The new moon of the 7th will be near Mercury on the 8th, Mars on the 11th, and Uranus on the 14th; and the waning moon on the 30th will again pay her respects to Jupiter. On the 22d there will be a total eclipse of the moon, which will be invisible in this portion of the globe, but will be partly visible in the Western part of the United States, and entirely visible in the Pacific Ocean.

## Correspondence.

### What is the Temperature of the Sun?

*To the Editor of the Scientific American:*

The voltaic arc affords a very ready means of comparison. The intensity of light in a good arc is fully equal to that of the sun. Therefore, the temperature of the sun is not greater than that of the arc.

The temperature of the arc is not greater than 60,000° Fahr. Therefore, the temperature of the sun is not in excess of 60,000°; and those who have estimated into the millions have gone very wide of the mark. Rossetti's estimate of 20,000°, and Spoerer's of 27,000°, are nearer the point.

The light, and consequently the heat, condition of the sun can be very closely imitated in the incandescent electric light, whose temperature can be closely calculated. The voltaic arc emits light by reason of the incandescence of minute particles of carbon passing between the electrodes. In the incandescent light, so-called, the carbon is a solid mass. The dissociated particles of carbon in the arc are much more highly heated than the particles of the solid incandescent pencil, but the latter is homogeneous, and therefore more like the sun. To bring a carbon pencil to that point of incandescence at which it acquires the intense limpid appearance of the sun, no longer seeming an opaque mass but seeming transparent, it is necessary that the pencil should be heated above 12,000°. It is a veritable miniature sun, so far as the heat condition is concerned. Under no circumstances can its temperature exceed 50,000°, and the pencil even temporarily remain a solid; and even at the lower temperature volatilization occurs. Therefore, the temperature of the sun is not less than 12,000°, nor more than 50,000° Fah.

There is another way of arriving at the result:

The diameter of the sun is said to be 800,000 miles. The earth is said to be 95,000,000 miles distant from the sun. The diameter of the earth's orbit is therefore 95,000,000 + 800,000 + 95,000,000 miles, or roughly, 190,000,000 miles. The heating surface of the sun is represented by a sphere 800,000 miles in diameter, and if we imagine the diameter of the earth's orbit to be that of a hollow sphere surrounding the sun (its inner surface situated 95,000,000 miles from the source of heat), we can approximate very nearly the difference in the degree of heat where we are and at its source. As the diameter of the sun is contained in the diameter of the earth's orbit 237·5 times—as the heat of the entire surface of the sun is distributed over a space (the space of the surface of an imaginary hollow sphere having a diameter equal to that of the earth's orbit) 237·5 times the surface of the sun—it follows that the heat of the sun at the sun's surface must be 237·5 times as great as it is at the earth's surface; and if we assume a mean of 100° at the earth, the temperature of the sun must be 23,750°, no more nor less, and this corresponds very nearly with what I have observed in electric temperatures. W. E. SAWYER.

New York, June 5, 1880.

[NOTE.—Recent comparative photometric experiments between the light of the sun and the light of the electric arc show that the latter has a yellow tinge, the sunlight a purplish hue. This would afford ground for the inference of a higher temperature for the sun than that yielded by the electric arc.—EDS. SCI. AM.]

### On a New Sytem of Photography.*

BY L. WARNERKE.

When experimenting with various phosphorescent substances it occurred to me to apply it to photography, and the following are the results obtained up to the present moment:

I prepare a phosphorescent plate, either rigid or flexible, by applying phosphorescent sulphide of calcium, either in the form of paint or powder, to the surface of glass or paper. The coating must be very smooth and uniform. Several substances can be used to cement the powder. Balmain's paint answers fairly well, but I suggest that albumen may be found more suitable, because it forms, when mixed with phosphorescent calcium, a coagulum which protects the phosphorescent material from the destructive action of the atmosphere (carbonic acid and moisture) more effectually than anything else.

A glass may be coated with collodion and a luminous surface formed on it. The film may be stripped off, and this will be found to be the best process by which to produce a smooth plate.

The plate so prepared, and previously kept in the dark, is inserted in the dark slide and exposed in the camera. After exposure it is removed to the dark room and put in contact with a sensitive collodion or gelatine dry plate. After suitable exposure by contact the sensitive plate can be developed and gives, as the result, a negative with perfect gradation, but reversed.

