## EDITORIAL CORRESPONDENCE.

*Rome—Candles—Mass at St. Peter's—Coliseum by Moonlight.*

ROME, Feb. 12, 1868.

Upon reaching the frontier, we experienced a tedious delay of upwards of an hour for a change of cars and the examination of passports and baggage. Our trunks were not opened, as our courier had taken the precaution to procure from Rome, in advance, a "*Lascia Passurē*," or "Let Pass," which saves a good deal of bother. Upon signing this document in the presence of the guard, nothing more is demanded. There is no difficulty in entering Rome. All that is now wanted is a passport, which need not be *visèd*. The train was filled with Americans, who rush down to Italy to pass the winter months. And here I feel inclined to remark, that it is impossible to travel long in Europe without discovering the existence of a rough fiber in the composition of some of our countrymen, which, though less marked than what one sees in English travelers, is nevertheless the subject of occasional ridicule. For example—one pompous New Yorker, who seems to be "traveling on his muscle," boasted of having knocked down the servant of a family, who was trying to do his duty in keeping some seats for them in a car. Another, impatient of the delay, thrust his head out of the car window and shouted at the top of his lungs: "I say, old liver-sweet, how long have we got to stop here?" in response to which the guard very civilly tried to find out what the man wanted. Such brutality, such coarse impudence is certainly not excusable anywhere; and to presume too much upon the ignorance and forbearance of foreigners is not always a safe rule to follow. These cases, however, are exceptions, which one meets with here; for, as a rule, our people are orderly, civil, and liberal travelers.

One week spent in Rome only serves to whet the appetite for the almost endless objects of interest which crowd the attention To be in Rome—Pagan Rome, the Rome of the Cesars, Papal Rome—is of itself a magical fact, a grand incident in the life of any one. Our first visit was made to St. Peter's, on Sunday morning, to witness the Feast of the Purification, and the blessing of candles by the Pope—one of the things to be seen. We were up early in the morning and off to St. Peter's to witness one of the grandest ceremonials of the church. Ladies were admitted to seats near the tribune if dressed in black, with veils thrown over their heads. Gentlemen were allowed to stand inside, if dressed, in swallow-tail coats. A guard of gaily dressed Swiss lancers, resembling harlequins in a play, were stationed upon the dividing line, to prevent any breach of etiquette, which was rigidly enforced, as I noticed that an American gentleman, wearing an ordinary frock coat, upon being observed by one of the guards, was invited to step outside the line, not having on the wedding garment. After waiting for upward of an hour, a regiment of soldiers were marched in, and divided, so as to form an open way in the central aisle for the passage of the procession. In a few minutes more, music, proceeding from a side chapel, announced that the Pope was coming, and all eyes turned in that direction. The procession was led by several ecclesiastical dignitaries, richly dressed in robes of gorgeous hues. The Pope, sitting in his grand chair, was borne upon the shoulders of six men, in scarlet gowns, when upon reaching the tribune, His Holiness took his seat upon a throne facing the bronze altar of St. Peter, and looking toward the vast audience. The cardinals—princes, members of the guard, nobles, and other dignitaries of privilege, were all richly clothed, and the whole effect was brilliant in the extreme.

The assemblage having become composed, the candles were passed before the Pope, who placed his hand upon them, which was kissed by the attending priests. This ceremonial being completed, the candles were lighted, a procession formed, the Pope again mounted upon his big chair

broidered canopy commenced to move around the church to bless the people, returning to his seat in the tribune. Then commenced the ceremony of high mass, in which the Pope assisted, the services lasting upward of an hour. The music, by male voices, was also very fine; indeed, it forms one of the remarkable features of the services of St. Peter's. We have wandered through the Coliseum by moonlight, and have been hooted at by the owls that haunt its immense arches. We have visited the famous Vatican, and traversed the ruins of the Palace of the Cesars, famous baths, temples, churches, catacombs, and prisons, yet dull, dirty old Rome continues to grow in interest.

