Correspondence.

Concerning a Telescope of Unlimited Power.

To the Editor of the Scientific American:

In connection with D.'s communication, on page 368 of your volume XXIX., it may be observed that the mercury, revolving in the manner described, will have a stability due to its motion, above that belonging to it while in a state of rest. The same principle applies alike to the motions of atoms and of suns, and a very striking illustration is afforded by the rigidity imparted to a stream of water issuing from an orifice under great pressure. (See Mr. Emerson's communication, page 340 of your volume XXIX).

From lack of necessary data, the writer is unable to state the exact stability of mercury due to different velocities; but after a rough estimate, it is safe to say that, if the basin of 20 feet diameter be made to revolve at the rate of 200 revolutions per minute (which speed is practicable), the mercury near the circumference of the basin will have a stability greater than lead. Now, unfortunately, the velocity at the center of the vessel will be 0, and consequently the stability at the center will be only that due to mercury in a state of rest. It is possible that we may dispense with a portion of the center of the mirror; perhaps some one will be kind enough to tell us how much, if any, may be dispensed with, without seriously impairing its efficiency.

The great amount of power required to operate the necessary machinery would preclude the possibility of using weights for imparting motion, and the next best thing that we have is an accurately balanced water wheel, imparting its motion through friction wheels. After reducing the possibility of friction to a minimum by accurate balancing, etc., we may obviate still further difficulties arising from vibrations and inequalities of motion by floating the vessel, containing the mercury destined to act as a reflector, in another vessel also containing mercury. The motion would then be imparted through the mercury in the outer vessel by friction to the mercury in the inner vessel. The consequences of this arrangement are obvious.

In regard to the plane mirrors, will some one well acquainted with the principles involved be kind enough to inform us if it is necessary that they should be quite as large as the parabolic reflector?

The oxidation of the mercury would be an item requiring attention. It might be prevented by covering the metal, while at rest, with a suitable oil, which would separate itself from the mercury while in motion. JOHN LINTON.

Baltimore, Md.

Heat and its Origin.

To the Editor of the Scientific American:

The origin of the heat developed during combustion has hitherto been a profound mystery. In the beginning of this century, it was suggested that a portion of the specific or of the latent heat of the bodies consumed was set free during the process of combustion; but this idea was soon overthrown, as it was found that the products of combustion often possess more specific heat, and almost more latent heat, than the bodies themselves did before burning, that is, before chemically combining under evolution of heat. Hence arises the question: Whence comes all this intense heat of combustion, and the subsequent great amount of latent heat, when the resultant substance in the end possesses more specific heat than its elements before combination? It is curious to remark that, in this case, the most eminent physicists concluded that combustion must be an electric phenomenon. That ignorant persons, knowing nothing of electricity, attributed the so-called spirit rappings and similar manifestations to its agency may be readily comprehended; but that scientists who have studied its laws should use this word as a pretext for explaining fire, solar heat, volcanoes, and even earthquakes, seems almost incredible. Physics form a positive science, which does not admit of vague suggestions, and a phenomenon cannot be ascribed to the work of electricity unless it is clearly shown that the well known laws and properties of electricity, when applied, explain every peculiar phase of the same. Notwithstanding that the laws of heat and electricity have been thoroughly investigated we are as yet not sure of their ultimate nature; one thing only appears certain, namely, that both are not peculiar fluids penetrating matter, but mere motions of the molecules or atoms of ponderable matter. Therefore, it is inappropriate to speak of imponderable matter, on account of the contradiction in terms, as the first property of matter is to be ponderable; we may have imponderable forces, or, better, caloric and electric forces. The so-called ether, which fills the planetary space and propagates heat and light, is probably ponderable matter; it is an atmosphere surpassing hydrogen in brightness more than hydrogen surpasses platinum, and of so small a gravitating force that millions of years will elapse before it is condensed on the planets. In fact, the spectroscope shows that, in the atmosphere of the planets and even of the sun, the materials of our earth's atmosphere are present, including water or its elements. Recent investigations of the sun and other heavenly bodies, by means of this wonderful apparatus, have besides revealed the fact that all matter may be in a more than gaseous condition, incandescent gas of so high a temperature that the elements are dissociated, that is, that all chemical affinities are destroyed, and each element exists separately in its uncombined condition, notwithstanding that it is intermingled with others A descent from this exceedingly high temperature to that in which the chemical affinities can manifest themselves results in the combination of the gases. The chemical affinities of the different elementary substances manifest themselves only between a comparatively limited range of temperature, below and above which they do not operate. Even as at an extreme cold no combinations can take place, so at the extreme heat, of say 8,000° Fahrenheit, not only no combustions take place, but all compounds are separated into their ultimate elements. On cooling and reaching 4,000° or 3,000° or thereabouts, the volatilized substances or gases will again combine; the chemical affinities come into play, and combustion will ensue, the heat of which will again originate partial new dissociations. This is what continually appears to take place in the sun. It has been proved that the work of dissociation is strictly analogous to that of evaporation. In imparting to a liquid, water, for instance, the property of gaseous elasticity, steam, a definite quantity of calorific energy is manifested in the newly acquired expansive power, and therefore is not displayed as temperature; in other words, heat is made latent when changing water into steam. In like manner a still larger amount of temperature is converted into the force necessary to separate the vapors into their component gases; here a greater quantity of heat is made latent, and this is that which is set free and appears in combustion when the gases combine by burning, just as latent heat is freed when gases condense into a liquid, and again when the liquid cools into a solid. In regard to the temperature of the sun, we know now that those substances most prominent on our earth exist there in a state of vapor. Iron, lime, soda, potash, etc., are there in that condition, and also steam in the dissociated state of oxygen and hydrogen. Therefore the actual temperature must be several thousands of degrees, in fact, such a heat as we cannot practically produce. Direct measurement caused Sir Isaac Newton to conclude that the sun was thousands of times hotter than melted iron, while Sir John Herschel supposed that it was a solid or liquid body, radiating from its surface only, and that its temperature ought to exceed thirteen million degrees Fahrenheit. Modern discovery has shown, however, that the sun is gaseous at least to a depth of several thousand miles, and that the gas is all incandescent, luminous, and hot.

