using mortar is analagous to the French mixture known as Coignet's béton, which, when thoroughly rammed as above described, forms artificial stone of great strength impervious to water. M. Coignet appears to have been long anticipated by the Mexican builders.

Correspondence.

The Manifestation of Energy in Nature.

To the Editor of the Scientific American:

If we would ignore the assumed existence of the hypothetic ether, and look upon every particle of matter as being the center of a ubiquitous sphere of static energy or influence, natural phenomena could receive a better explanation. From our knowledge of matter we say that it is indestructible; and as every portion manifestly influences in its motion every other, we may say that its energy is practically ubiquitous, and continually exercised for the attainment and maintenance of equilibrium. Faraday supposed the existence of "physical lines of force;" and both Thomson and Maxwell show that this hypothesis gives a more correct view of electro-magnetic action than the usual mathematical expression. As then all that we know of Nature is summed up in matter and energy, we may fairly assume the physical existence of both, while looking upon the essential nature of either as beyond the reach of speculation. By this means we rid ourselves of unwarrantable hypotheses. Space becomes neither a vacuum nor filled with one or more impossible ethers. Electric or magnetic phenomena are not action at a distance, but action along unbroken lines of induced force within a body's sphere of energy, the transversal vibrations of such lines when broken into an advancing wave constituting heat and light.

The constitution of every cosmic system proves the physical existence of energy. Static potency is inversely as the distance from the center of exerted power, as shown by the lever or balance. The centripetal force varies inversely as the square of the distance, the centrifugal as the cube. This makes the revolving force to vary inversely as the distance, when both tendencies are produced from the same center, as in the common illustration of a sling—constraint and outward motion acting along the same connecting line. But the physical connecting line is necessary. Now we find, in every cosmic system, the energy of motion (velocity squared) of every revolving body to be inversely as its distance from the united balancing center.

The solar system, say, represents a certain amount of energy—that of the matter composing it—and is formed in the universal tendency to equilibration, by the matter blending its energies into one common concentric sphere for the mutual balance of the various bodies. The laws of Kepler, in regard to which there has been so much speculation, become inevitable. Equal areas are moved over by each body in equal times. As the force of motion is inversely as the length of radii in the concentric spheres encircled in revolution, the linear length defines the time occupied in motion by each body. The radii squared give the respective areas swept over in revolution. The areas (radii, or times squared) therefore, described by the different bodies, must be to each other as the volumes of energy in the concentric spheres of which they are great circles. The squares of the radii for areas are to each other as the cubes of the same for the volume of energy, which gives the areas to be moved over.

The blending of energies into one common center of balance explains the law of gravitation. For matter must approach until stable equilibrium is attained by the proportional masses, at the necessary distance from the united center of gravity. But by the principle of the conservation of energy, when the bodies have attained balancing distance in free space, the force of approach necessarily becomes transformed into revolutionary motion. Of this deviating force, the Newtonian law renders no account. But the ascription of physical energy to matter, with its universal tendency to equilibrium, not only explains but shows the necessity of the conservation of both centripetal and tangential tendencies.

The theorems of La Grange and La Place are necessitated also by the physical reality. For that definite amount of energy which centered itself for the equilibrated motion of bodies cannot otherwise than conserve what it formed, local action being continuously neutralized by counter strain.

My conclusion, then, is, that matter and energy are physical realities, because they constitute all that we know of Nature. The energy of every particle of matter we look upon as universal because it acts upon all others. The energy of every body is exercised in maintaining or in striving to attain equilibrium with all others, and may act either attractively or repulsively, according to the most powerful enforcement or solicitation; we find that Nature teaches this also. To this variation of action, according to molecular constitution, must be ascribed cometary eccentricities. In apparent defiance to the gravitating law, cases of division and permanent separation of parts have been witnessed. Static potency is inversely as the distance from the center of balance; as we see that a small body will, by a nearer approach to the center of the earth, raise a much larger, if only at a greater distance from the balancing center, although both originally were at the same distance from the earth's center, and the larger body attracting according to its mass. Radiant action, or vibration from the center of a body's sphere of energy, outwards, must vary with the square of the distance, and also tractive potency if acting in all directions. Such variations of potentiality bring about all natural charges amidst all tendencies to equilibrium; and the amount of energy in the universe is measured by its matter. The energy of the atom is no less universal than indestructible.

Philadelphia, Pa. WM. DENOVAN.

The Million Dollar Telescope.

To the Editor of the Scientific American:

Much has been said about this proposed instrument, and several plans given. I have another plan that, if it be not too visionary, will be far less expensive than and fully equal in its results to any other. I have read somewhere, or else I dreamed it, that if a plate of glass be placed over a circular opening and the air exhausted from behind it, the glass is bent back by the pressure of the atmosphere, and it may be made to retain this concavo-convex form. If this be true, why may not the lens be made in this way and filled with bisulphide of carbon? I see no reason why it may not, for all the glasses needed may be made of any convexity required Some genius can certainly work this out.