S. H. W.

### Separating Coloring Matter from Madder and other Plants.

Alfred Paraf, of Boston, Mass., has lately received a patent for the above new and useful process of liberating the coloring matter of madder and similar vegetable substances from the ligneous matter or cellulose with which it is combined in the plant, and hereby declares that the following is a full, clear, and exact description of the said invention.

In the ordinary process of dyeing and printing madder colors, only about half the coloring matter is utilized; and this portion is obtained by tedious processes, requiring a large amount of manual labor. The object of this invention is to liberate the coloring matter of the madder root or similar plant from the ligneous matter, so that, practically, the whole amount of coloring matter of the root may be utilized. The invention is based upon the fact that cellulose becomes soluble when in the presence of cupric oxide with ammonia. The madder root, previously dried and reduced to powder by grinding or other means, is washed with water by several successive operations until the sugary matters are separated and removed, which may be ascertained by testing the wash water for sugar with Bareswell's liquor in the usual manner. The damp, washed madder root, drained from the water, is next subjected to the action of cupric oxide with ammonia by steeping, in an open vessel, in aqueous ammonia in which copper turnings have been placed. This operation may be conveniently performed in an earthenware vessel, fitted with a perforated cover, which permits the access of air. In performing the operation, it is expedient to use one pound of metallic copper and seven gallons of aqueous ammonia for each pound of ligneous matter to be removed. Thus, assuming that the madder root contains thirty-eight per cent of ligneous matter, thirty-eight pounds of copper turnings and about two hundred and sixty gallons of aqueous ammonia may be used for each one hundred pounds of dry ground madder root. In the presence of the copper, the aqueous ammonia, and the air, the ligneous matter of the plant is gradually dissolved, while the coloring matter and copper form insoluble compounds, which remain in the liquid in the form of a precipitate. The operation requires generally several days, during which the materials should be occasionally stirred. The ammonia in the liquid also must be renewed, which is conveniently effected by passing a current of gaseous ammonia into the liquid in the vessel. The coloring matter being thus set free from the ligneous matter or cellulose by the solution of the latter, the next operation is the separation of the coloring matter and copper. This may be performed in several ways, as follows:

1st. By filtration, and by washing the precipitate. Then the precipitate is mixed with alcohol, and a current of sulphuretted hydrogen (H. S.) is passed into the mixure. This substance

coloring matter and copper, setting free the coloring matter, and transforming the copper into an insoluble cupric sulphide. The coloring matter dissolves in the alcohol as fast as it is set free, while the cupric sulphide remains in the liquid in the form of a black precipitate, which is readily separated by filtration. The filtered alcoholic solution of the coloring matter may be concentrated by boiling until the coloring matters will crystallize; or, the coloring matters may be precipitated by adding acetic acid to the alcoholic solution until precipitation ceases, after which they may be separated from the liquid by filtration.

2d. After the removal of the dissolved cellulose by filtration and washing, a current of sulphuretted hydrogen is passed through the mixture until precipitation ceases. The precipitate is separated by filtration, dried, after which the coloring matter is extracted by treating the precipitate successively with small quantities of boiling alcohol. The coloring matter may be obtained from the alcoholic solution as in the previous mode.

3d. The compounds of coloring matter and copper, separated from the dissolved cellulose by filtration, are mixed (without previous washing) with a dilute solution of hydrochloric acid (H. Cl.), sufficient to transform the copper into the protochloride of copper, and the excess of ammonia into chloride of ammonium. The liquid is boiled for about ten minutes, or until the copper is dissolved in the form of the chloride, while the coloring matter remains in the form of a reddish precipitate, which is separated by filtration and washing.

4th. If the coloring matter is to be used at once for dyeing, the dissolved cellulose need not be removed from the compounds of coloring matter and copper, but a sufficient amount of hydrochloric acid (H. Cl.) may be added to the liquid to combine with the excess of ammonia, to transform the copper into the soluble protochloride of copper, and to peecipitate the cellulose. The coloring matter, being insoluble in water and acid, remains in the liquid in the form of a precipitate. The precipitated cellulose and coloring matter are then freed of the chlorides of copper and ammonium by filtration and washing, and the product remaining in the filter may be used in the same manner as practised in dyeing with madder root; but, as the coloring matter in this product is liberated from the cellulose, and is only mechanically mixed with it in the same manner as it might be with any inactive, adulterating material, the dyer is able to utilize, practically, the whole of the coloring matter of the plant, instead of only about half of it, as in the ordinary method of using madder.

