circular, to be followed by an elaborate work in which the subject will be fully treated, I shall pass at once to such points as seem to me useful for the trade, either as dealers or manufacturers.

PENCILS.

The first, and still the most widely extended, use of plumbago was for marking-crayons or pencils. The original method of manufacture was very simple. The lumps of mineral were cut into the required shape, and used in the natural state. At a later date it was sawn into the shape now used, and covered with wood, making the well known lead pencil; but the Borrowdale mine in England, the best known, finally ceased to produce the mineral pure enough for the purpose, and that method was reluctantly abandoned. The refuse about the mine was then utilized by purifying and pressing it into blocks, and these in turn were sawn into "pencil leads." But the leads made in this way were weak and unreliable; and even had they been useful, the march of civilization required pencils of different grades, some soft and others harder, while the sawn leads were all alike. The present method consists in selecting the best granulated plumbago (found till recently only in Germany), pulverizing it very finely, and floating it in water through a series of vats, the coarser particles settling to the bottom of the first vat, the finer in the next, and so on till, after passing through several, that which settles in the last vat is considered fine enough for the purpose. A suitable clay is found as yet only in Germany, and this is treated to the floating process, the finest only being fit for use. The plumbago and clay are then mixed together with water to the consistency of cream, and ground together like grinding paint. When this operation is completed, the mass is plastic, water enough having evaporated to leave it in that state. It is then placed in a press and forced through an opening of the size desired for the pencil leads, and the leads are cut to a suitable length, straightened, and dried. When dry enough to handle, they are placed in a crucible, the air excluded, and subjected to a high heat, which bakes them and brings them out ready to be placed in the cedar for pencils. The different grades are produced by the different mixtures of clay and plumbago; the more clay the harder the grade produced. Skill in the manipulation, the exercise of great care as it progresses, and an expert to select the raw materials, are absolute prerequisites for a perfect product, and our success has been greater than we hoped for, to start with. We shall have five grades of the commercial pencils, ranging from the very soft up to a very hard grade. They are smooth, reliable, and pleasant to use beyond any heretofore made, and are a credit to us and to the country as an American manufacture. We are the only Americans making fine pencils, but are not unwilling to place our common commercial polygrade pencils by the side of the finest drawing pencils heretofore used by artists, ours being made by machinery only, while those are made by hand. All of the fine pencils used in this country have so far been imported, but we propose to turn the tide of trade homeward.

CRUCIBLES OR MELTING POTS, RETORTS, ETC.

Forty-five years ago the only plumbago crucible was made by the Dutch, the melting pots used in most countries being made of clay and sand; but the late Mr. Joseph Dixon, the founder of our house, in 1827 made crucibles by using the plumbago found in the State of New Hampshire, of a quality so far superior to the Dutch black lead pots that he took the market from the first. He afterwards saw specimens that had been brought from Ceylon as curiosities, by captains in the India trade; and finding them so much better than the New Hampshire plumbago, he procured a shipment, being the first importation of Ceylon plumbago in the United States.

Captain Rogers, who brought that shipment, is still alive and residing in Boston.

For crucibles, the pure lumps known as "prime lump" only should be used, ground to a fineness that leaves the particles bright and glistening when held to the light, but not so fine as to destroy this appearance. It is then mixed with clay, and the best known for that purpose is found at Mayence, comes down the Rhine, and is shipped to this country from Rotterdam. A small amount of finely pulverized charcoal should be added to render the crucible porous. As little clay should be used as will suffice to hold the plumbago together, the object in using the clay being only to cement the particles of plumbago.

After a thorough mixture, the crucibles are turned into the desired shape, much the same as pottery ware; they are then dried and baked in a kiln like pottery.

In use the crucibles should be placed in the fire, and not on it. The fire should surround the crucible to the very top.

If used with a blast, the blast should not strike the crucibles direct, but there should be coal for the blast to strike against.

The crucible should be kept in a dry place, the least dampness being fatal. If they are well made no annealing is needed, the object of annealing being only to complete the shrinkage that should be fully accomplished in the "burning" by the crucible maker. To provide against slight dampness, however, it is well, when possible, to use the crucible for the first time in a new fire, placing the crucible in the furnace at the time of lighting the fire, so that it heats up gradually with its surroundings. After the first time even this pre-