Theoretically, instantaneous exposure in the camera should be sufficient to give the requisite impression to the phosphorescent surface; and, if this surface could be produced sufficiently fine and smooth, it would be so practically. However, a few seconds' exposure with bright light is sufficient to render the luminous image easily discernible in the dark.

There is, besides this, the means of allowing a great range of exposure in the camera; since if the luminous image be not strong enough, prolonged exposure of the sensitive plate in contact with it will correct the shortcoming. By warming the plate bearing the luminous image the luminosity will instantly be increased, and there will be a corresponding effect on the sensitive plate.

The luminous impression, as shown in my previous paper on actinometers, is persistent, and this allows several negatives to be obtained from one luminous plate. By this means it is observed that contact printing is unsatisfactory for want of, or by too much, exposure; it can easily be remedied without the necessity of giving another exposure in the camera.

There is, however, a certain particularity which must be taken into consideration—the luminous image is not sharp. I repeated my experiments in regard to this fifteen times, and I came to the conclusion that the phosphoro chemical focus is far away from the corrected focus of our lenses.

When once impressed the plate will remain luminous for many hours; but the luminosity can be extinguished by exposing it again to the light filtered through certain colored transparent media. Respecting this I may remark that the most suitable extinguishing substance can only be found by actual experiment. I had several sorts of red and ruby glass, and only two of them acted as an extinguisher, but required an exposure of ten minutes to the sun's rays.

I found a green aniline color dissolved in collodion or gelatine more serviceable. The exposure of two minutes to diffused daylight was sufficient to complete the extinction. Strange enough, I have green glass of exactly the same green color, but it does not act as an extinguisher.

I may mention here that by exposing the phosphorescent plate behind a negative a negative luminous image is obtained, which can produce a positive on the collodion sensitive plate put in contact with it, and in this case it will be quite sharp.

If the phosphorescent plate be exposed to the light, and then put in contact with a negative covered with an extinguishing medium, and again exposed to the light, the opposite result to that previously described will be observed.

By using a phosphorescent plate it is possible to obtain a photograph of the red end of the spectrum. To do this the plate is exposed entirely to the light; and when the spectrum is projected on it the rays of low refrangibility will extinguish the excited luminosity of the plate, leaving the lines of the spectrum luminous. This is printed on the gelatine or collodion plate.

The negative passed round for inspection was made under the following conditions: The phosphorescent plate was exposed in the camera for one minute, using a rapid rectilinear lens. The light was of medium quality. A gelatine plate was put in contact with the luminous image for five minutes.

* A communication to the Photographic Society of Great Britain.

### AMERICAN INDUSTRIES.

[*Continued from first page.*]

establishment, and conveys a good idea of the activity prevalent here. The experimental work is carried on in the laboratory, which is fitted with all of the modern appliances for making electrical tests, and with a full line of chemical and physical apparatus. The machine work is all done in a machine shop covering an area of 80 x 120 feet, well stocked with machinery from the shops of the best makers in this country.

The wire used in winding the armatures and magnets is all covered by a simple machine shown in one of the views in our engraving. The same view represents the machines on which the armatures are wound. The machines and lamps are all thoroughly tested before being shipped.

The carbon rods used in the Weston lamp are all made here, the company having determined by careful tests that their own carbons are better than the French. The operation of making the carbons is very simple; the retort carbon, being ground to an impalpable powder, is mixed with a moistening liquid and forced by hydraulic pressure through a die, which gives them their cylindrical form; they are then baked for a number of hours at a high temperature, and after cooling are inspected and pointed for use.

The manufacture of electric lighting apparatus is now one of our leading industries, and it is likely to expand as the advantages of this system of illumination become better known.

The new works of the Weston Electric Light Company are located at 23 to 29 Plane street, Newark, N. J., and their New York offices are located at 92 and 94 Liberty street.

### MISCELLANEOUS INVENTIONS.

Messrs. Lewis H. Raymond, of New York city, and John Roberts, of Dunellen, N. J., have patented a life raft made with sides of equal height below and above the floor, and having independent cylindrical air chambers fastened thereto between the seats above and below the floor, and also having air chambers, made in compartments, formed between the sides at both ends of the raft. The gunwale on the top and bottom of the sides and thwarts is held and braced by means of braces connecting the gunwale and the thwarts.

Mr. Christian J. B. Hirsch, of Zumbrota, Minn., has patented an improved pipe stem. The object of this invention is to furnish a short pipe stem which shall have the effect of a long one, cooling the smoke and allowing the nicotine to condense from the smoke.