The filtered solution of cellulose obtained in any of the preceding modes may have hydrochloric acid added to it until the excess of ammonia is neutralized, the copper remaining in the liquid is dissolved in the condition of a chloride, and the cellulose is precipitated. The liquid may then be removed by filtration and washing, and the product utilized for any purpose that is expedient, one of such purposes being the manufacture of paper. When using the product for this purpose, I treat it with sulphuric acid, in the manner practised for transforming paper pulp into artificial parchment.

The material obtained by the above-described operations, designated, respectively, first, second, and third, may be used advantageously for either dyeing or printing, the material, when used for printing, being previously mixed with the acetate of alumina, or of iron, or a mixture of the two, to produce red, purple, or chocolate colors, and being also mixed with gum or starch in the usual mode of thickening. After printing, the cloths should be steamed in the usual mode, and washed with water, with or without soap. The material obtained by the operation designated fourth is useful specially for dyeing.

### Composition for Cleaning Millstones.

Daniel Kindig, of Newville. Cumberland county, Pa., has patented a new solution, which, he says, if applied to the burr stone, keeps the same perfectly clean, and makes a more perfect and much finer article of flour, and a better yield; also enabling the miller, during all seasons, to use the No. 13 bolt, producing thereby a greater quantity of flour. While grinding garlic wheat, it does not become necessary to take up the burrs oftener than once in a fortnight. The solution is to be rubbed on the burrs with a scrubbing brush.

The solution is composed as follows: 1 gallon hot water; 2 oz. of borax; three balls, of the size of a hazel nut each, of sal-prunel; and ½ pound of washing soda. Mix, and apply it to the burr. When grinding garlic wheat, it is not necessary to take up the burrs at all. It is sufficient to drop through the eye of the burr twice a day one of the above-described balls of sal-prunel, and that, he says, will keep the burrs sharp and clean.

### Gold Mining in California.

Though the whole of the gold bearing region of California has been prospected, yet new discoveries of gold fields are continually being made. Many of these, however, are not workable on account of the scarcity of water, although some of them are very rich. Near the San Joaquin valley is a tract of mining region, fifteen by eight miles, rich in ores but entirely destitute of water. A canal has been dug to supply this section, and the result has been to make it one of the liveliest mining localities in the State. The stories of "big strikes, or the discovery of nuggets, which so excited the imagination of early adventurers are now seldom heard, either because it is found expedient to keep such things quiet, or because they are found less frequently. Nuggets, or "*chispas*," have been found weighing 45 pounds, and worth $15,000. But the most interesting, and it is supposed most profitable, mining is that known as the "deep placer mining." Certain sections of the state are traversed by troughs or beds, supposed to be the course of ancient rivers, which for ages have received the washings from the mountains. These beds are rich in auriferous metal. But the deposits are so deep, and the surface has become so hardened, like cement, that the ores are reached with difficulty by shafts, open cuts, or tunnels. The sinking of these often prove very expensive, sometimes involving a cost of $200,000, and several years' labor. The gold from these shafts and tunnels is separated from the earth and sand by sluice-washing. If, however, the material is hard and cemented, it is crushed as the vein or quartz ores are. This sand and gravel is sometimes found to be marvelously rich, not unfrequently yielding thousands of dollars to the cubic yard. On this account the mining laws have restricted the ownership of such sections to fourteen square feet for each individual, from which space handsome fortunes have been made. Hydraulic mining has been in use for fourteen years, and is at once a successful and ingenious plan. The material chiefly operated upon by this plan consists of immense masses of alluvial deposits, drift, and gravel, forming mounds and sometimes high hills. These rest on a base of rock. The whole mass of deposit contains gold grains, which grow more plenty and richer as the rock is approached. To remove these superincumbent masses water alone is employed, and the whole may be said to be literally washed away.