It has been proposed that the telescope be erected at Philadelphia, and that, during the exhibition of 1876, people be allowed to look through it at so much per head. This might do to raise money, and many would take the look just for the name of it, though very few would appreciate the sight. It requires a knowledge of such things and a taste for them to appreciate them properly. I have shown persons objects of the lesser world through the microscope; and though they considered themselves cultivated, they no more appreciated those beauties than would Lo, the poor Indian. There are many people, too, who are very fond of pictures; but after all, they do not appreciate them: they lack the knowledge of and taste for art. One may admire, and yet not appreciate. Thus it would be with the great telescope. While many might, from curiosity, want to gaze at the stars, the instrument would be doing mean service. Far better that it be placed at some point favorable for observation, and some experienced observer appointed to use it, and then we may expect it to do something worthy of so great an instrument.

I would willingly forego a look through it, much as I might desire it, that it might be used to better purpose. It is just the thing that I have thought of for years; if I were worth the million, I would have constructed it at my own expense for the benefit of science; but as I am worth less, I will have to stand back and wait awhile. Still, I hope the project will be carried out in some form.

Sans Souci, Ohio. X. PERRY MENTOR.

[Special Correspondence of the Scientific American.]

UP THE AMAZONS.

NO. 1.

PARA.—ITS SITUATION, CLIMATE, INDUSTRY, AND COMMERCE.

The largest city on the largest river in the world, and the sole commercial outlet of a region equal to the United States east of the Mississippi but really more fertile: such is Pará.

It is a city of strange contrasts. Founded two hundred and fifty years ago and having an unparalleled position, it has to-day but thirty-five thousand inhabitants, a slow growth, due mainly to revolutions, yellow fever, and absurd legislation. Standing seventy miles from the ocean, it is nevertheless approachable by the largest steamers. It is built on a low tract of land, so that at a distance it appears, like Venice, seated on the sea, with beautiful rocinhas nestling in gardens along the shore, and every variety of craft, from frigate to canoe, on the water; hemmed in between the river Guajará and a perpetual forest that stubbornly disputes every inch of ground; with picturesque avenues of mongubas, graceful palms, and superb bananas in elegant luxuriance: with unpaved streets, neglected plazas, dilapidated houses, sombre churches with grass and shrubs growing on their tiled roofs; with screaming parrots and toothsome vultures, yellow dogs and chattering monkeys; with wealthy Brazilians in spotless white, noisy Portuguese porters, idle soldiers, merry negresses with trays or water jars on their heads, sober Indian women with naked children astride on their hips or rolling in the street; with a mongrel population of amalgamated Portuguese, Indian, and Negro blood—mulattos, Mamelucos, Cafuzos, Curibocos, and Xibaros; everywhere the signs of human indolence and Nature's thrift, of filth and poverty alongside of overpowering beauty and wealth of vegetation, yet altogether leaving a pleasing impression on the mind which can never fade.

Pará (officially called *Belém*—the Portuguese for Bethlehem), is justly celebrated for the almost perfect equilibrium of its climate. The temperature ranges from 73° to 93°, the mean of the year being 81°. The heat is never so oppressive as in New York, being tempered by strong sea breezes and afternoon showers. Were it not for the imported diseases, Pará would be the paradise of invalids. In 1819 the small pox first visited the city, in 1850 came the yellow fever; and in 1855, cholera. The natives suffer most from the first epidemic, and foreigners from the second. At the present time (July), the small pox is at work, not only in Pará, but also in Manáos, a thousand miles up the river. As

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is at a low ebb and import duties high, living is dear in comparison with former rates or with what we might expect in a city on the edge of an empire of exhaustless fertility. Luxuries are exorbitant. Hotels charge $2.50, gold, per day. Enterprise runs mainly to small shopkeeping and wholesale trade in rubber and cacao. But there is progress toward a better state of things. We notice many changes since our visit in 1867. The passport system was abolished last year. The State religion is more tolerant (the Jews have a synagogue), and religious holidays, which once seriously interfered with trade and industry, have been reduced in number. Among the new public buildings are the President's Palace and the Grand Opera House. The latter will cost $500,000, and contain a theater accommodating 1,600 persons and a saloon holding 1,200, in every respect out of all proportion to the wealth and size of the city. There are two banks, with a joint capital of $6,000,000. The city is lighted by a London company, the gas costing four dollars per thousand cubic feet. A circular railway now connects Pará and Nazareth, and is well patronized by high and low. The rolling stock consists of five locomotives, fourteen passenger and eight freight cars.