An improved hanging lamp, patented by Mr. Otto F. Eichberg, of New York city, consists in combining with a cup perforated at the top, and forming an extension of the tube, an adjustable extension having an interior depending flange and exterior absorbent.

Mr. John S. Birch, of Orange, N. J., has patented a novel key ring, so constructed that keys and other articles can be conveniently placed upon and removed from it, and which will not be liable to become opened accidentally. The invention consists in constructing the key ring of a strip of metal bent into V form, with rounded angle, having its end parts bent inward and outward to form shoulders, having one of its ends longer than the other and bent into U form, and having a lug upon one end and a recess in the other end.

Mr. Augustus J. Kuhn, of Lewistown, Pa., has patented an improved drying apparatus, intended more particularly for drying sand, which, by its peculiar nature, is difficult to dry and inconvenient to handle; but this improved machine may be used to advantage in drying any material that will run through the machine. The principal objects of the invention are, first, to permit the use of exhaust steam for producing the drying heat; second, to save handling of the material from the time it is placed in a wet condition in the machine to its delivery in a dry condition; and, third, to permit the regulation of the feed and delivery according to the heat and condition of the material and to prevent clogging of the feed.

Mr. Jesse M. Harr, of Baltimore, Md., has patented improvements in that class of skylights which are made strongly and studded with thick glass disks and placed in the sidewalk for the purpose of illuminating the dark recesses of a cellar or vault without allowing the entrance of rain and without breaking up the continuity of surface or weakening the pavement at such points.

Mr. John F. Henderson, of Franklin, Ky., has patented an improved coffeepot designed to more thoroughly extract the strength of the coffee and without boiling. A pendent cylindrical water receptacle is placed in the top of the pot, and is provided with a straining sack below, in which is contained the ground coffee.

In preserving fruit, vegetables, and meats by what is known as the "refrigerating" process, a current of air of reduced temperature is, in many instances, forced into and through the chamber or receptacle containing the substances to be preserved. In other cases the air is drawn from a well or through a tube passing through a collar, the current being established and maintained by the rarefaction of the air in the preserving chamber. Mr. Louis G. Volkmar, of New York city, has patented a portable apparatus for use in drying fruit, etc., by means of a cold air current, which is conducted through a tube that traverses an ice box, and is so arranged therein that ice may be packed around and in contact with it.

Mr. Charles E. Wallin, of Salt Lake City, Utah Ter., has patented a horse cover or blanket which affords greater protection than the ordinary blanket to the breast and other parts of the body, also be more comfortable to the animal by allowing greater freedom of movement, yet less liable to rip or tear or become displaced when the animal lies down or gets up. These results are attained by the provision of a detachable breast piece, elastic straps, a pad, and gussets or gores attached to the body of the cover.

Mr. James R. Barry, of Yonkers, N. Y., has patented a novel top, so constructed as to contain the cord when not in use.

An efficient and powerful implement for raising stumps, roots, rocks, and other objects, has been patented by Mr. William H. Wright, of Belmont, N. H. The invention consists of a vertical U-shaped frame in which moves a ratchet bar, the frame being provided with a lever for lifting the ratchet bar, a latch for retaining the bar at the point to which it is lifted by the lever, and springs for throwing the latch in and out of engagement with the ratchet bar.

Mr. Leroy Brown, of Waitsburg, Washington Territory, has patented an improved sulky plow which is so constructed that it may be readily adjusted and controlled by the driver. It is simple in construction, strong, and durable.

Mr. Thomas Bickerton, of Lawrence, Kan., has patented a hand corn planter with a drop slide which will accurately drop the corn. The end plates are shaped so as to prevent dirt from getting between them when thrust into the ground.

Mr. William Lay, of Seneca City, S. C., has patented a cheap, simple, and powerful water motor for running machinery or performing other work. It can be operated with a small quantity and with but slight fall of water.

### New York Elevated Railway Cars and Engines.

The total number of engines now running is 167, divided as follows: Second avenue line, 29; Third avenue line, 68; Sixth avenue line, 46; Ninth avenue line, 24. The cars as follows: Second avenue, 66; Third avenue, 221; Sixth avenue, 152; Ninth avenue, 49. Total, 488. The combined mileage of the Eastern Division is about 269,400 miles; of the Western Division, about 146,000. Total mileage per month, 515,400 miles. These engines make two and a half stops to the mile, making an average of over one million train stops a month.