Such is the completeness of the adaptation, however, that the same process by which the earth is removed is made to separate the gold from it. The digging and washing are both effected by the same power—water. In many instances, where the material of these deposits is so compact as to resist the action of the water, a tunnel or drift is run in at the base of the mound, which is filled with powder—sometimes two or three hundred kegs are required for the purpose—and by means of a fuse exploded. Many hundred tuns of earth are thus crumbled and shattered, and so easily carried away by the hydraulic process. It is estimated that one fifth of all the gold of California is taken out by this process. The average price paid to miners in the hydraulic mines is $3 per diem, and the yield per hand varies from $15 to $30 per day.

BEACH [illegible] richly em-

This class of mines is confined to the northwestern portion of the state, extending into Southwestern Oregon. They are located, as their name implies, directly on the coast. Geologists account for their origin on the hypothesis that ancient rivers carried down these auriferous sands, and deposited them in the ocean. Afterward, by some unheaval of nature, they were thrown up into elevated shores, or sometimes bold bluffs or promontories. These banks are now being reduced by the action of the waves, and the sand containing the gold particles is left on the beach by the receding tides. The prospecting is done after the ebb of the tide, and when a deposit is discovered the sand is gathered quickly by the ever-vigilant miners, and carried to high ground before the tide flows again. As a consequence, these mines are ever shifting, and where a rich haul has been made at one time, in twelve hours there may be no appearance of gold. After the gold bearing sands have been gathered in this way, they are usually packed on mules and carried to sluices, where they undergo the usual washings for purposes of separation. This style of mining is profitable, but the misfortune has thus far been that these gold-bearing beaches have fallen into the hands of a few owners, usually companies, who own stretches of miles together, and thus prevent that individual enterprise so essential to mining success. The daily yield of some of these beach washings runs from $5 to $15 per hand. The wages paid is about $70 per month. Owing to the continual wearing of these gold ridges, and the never-ceasing deposits by the tidal waves, the supply of gold from beach mining may be set down as unceasing.

TAIL WASHING.

This is simply rewashing the refuse matter of the sluices. The earth, sand, and gravel from the washing machines collect in great quantities, and frequently interfere with mining operations. Their removal is then made a matter of convenience, as well as wealth, for gold-bearing earth will frequently pay after two or three washings. This branch of operations has been resigned principally to the Chinese.

GROUND SLUICING

is a process by which the superincumbent masses of poor gold-producing earth is removed from the richer substrata, by means of water. This process is almost identical with the hydraulic plan—the same agent being employed and the same result accomplished. The only difference is, the latter is confined mainly to the river bed and valley deposits, while the former is made use of only in favorable localities. Some of the claims worked upon this plan pay well, averaging from $10 to $20 per hand.

QUARTZ MINING.

The only other kind of mining operation carried on in California is that known as quartz mining. The mines of this description pierce the mountains and run far below the surface of the earth, following wherever the quartz veins or lodes may chance to lead. The ores of gold are imbedded in the rock, and, in order to extract them, the first operation after they are brought to the surface is that of crushing. This is done with the stamp mill. The ores are then roasted, and the pure gold obtained by chemical processes. The whole number of quartz mills now in operation in the state is not far from 500, running 5,000 stamps, and erected at a cost of $4,000,000. Great improvement has been made in the machinery of these mills during the last few years, and many of them have proved good paying investments. The majority of them are run by steam. Quartz ores yield from $15 to $40 per tun; the latter figure, however, is only reached by a few of the very first quality mines. The veins of ore are often pursued to a great depth. A lode in the celebrated Hayward mine has reached a vertical depth of 1,200 feet beneath the surface.—*Philadelphia Press.*

