ried with it always on the side away from the sun, and which stretched out 125, 150, and even 200 millions of miles in length. To make in two hours a half revolution of the sun, it rushed along with a velocity of 167,700 feet per second (perhelion of 1843)—a velocity of the elliptical order, considering the fearful attraction of the sun, but which would have become rapidly parabolic at a little greater distance. Now at the distance of the earth, at 95 millions of miles, the rectilinear and rigid tail must have swept space with a velocity of over 19,500,000 feet per second!

Does not this circumstance, which has presented itself to our eyes twice in thirty-seven years, taken in connection with the perfect transparency of these trains of light, lead to the consequence that *the tails of comets cannot be material?* Is it an electrical illumination of the ether? Is it an undulatory motion excited by the comet itself on the side opposite from the sun? We do not as yet know all the forces of Nature.

A STRANGE EXPLOSION.

To the Editor of the Scientific American:

I was recently called upon by Professor S. P. Langley, Director of the Alleghany Observatory, to silver three heliostat mirrors for him that he intended to use in his present expedition to the Sierra Nevada Mountains. These mirrors he wanted with a surface as perfect as could be made, and they were to be so bright from the bath as to need absolutely no retouches with a polishing pad, as the microscopic scratches produced by the pad would be detrimental to his experiment. The silvering was a success; a beautiful and fine reflecting surface being obtained from the bath.

In making one of the solutions, I had put 240 grains nitrate silver in 2 oz. distilled water, and 240 grains absolutely pure potassa in the same amount of water; each in separate vessels. I now poured them together, with the usual result. The silver was precipitated in the form of a grayish brown oxide. I then poured in aqua ammonia to redissolve the silver, but for some cause unknown to me, after pouring in fully seven ounces of ammonia, three times the usual amount, the precipitate would not dissolve, and I gave it up for a bad job, as an excess of ammonia always causes a thin deposit of silver. I poured the solution into a pint jelly glass and set it on top of my writing desk with simply a bit of paper over it to keep the dust out.

Three days afterward, at about two o'clock in the afternoon, I sat down at the desk to answer a letter, but before I finished it I was called out of my shop, and I think I was not away three minutes when a fearful explosion was heard in the shop. I hurried in, as also did the neighbors, and I found my shop literally strewn with glass fragments of silvering dishes, bottles, graduates, and funnels, and the sides of the shop floor and roof splattered all over with particles of glass as fine as dust. Every place the solution had touched was turning brown. The crash was heard for a great distance, and the wreck was complete. The force of the explosion caused the bottom of the glass to embed itself fully a quarter of an inch deep into the hard cherry wood, showing that it must have been very powerful, the glass itself being blown into atoms. The thermometer marked 96 in the shade about the time of the explosion. Now I would like some of your chemical readers to explain this, if it is explainable. Did the fulminate of silver form in any way? The vessel being open a gas could not have done such destructive work. It was fortunate for me that I was called out when I was, or I should likely have lost a pair of valuable eyes. Of course I shall leave no such solution stand even uncovered hereafter. Nevertheless I should like to know what caused the explosion.

I. A. BRASHEAR.

Pittsburg, Pa., July 23, 1881.

[REMARKS.—The explosive in Mr. Brashear's case was Berthollet's fulminating silver, a very curious and dangerous substance which results from the action of ammonia on oxide of silver. A very good receipt for producing it, is as follows: Digest freshly precipitated oxide of silver in strong liquor of ammonia for twelve or fifteen hours, then pour off the liquid, and cautiously dry the black crystalline powder which remains and which is the fulminate. Also the decanted ammonia contains some fulminate, and this will be deposited on cooling after gentle warming of the liquid or on spontaneous evaporation. Only a very few grains of oxide of silver should be used in a single operation.

Mr. Brashear had in his jelly glass freshly precipitated oxide of silver and ammonia, and the digestion went on, all as the receipt prescribes. There was also in the glass nitrate of potash, which probably was an inactive substance, for it did not prevent the formation of the fulminate. Perhaps there was present for the explosion about as much fulminate as was possible to produce from 240 grains of nitrate of silver.