Moreover, incandescent gases and flames are perfectly transparent for light and heat from lower strata, and therefore the solar rays not only come to us from the surface, but we receive the accumulated rays from layers of incandescent gases several thousand miles in thickness. From the effects of these gases, the surface of the sun is continually being disturbed in a manner compared to which the more violent hurricanes, thunderstorms, and volcanic eruptions on our earth sink into utter insignificance. X.

The Prismoidal Railway.

To the Editor of the Scientific American:

Observing in your journal of December 13, 1873, an article, copied from the *Public Ledger*, referring to Crew's prismoidal railway, we beg to call your attention to an error which we will thank you to have corrected. The error lay in the statement that "the track upon which the trial was made, contained 36 feet lumber and 18 pounds of iron to the lineal foot;" it should read "lineal yard." We beg further to inform you that, by consent of the President of the Atlanta and West End Street Railway Company, Atlanta, Ga., for whom the locomotive was built, Mr. E. Crew, the patentee, has been allowed its use in order to demonstrate its power and the principle of his railway on a track of 500 feet circumference, now building at the Chestnut street rink in our city, which he has rented for that purpose; where, in the course of a couple of weeks, he intends to bring it directly before the attention of railroad men and corporations. The prism of this trial railway is 24 inches wide at base, with 18 inches hight to top of cone, with an 18 lbs. rail on its apex. The curves will be of 37 feet radius, and he purposes to demonstrate his principle, starting on a trip of 500 miles.

We enclose you a photograph of the "Atlanta" locomotive which is now at the rink. It is 11 feet long, 4 feet wide, and has two 24 inch drivers, with cylinders 5 x 8, and weighs only 4 tuns.

We contend that, by the use of the prismoidal railway, rapid transit can be insured between the cities of New York and Philadelphia, and the time reduced to 1½ hours.

Philadelphia, Pa. GEO. W. PRICE & CO.

The Relative Efficiency of Engines and Boilers.

To the Editor of the Scientific American:

The question of the relative economic efficiency of modern engines as compared with that of boilers, as they are now constructed, is being agitated among engineers in this city, and it has occurred to me that it is a subject that will interest the readers of your valuable journal. The discussion arose from a statement, made by one engineer, that, whereas the best modern steam engines have frequently developed from 75 to 85 per cent of the power actually furnished by the boiler, the boiler does not develope more than 15 per cent of the power actually contained in the carbon fuel. This was objected to, the reverse being claimed as being nearer the truth. Discussion on this subject in your valuable journal would be highly appreciated by the public, who well know that you are desirous of obtaining as much light as possible on all scientific subjects, and especially on steam, which enters so largely into all concerns of our daily life.

Boston, Mass. CONSULTING ENGINEER.

REMARKS BY THE EDITOR:—The subject here suggested is one of interest, and we invite correspondents to give their views.

THE Parisian pharmaceutists have contrived to incorporate cod liver oil with bread. Each pound of bread contains a little more than two ounces of the oil.

ALUMINA, FROM THE CLAY TO THE SAPPHIRE.

READ BEFORE THE POLYTECHNIC CLUB OF THE AMERICAN INSTITUTE, ON DECEMBER 18, 1873, BY DR. L. FEUCHTWANGER.—PART I.