### Sketches from the Late Paris Exposition.

Among the innumerable variety of chemical products and minerals at the late Exposition, it was gratifying to note so many substances which but a few years since, from their rarity, possessed merely a scientific interest, that are now manufactured at will and in large quantities. Wöhler discovered, in the silicate of alumina—pure kaolin—the metal aluminum, and St. Clair Deville, in 1854, first produced it on a large scale, and since then it is used for technical purposes. Although aluminum has not gained the importance which had been predicted for it from its great lightness, it is, notwithstanding, destined to play a conspicuous role in the arts. Cryolite, again, is a mineral which, for a long time known only to the mineralogists as a rarity, was first turned to practical account by Henry Rose. Since the discovery of heavy beds of the "ice-stone," an industry has been established in the extraction of soda and production of fluosilicic acid, a valuable substance, not to be disregarded in the refining of the crude beet molasses. The beautiful iron—free sulphate of alumina, manufactured in large quantities in Natrona, Pa., is being substituted generally for alum, which because of its property of holding a large amount of water of crystallization, increases the expenses of its transportation. The chloride of chromium, a magnificent violet substance, has been applied to the printing of wall paper, imparting a peculiar, beautiful aspect, hitherto unknown. The metal thallium, which was discovered by spectral analysis and exhibited in all its important combinations by Hopkins and Prof. Laury, is already employed by the latter as a substitute for lead, in the manufacture of glass, thus forming a new crude material in the preparation of highly refractory optical lenses, and of brilliant imitations of gems. The indium, exhibited for the first time in bars of several pounds' weight, will find use in pyrotechnics, and, perhaps, also in photography, more so than magnesium, on account of its emitting a chemically, very active light. The naphtaline of the gas works forms the starting point for the preparation of a new coloring principle, which, on account of its relation to the alizarim of the madder, has, with its compounds, found use in dying and printing. The camphor-like smelling sesquichloride of carbon, a substance theoretically important as forming a link between organic and inorganic chemistry, serves at present for the production of the beautiful aniline dyes, not to refer to its value as an antidote to cholera.

Vegetable bases, formerly to be found but in minute doses, were exhibited at the Exposition in enormous quantities. We found among them the rarest opium alkaloids and their derivaties, for the extraction of which at least three hundred pounds of veritable thebaic opium was requisite. The exhibited samples of brilliant crystallized strychnine would have been enough to poison a thousand persons, a single grain being sufficient to destroy life. Four thousand pounds of coffee beans, at least, must have been requisite for the extraction of the amount of caffein we met with. If many of the last mentioned chemicals have not yet gained any technical value, if many are only of pharmacutical interest, they are nevertheless capable of giving an idea of the extent of technical chemistry and the state of an industry of a country, as their presence proves sufficiently what materials, apparatus, and knowledge must have been at the disposition of the respective establishments. Until a substance has left the laboratory of the investigator, it has no industrial importance; as soon, however, as it comes from the hands of the manufacturer, it is a representative of industy. Hence an enumeration of these preparations would give us an insight into the resources of a country, were the number not too great, nor too tiresome to be calculated. Also those bodies, the discovery of which belonged to a former century, regarded long enough as useless, will give a most brilliant testimonial as to the persistence of progressing science.

MESSRS. JACOBS BROTHERS of Columbus, Ohio, have sent us a specimen of large crystallized sugar, made from sorghum, without chemicals or bone filtration.

## Correspondence.

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

### Efficiency of Small Fire Engines.

MESSRS. EDITORS:—In your paper of January 11, 1868, page 21, is an account of experiments made in Germany, to prove that small quantities of water thrown from little engines are very efficient for putting out fires. This subject has been understood and acted upon by a few persons in this neighborhood for years, and I now propose to do what I can to bring it into general use by comparing it with the workings of the "Extinguisher," as it is called, which has the past year been exhibited nearly all over the country.

I have no engines now which I care to sell and my motive is the same which prompts me to take my engine to a fire, to save property and prevent distress. I have no doubt whatever that the general introduction of small engines into fire departments, with steam fire engines, will result in preventing at least three fourths of our fires, and of lessening the rate of insurance an equal amount, that is, three fourths. I am sure this will be so when a new kind of engine, of which I intend to write to you soon, is brought into use with the small and the steam fire engines. At present, however, I wish to write only of small engines, and to address myself to the pump makers of the United States. A cast-iron pump can be made by any one, weighing no more than forty pounds, which will stand up when left alone, which can be put at first in a water pail and yet there can be fired from it by one man a perfectly steady stream of water three eighths of an inch in diameter that can be raised to a hight of more than thirty feet, and that water will put out more fire of any kind of wood, tar, kerosene, resin, or, in short, that of any fire, however made or composed, than any "Extinguisher" which has ever been exhibited.