The Berthollet fulminate is one of the most unmanageable and dangerous of known explosives. One writer says: "This compound is exploded by the slightest friction or percussion, and should therefore be only made in very small quantities at a time and handled with great caution. Its explosive powers are tremendous; in fact it can hardly be handled with safety, even in the moist state. Many frightful accidents have happened from the spontaneous explosion of this substance."

It is a singular fact that this fulminate is mentioned by only a few of the modern treatises on chemistry, and that although it was discovered in the last century very little is known of its chemical relations. The fullest accounts of it are to be found in books which are now obsolete. We quote a few sentences about it from Akin's Dictionary of Chemistry, London, 1807: "Even when still wet if it be pressed upon with a hammer, or any hard body, it fulminates with extreme violence, but when dry, the touch of a slender wire or even a feather, or a heat of about 96° is sufficient to make it explode. Even a moderate concussion of the air is sufficient, so that a heap may be exploded by the concussion of any other in its immediate neighborhood. Sometimes too it will go off in the hand, when carrying from one place to another, so that in fact when it is once dry, the operator should be prepared for the explosion at any time, even with the most careful handling."

Berthollet's fulminate must not be confounded with the ordinary fulminate of silver which is employed in the toy torpedoes, and which is made by heating a mixture of nitrate of silver, alcohol, and nitric acid. The latter, although a terrific explosive, is comparatively safe.—ED.]

DUST EXPLOSION IN EHRET'S BREWERY.

The splendid building owned and occupied by Mr. Geo. Ehret, as a lager beer brewery, located between 92d and 93d streets, and 2d and 3d avenues, N. Y., was injured on the 30th of July, 1881, by an explosion of malt dust, which also set it on fire. It is one of the finest breweries in the country, seven stories high, and ornamented elaborately with insignia of the business and samples of fine bricklaying. Our engraving gives an idea of the magnitude of the structure. The crushed malt from the malt crushing machines in the lower part of the building is carried by an endless belt elevator through a closed box to an upper chamber in the top of the tower, whence the malt is distributed for brewing through spouts to all parts of the building. The fine dust occasioned by the crushing is suspended in

DUST EXPLOSION IN EHRET'S BREWERY.

the air in the chamber, and in this condition it will burn with explosive rapidity when ignited. The distributing chamber of the central system of this establishment was located on the upper floor, formed by a light transverse partition in the room beneath the clock tower, the lower end of the elevator being on the third floor, just below the crushing rolls which were on the fourth floor. The initial explosion, which was followed by two or three secondary ones, or noises like explosions, and the fire, took place at or near the upper part of the elevator case, bursting out a small area of perhaps its weakest part. The margin of the opening was scorched and splintered, but not set on fire, and the ceiling boards in the vicinity were also scorched as though they had been exposed to a flash of gunpowder.

The fire, however, appears to have originated in the attic above the malt bins in the western wing, which was probably the location of the second, and, perhaps, third explosions, if such really occurred. To persons inside of the building the falling of the bricks into the street and upon the roof of the two-story extension might have been mistaken for explosions of dust. The flat portion of the main roof of the western wing was lifted and took fire, and the iron stairway and ornamental railings were broken and thrown about. The sloping mansard roof at the western end, together with the metal cornice and the upper part of the brick wall, was blown out and fell through the roof of the two-story extension of the western wing into the dry room above the boilers, luckily going no farther in that direction. Near the location of the initial explosion at the center of the north front, the ornamented gable of the transept was blown out and fell into the street, where some very narrow escapes of people from sudden destruction are said to have occurred. The timely appearance of firemen upon the scene and their prompt efforts soon subdued the flames and saved this fine structure, but a large quantity of stored malt was ruined by water.

In regard to the frequency of this class of explosions, the *Times* has the following:

"Mr. Hasslocher, the superintendent, and several of Mr. Ehret's employes, spoke of the occurrence as being far from extraordinary. On the 4th of July, 1880, a common lucifer match among the malt was ignited in the malt mill, in which are two steel grinders, which make about 150 revolutions a minute. The flash of the match set fire to dust in the elevator, and an explosion occurred which did about $2,000 damage. Similar explosions have recently occurred at Hupfel's brewery and at Ruppert's. A pebble or a piece of steel among the malt in the mill could produce a spark which, if it came in contact with the saccharine fine dust in the elevator, would cause either a flash or an explosion according to the quantity of dust in the air. Just as good a flash can be produced with this malt dust as with lycopodium spores, which were once used in theaters to simulate lightning."