There are very few Germans, French, English, and Americans in Pará; but of Portuguese there are about 5,000, all busily coining money as shopkeepers, artizans, carmen, boatmen, etc. The native Brazilians are exceedingly jealous of them. They complain that these foreigners are monopolizing the trade of the country; but instead of vigorously competing with them, they threaten to drive them back to Portugal. While agriculture, such as it is, is carried on by the Tupuyos or civilized Indians, the mechanical arts are mainly in the hands of the Portuguese. Among the

INDUSTRIAL ESTABLISHMENTS,

there are fifty-nine bakers, forty-three tailors, thirty-six shoemakers, thirty-two carpenters and joiners, twenty barbers (including such as bleed by lancet and leech), nineteen tinners and glaziers, sixteen blacksmiths, thirteen butchers, ten printers, eight sugar refiners, eight soap and tallow chandlers, eight makers of fireworks, four dentists, four bookbinders, four confectioners, three photographers, three saddlers, three tanners, and three potters. No foreigner can practice a profession (as medicine or law), and charge for his services, without a certificate from the University at Rio. Dentistry, being considered a mechanical art, is allowed. There are at present sixteen printing presses at Pará, from which issue fourteen journals—five dailies, three semi-weeklies, and six weeklies; four bookstores; one college (*Lycéo Paraense*) with twelve departments: a normal school, having a course of three years; a library, museum, and literary club.

The great want of the country is laborers of all kinds, but especially field hands. Agriculture has been ruined by the universal rush into "extractive industry," that is, the collection of the natural products, as rubber, nuts, sarsaparilla, etc. The rubber trade absorbs supreme attention; sugar cane is grown for the manufacture of rum, sugar being imported from the southern provinces; and the cultivation of cotton, rice, coffee, and cacao along the Amazons is nearly neglected. Another check to commercial enterprises is the high and irregular tariff. The duty on imports varies from five to eighty per cent. Ordinarily it may be reckoned at forty; but the same goods will enter at different rates, evidently depending on the caprice of the official. Bribery is openly practiced and expected. The duty on ready-made clothing is determined by weight, and on shoes, by the length of the sole. The usual cost of exportation is seventeen per cent; but the loss is much greater on certain products, as cabinet woods. This practically discourages labor by taxing it. Not $400 were collected at the custom house on all the woods exported from Pará in 1868-9. Brazil abounds with the most valuable timber in the world, but is prevented from competing with other nations by this system of self-strangulation. There are but two or three saw mills on the Amazons. A dozen boards of the common wood of the country (cedar or itauba) costs eighteen dollars at Manáos. Fine rubber costs about fourteen dollars an arroba (32 lbs.) up the river, and the loss is about forty-five per cent in getting it to Liverpool or New York, half of which is for freight and the other half for custom charges.

But Pará is destined to enjoy an enviable rank among the commercial centers of the world. She can never have a rival at the mouth of the Amazons, for she occupies the only available spot, the northern channel between Macapá and Chaves being scarcely fit for navigation. Standing at the gateway of a magnificent valley covered with the richest and largest forests on the earth and at the *embouchure* of a river which affords an unparalleled extent of water communication, touching every country on the continent except Chili and Patagonia, Pará must become the

LIVERPOOL OF THE TROPICS.

Her most prominent citizens are men of progress, and the dead weights on trade and labor will soon be removed.

At present the commerce of a country of such vast extent and resources is ridiculously insignificant. As most of the articles of consumption are imported, and many of those produced are exported, the foreign trade is greatly in excess of the internal.

In 1872 the value of exports to England = $2,766,761; to the United States = $2,371,138; to France = $466,788; to Portugal = $247,222; to Germany = $38,438; to Southern Brazil = $171,469.

The greater part of the rubber goes to England and the United States (about 2,500 tuns to each); cacao goes chiefly to France; Brazil nuts, copauba oil, and tonka beans to the United States; straw hats, sarsaparilla, and tobacco to Southern Brazil; piassaba and fish glue to England; cotton, sugar, rice, farina, hides and cachaca to Portugal. During last year there entered the port of Pará twenty-four steamers and forty-nine sailing vessels (tunnage 62,393) bearing the stars and stripes; thirty-five English steamers and eighteen sailing vessels (tunnage 41,937); thirty-nine steamers and ten sailing vessels (tunnage 41,845) of the Empire; Portuguese sailing craft, twenty three; French, nineteen; and from other nations sixteen. The total value of exports from Pará in 1871 was $6,710,501, of which $5,323,135 belong to rubber.

In my next I will treat of the navigation and commercial resources of the Amazons. JAMES ORTON.