Alumina is the oxide of the metal aluminum. It occurs in nature as corundum, which is an extremely hard mineral, ranking next to the diamond, its specific gravity being 4·0. It consists of 53 per cent aluminum and 47 oxygen. The precious gems sapphire and ruby are the representatives of pure alumina, the first of a blue and the other of pink or rose red color. If they possess a stellated opalescence, when viewed in the direction of the vertical axis, resembling a star, they are called star sapphires or rubies, which were known to Theophrastus and Pliny in the first century. The mineral corundum occurs in very fine crystals of the blue and red colors in many localities of the United States, such as New York furnishes at Amity, New Jersey at Newton, Pennsylvania at Unionville, and North Carolina. At Franklin, an extensive quarry of the crystals is now mined, one crystal weighing 30 tuns. Georgia gives red sapphires, of which California and Canada both furnish fine specimens. The minerals gibbsite and diaspore are hydrates of alumina; but the mineral emery, which stands near corundum in hardness and is the most useful material in the arts, containing the alumina and magnesia in about equal proportions, was originally brought from Asia Minor, but is now extensively mined at Chester, in Massachusetts. Alumina is also contained in a vast number of minerals. Clay is the result of the decomposition of aluminous minerals, and is, strictly speaking, a mixture of silex or flint, with at least one fourth of alumina, and has a peculiar earthy odor when breathed upon; and the mineral shale, which differs but little from clay, is extremely infusible and insoluble, and is also the companion of the silicated minerals: any earth which possesses sufficient ductility, when kneaded up with water, to be fashioned like paste by the hand, is called clay. These clays vary greatly in their composition, and are nothing more than mud derived from the decomposition or wearing down of rocks, as we see by the rain drop impressions, ripple marks, or mud cracks, which bear marks and evidence of exposure above the water, indicating plainly the long time which was required for the decomposition of the felspathic rocks, mostly contained in granite, and of granitic and gneissoid rocks and porphyry. In some regions where these rocks have decomposed on a large scale, the resulting clay remains in vast beds of kaolin mixed with pure quartz or silex, and sometimes with oxide of iron from some of the other minerals present, such as we find extensive beds of in the tertiary formation, as in New Jersey, Virginia, and South Carolina.

Before proceeding further to state what function the component parts of granite, which are the quartz, felspar and mica, occupy in the aluminous silicates, let me say a few words on the classification of rocks according to their origin and age, meaning the earth's crust, of which but a small portion is accessible to human observation. All rocks are divided into four great classes according to their different origin. The first are the aqueous; second, volcanic; third, the plutonic; and fourth, the metamorphic. Each of these four distinct classes has originated at many successive periods. It was formerly supposed that all granites, together with the crystaline or metamorphic strata, were first formed, and were called, therefore, primitive rocks, and that the aqueous and volcanic rocks were afterwards superimposed, and would rank, therefore, as secondary in the order of time. The aqueous rocks are also called the sedimentary or fossiliferous, and cover a larger part of the earth's surface than any others; they consist chiefly of mechanical deposits, such as pebbles, sand and mud, but are partly of chemical and some of organic origin, especially the limestones; they are called the stratified rocks, meaning strata which have been produced by the action of water. We have adopted these names of formations, such as the stratified and unstratified, fresh water and marine, aqueous and volcanic, ancient and modern, metaliferous and non-metaliferous formations.

The volcanic rocks are those which have been produced at or near the surface, whether in ancient or modern times—not by water, but by the action of fire or subterranean heat. These rocks are, for the most part, unstratified, and are devoid of fossils; they are the results of volcanic action and of craters more or less perfect; they are composed of lava, sand and ashes, similar to those of active volcanoes; and streams of lava may be traced from high summits or cones into adjoining valleys; and earthquakes have produced erosions, fissures and ravines (whereby we can detect porous lava, sand and scoriæ), dikes or perpendicular walls of volcanic rock, such as are observed in the structure of Vesuvius, Etna, and other active volcanoes. The basaltic rocks, forming the rocks of Staffa and of Giants' Causeway, are all volcanic; they have in their mineral composition much resemblance to the lavas, which are known to have flowed from the craters of volcanoes.

The plutonic rocks, which comprise mostly the granites, etc., differ much from the aqueous and volcanic; they are, in common with the next class, highly crystaline and destitute of organic remains; the plutonic comprehend all the granites and certain porphyries, which are nearly allied in some of their characters to volcanic formations. The metamorphic rocks, however, are stratified and often slaty, and are called by some the crystaline schists, in which are included gneiss, micaceous schists, hornblende schists, statuary marble, the finest kinds of roofing slate, and others. All the various kinds of granites which constitute the plutonic family are supposed to be of igneous and aqueo-igneous origin, and have been formed under great pressure at a considerable depth in the earth, or under a certain weight of incumbent ocean. Like the lava of volcanoes, they have been melted