The same journal also says of the lecture of Prof. L. W. Peck, which was delivered in May, 1878: "He illustrates the theory that dust mixed with air is not only combustible, but explosive, by saying: 'If a large log of wood were ignited it might be a week before being entirely consumed. Split it up into cord wood, and pile it up loosely, and it would burn in a couple of hours. Again, split it up into kindling wood, pile it up loosely, and perhaps it would burn in less than an hour. Cut it up into shavings and allow a strong wind to throw them in the air, or in any way keep the chips comparatively well separated from each other, and the log would, perhaps, be consumed in two or three minutes; or, finally, grind it up into a fine dust or powder, blow it in such a manner that each particle is surrounded by air, and it would burn in less than a second.' Prof. Peck instanced the burning of the Washburn, Diamond, and Humboldt Mills on the 2d May, 1878, at Minneapolis. This fire was due to the explosion of particles of flour and bran mixed with air, and the force of the explosion was so great as to throw down walls six feet thick, and sheets of iron from the roof of the Washburn Mills were thrown so high in the air that they were carried away by the wind a distance of two miles. He also cited the fire in Greenfield's candy factory, in Barclay street, New York, on the 20th of December, 1877, as one which 'no one need regard as a mystery,' as large quantities of starch and sugar were kept there, and could have been thrown into the air by minor disturbances. Prof. Peck, by numerous and interesting experiments, demonstrated the explosive force of fine dust mixed with air and ignited under proper and favorable conditions. The lid of a box of two cubic feet capacity, with a man standing on it, was raised when flour blown on to a light within was ignited. In a similar experiment, dust from a factory gave similar results."

In the back volumes of the SCIENTIFIC AMERICAN and SUPPLEMENT will be found recorded a number of cases of disastrous dust explosions. One of the most fearful was that which took place at the Albion coal mines, Nova Scotia, last year.

Another Trial of the English Yacht Anthracite.

A recent letter from the Secretary of the Perkins Engine Company, Major George Dean, of London, England, informs us that a third economic trial of the machinery of the little Anthracite has lately been made by F. J. Bramwell, Esq., C.E., F.R.S., assisted by William Rich, Esq., C.E., while the vessel was running under steam on the river Thames. The letter accompanies an extended report of the three rigid trial tests that have now been made, the first and last of which were conducted by Mr. Bramwell, while the yacht was running on the river Thames, and the second, by a Board of United States Naval Engineers, Chief Engineer C. H. Loring, President, pursuant to orders from the Secretary of the Navy, while the vessel was tied to the wharf in the New York Navy Yard, August 13 and 14, 1880.

This vessel was fully described in current numbers of the SCIENTIFIC AMERICAN and SUPPLEMENT, and illustrated in the SCIENTIFIC AMERICAN, under date of August 7, 1880, by means of a large engraving, which shows her in elevation and section, and her machinery somewhat in detail.

It appears from the last report that since her successful voyage to America, the yacht has been fitted with a new propeller, and that she now has beaten her own record both as to power developed and economic performance, yielding a horse-power at the expense of 1·66 pounds of coal, and showing a gross of about 110 indicated horse-power, against 1·7 pounds of coal at the first trial, and 2·7 pounds at the second trial, with, respectively, a gross development of 80·9 and 80·15 horse-power. In regard to the apparently wide difference between the American and the first English tests, the Report of the Naval Board says: "A cursory glance at the cost of the indicated horse-power, in pounds of coal consumed per hour during the two experiments, shows the wide difference between 2·7115 pounds in our experiment and 1·7114 pounds in Mr. Bramwell's, or that the economic results in the latter were $\left(\frac{(2\cdot7115-1\cdot7114)\,100}{2\cdot7115}\right)=36\cdot88$ per centum superior to those in the former. This great difference, however, is only found when the crude coal is employed as the measure of the cost, and it includes not only the difference due to the condition of the steam (meaning as to superheat) in the two experiments, but the difference in the evaporative power of the coals."

Major Dean in his letter properly says of these trials: "Though differing, all bear such a favorable testimony to the value of the Perkins system, that the comparison will do much to help those interested in steam to judge for themselves as to the advantages claimed."