I do not make this assertion without knowledge, but I have such an engine which has done this work, which has been to and extinguished fires quite equal to those described in your article of the German exhibitions, and from fifteen and more years of experience I tell you that the time has come when the people of this country should understand and act upon the knowledge that fires to be combatted successfully must be reached and fought sooner than they are now or will be by the steam fire engines, or by large man engines. Every person has had an opportunity of seeing the apparently wonderful power the "Extinguisher" has over fire. Your article of the German experiments proves that little engines throwing only cold water will, can, and did extinguish more fire than the "Extinguisher" has done. The building experimented upon in Germany was twice as large as those used here for the "Extinguisher" experiments, and only one engine was used for throwing water, while at the trials here half a dozen were always ready and from three to five used. And now will every maker of pumps engage in the effort to prove their great utility and efficiency for checking two of the great evils of our country, fires and insurance; fires first from their disastrous effects, and insurance from the everlasting strain upon the business portion of the people which it involves. A pump, such as I have described, with six feet of hose and ⅜-inch pipe should cost at retail no more than twelve dollars, or to towns and cities in large numbers from eight to ten dollars. Will every pump maker make experiments like those in your number of Jan. 11th. They will be astonished, for the idea in this country has been that a stream less than an inch in diameter and a power of fifty men or steam were of no use to quell a fire with. And this is true. There are so few of them and it takes so long to put them at work, that the fire, increasing by geometrical progression, doubling its proportion and power every three minutes, has become uncontrollable before they have got well at work. Take the fire which destroyed the city of Portland, for example. People supposed it was one fire. At first there was one fire, and the great engines from every part of the city rushed to it. Before a stream of water had been thrown upon it from one of them, the burning shingles and sparks of the fire had been taken by the high wind which was blowing to other places and set six other fires, so that by the time that the first engine got water upon the first fire there were seven fires in the city in a gale of wind, and before the engines could be put at work upon them, they had in their time made more fires than there were engines in the city. The result we all know. Now let us suppose that there had been, beside the large engines, five hundred such as are described in your paper of the 11th of January, or as much better as a Yankee can make, and that they were equally distributed about the city, in the houses of careful and judicious working men, and that each one who could extinguish a fire before a large engine could be put to work should have five dollars. The six fires before spoken of when they were seen were no larger than a man's hat, and one of them could have been extinguished in half a minute. So of all the others. There would never again be a great fire like that at Portland after a common sense fire preventive system were adopted like that of our people who, when at war, used every means large and small, but vastly more of the last than the first, to destroy an enemy. JOSEPH BIRD.

Mt. Auburn, Mass.

### Things to be Remembered by Machinists.

MESSRS. EDITORS:—Believing the observance of the following points to be indispensable to good workmanship, I make no apology for submitting them to you. If they were carried out in every shop in the land we should have fewer complaints of slovenly workmanship:

Never turn a shaft without drilled centers. Never turn the body until the ends are squared to the center and to the length. Never allow a nut and bolt to pass that will not run down properly on each other. Never pass a nut that does not screw down fair on its seat. Never take the last cut on a thin casting, whether in the lathe or planer, without easing off the chuck or clamp that confines it. Never use a tool square across the face to rough-off with. Never attempt to work steel that is harsh from want of proper annealing; better carry it back to the smith and have it annealed properly than waste time and tools in doing what will be only a poor job. If you can buy good tools cheaper than you can make them, buy them. E. P. W.

New York city.

### The So-called Heat Shadows.

MESSRS. EDITORS:—Your correspondents, in attempting to explain the above-mentioned phenomenon in your number of Feb. 15, p. 101, overlook the true cause of the details they so minutely and correctly describe; it is not that heated and rarefied air transmits the light more perfectly, but simply that the deviation of the light from its naturally straight course, called refraction, caused by those surfaces of the heated and rarefied air when they are in contact with the colder and denser air. Descartes discovered, two hundred years ago, the law of refraction which governs the changes in the direction of light when passing from a rarer into a denser medium, or *vice versa;* the phenomenon in question is simply one of the consequences of this law of refraction of Descartes. Complete explanations of this law are found in all good text books on Natural Philosophy, to which I refer for further details. I will here only speak of it in so far as regards the case in question.

When light falls from one transparent medium perpendicularly on the surface of another, its direction undergoes no change; when it falls obliquely its direction does change, and this change in direction, or this refraction, is greater in proportion to the obliquity and the difference in the density of the two media. When now, heated air is in contact with cold air, and a ray of light passes from one to the other, and in falling on such a part where both the media are in contact, passes obliquely through the surface of contact, its direction must necessarily change. When a stove is surrounded by a layer of a transparent medium denser than the air, it would act similarly to a glass lens, and converge the rays; but the air around a hot stove being, on the contrary, expanded, rarer than the surrounding air, it will do the contrary thing, and diverge the rays; that means the light will be refracted outward from the stove, making the shadow of a hot stove larger than of a cold one. The light passing close along the stove will consequently be refracted in such a way that it will fall where other unrefracted light is falling, will reinforce it, and this is the cause of the lighter band, very correctly represented in the figure on page 101. The tremulous motions are simply caused by the continually changing position of the surfaces between the hot and cold air, consequent on the continuous upward motion of the hot rarefied and lighter air; the direction of the rays of light, when passing through such air, is therefore necessarily also continually changing—here increasing the light in one spot, there obstructing it from another; therefore these so called shadows are simply results of continually changing refractions, and are no more shadows than the image in the camera obscura, which also is a result of refraction by means of a properly adjusted glass lens.

By the same cause (refraction), the sun and moon appear, when rising or setting, one half degree higher than they really are, and may be seen in slowly changing forms, and even sometimes in vibration by a similar cause.

P. H. VANDER WEYDE.

### Calculating Nominal Horse Power of Engines.

MESSRS. EDITORS:—I have seen the following rule for nominal horse power of the steam engine: Multiply the square of the diameter of the cylinder in inches by the cube root of the length of stroke in feet, and divide by 47, the quotient is the horse power.

Now, suppose we take two engines, each having 70 inches diameter of cylinder, one having 10 feet stroke, the other 5 feet stroke, and ascertain the nominal horse power of each:

$$70^2 \times \sqrt[3]{10} \div 47 = 224{\cdot}6 \text{ horses.}$$
$$70^2 \times \sqrt[3]{5} \div 47 = 178{\cdot}2 \text{ horses.}$$

Now, if the pressure of steam had been the same in these two cylinders, and both pistons moved with the same velocity, it is manifest that the powers will be the same, or nearly so. Yet, by this rule, they are made widely different; and if they are made so widely different, when the pressure of steam is supposed to remain constant, how would it be to use 40 pounds in one and 80 pounds in the other?

New Britain, Conn. W. E. CRANE.

[It appears to us that two very important elements are left out of the above proposition—the pressure of steam and the velocity of piston.—EDS.

NEW ELECTRICAL BATTERIES.—M. Balsamo has presented to the French Academy a battery, both elements of which consist of iron, the one being immersed in a solution of chloride of calcium, the other in diluted sulphuric acid, the two solutions being separated by a porous cell. The iron in the sulphuric acid acted as the positive element, and the other as negative. A constant and quite an intense current is obtained by this arrangement. Another novel battery, termed an "electric buoy," is now being experimented upon at Cherbourg. It consists of a zinc plate and a cylinder of carbon, attached to a cross piece of wood, having sea water as an exciting liquid. Still another variety is that of M. Miergue, of Bonfarik, consisting of a cylindrical cell of porous carbon, containing nitric acid, and an exterior cylinder of amalgamated zinc in a cell full of water.