Imponderable Agents.---No. 2.

[Second Series.

LIGHT—In our last number the theories of Descartes and Newton were presented, and their identity in relation to an undulatory action pointed out. The arguments we have adduced to prove that identity may be new, but not the conclusion. We have still something to add to them.

If light were composed of luminous particles projected through vacuo from the sun, then those particles, if possessing inertia—according to the corpuscular theory—must be deflected from opaque bodies, such as from the moon to the earth, and vice versa, and at last be deposited on all the planets and their satellites reciprocally. As these particles of light cannot be annihilated, it must follow that an accumulation of them should make our earth a luminous body. As there is no prospect of this taking place at present; and as the sun fulfills the same Divine office now as at the Creation—"giving light to the earth," we must conclude that the theory of a subtle ether pervading space, the vibrations of which produce the phenomena of light, appears to be the most rational. But we have stated that the luminous particles of Newton must, in the aggregate, form an elastic subtle fluid, and thus the theories of Newton and Descartes dovetail into one another. If those luminous particles do not form an elastic fluid in the aggregate, they must form "light-dust,"—an atmosphere of rigid particles—and if so, they can easily be weighed, but still this will not exclude them from the undulatory theory, for a motion impressed upon such particles must be undulatory. The readiness by which so many facts in relation to *light* can be explained by both Newton's and Descartes, theories, thus finds a solution; both are true—identical.

LIGHT AND SOUND—Euler has, in a most beautiful manner, compared the action of producing light by the vibrations of his subtle ether, to the production of sound, by the vibrations of our atmosphere. In explaining his theory, he employs a bell as an instrument of elucidation. In condemning Euler's explanation, it was said, "unfortunately for this hypothesis, it has been found that the conducting power of the air increases with its density, while wood and the metals are better conductors of sound than any other matter." This does not affect Euler's explanation, for density in bodies, independent of elasticity has nothing to do with propagating sound, and it was the great *elasticity* of his ether which Euler considered, gave it the power of producing undulations with such extraordinary rapidity. The above quotation conveys the idea that sound is conducted like water running through a pipe, not produced by vibrations, and is therefore not a proper explanation of the phenomenon. The power of any body to propagate sound, depends entirely on its elasticity—not its density. Taking air as unity, in producing sound, iron is equal to 17, while glass is also 17, and yet the specific gravity of the latter is to the former as 1520 is to 7786. Sound can scarcely be propagated by lead at all, and yet its gravity to iron is as 11,352 to 7,786. The velocity of sound through silver is 9, through copper 12, and yet the specific gravity of the latter is to the former as 8,788 to 10,474. Sound is propagated through the air with a velocity in proportion to its elasticity. An increase of temperature in the air of a close apartment augments the velocity of sound. A perfectly inelastic body, however dense, cannot propagate sound. This is well known to all those who are acquainted with the science of music, and with musical instruments. The elastic quality in bodies for producing and propagating sound, has no reference to their ductility, that drawing-out quality peculiar to some elastic substances—but the rapidity and power by which bodies, when pressed or impinged upon, return to their original state.

As we intend to present useful and interesting information on all subjects which have a bearing on these questions, the laws and phenomena of "Sound," may be profitably discussed. The aerial currents and fierce winds do not produce sound, and yet sound, loud and intense is produced without any current being felt in the air, by simple pulsations. How trite, then, is the comparison of Euler, namely, that Light, like Sound, is produced by the vibrations of a subtle elastic aeriform fluid.

It has been said of this theory that "a luminary emitting white light must, at the same instant, be vibrating at the different rates which produce all the colors in the spectrum."

This is not so; for these vibrations are modified in length and velocity by different media. If the objection were good, it would be equally so against any theory yet proposed. It is a curious fact, that sound is modified or affected in the same manner. The *pitch* of a musical sound is determined by the number of vibrations which reach the ear in a second of time. The sound of the steam whistle of a stationary engine is heard in a different key by a person traveling in a train in rapid motion, from that in which it is heard by a person standing beside it.

The same is true of all sounds. If an observer in a railway train be moving at the rate of 56 miles per hour *towards* a sounding body, he will meet a greater number of vibrations in a second of time, than if he were at rest, in the proportion to which the velocity of the train bears to the velocity of sound, and he will hear it a semi-tone higher than a person moving *from* the same sounding body at the same velocity. In the case of two railway trains running towards one another at this velocity, the one containing the sounding body, and the other the observer, the effect is doubled in amount. Before the trains come together, the sound is heard two semi-tones too high, after they pass two semi-tones too low—equal to a major third.

(To be Continued.)

Carburetted Hydrogen.

MESSRS. EDITORS—I beg to offer a few remarks in reply to J. F. Mascher's article, on page 90 of the "Scientific American," on the subject of Gas Burning. Combustion can only take place at the point where the substances which enter into combustion are immediately in contact—this is distinctly seen in the flame of a common gas burner. The true combustion is confined to a thin exterior sheet of the flame, and all within this is dark, affording no light whatever, because it is occupied by the combustible material or gas escaping from the source of its supply. The interior part of a gas flame varies in darkness according to the pressure of it in the pipe, and is incapable of entering into combustion and giving light from want of proper access to the oxygen of the atmosphere, which is indispensably necessary to the developement of combustion. There is also seen in gas flames a thin blue line around the exterior, which is caused by the low temperature of the gas, and affords little or any light; so that quite one-third of the gas flame is destitute of light. Now, the dark portion of the interior of a gas flame is simply the result of the gas escaping faster than the process of combustion can consume it. Mr. Mascher says, after charging the bladder with gas, "putting it under my arm the results were these; with a moderate pressure of the arm, I obtained the usual light, but on increasing the pressure to a certain extent, I was surprised to find that, instead of obtaining more light, the gas burned with a perfectly blue flame, and the room which was in the first place illuminated, suddenly became quite dark, although it is evident that with the increase of pressure there was an increased consumption of gas." Now my explanation is proved by the first part of Mr. Mascher's remarks, to be correct, that the dark portion of the flame, is caused by the gas escaping too rapidly for the process of combustion, which is unable to take it up so fast. But with increased pressure I don't think there is an increased consumption of gas by combustion; it is wasted because it is carried beyond the point where combustion is actually taking place by its own elastic force, when a considerable body of it is confined, thereby creating great pressure. CHAS. W. TYLER.

Philadelphia. Pa.

[Our correspondent fails to explain the phenomena described in Mr. Mascher's letter. By the theory above set forth, a white flame should give the most intense heat; but this is not so in fact. If we take a common gas white flame and reduce it to a blue flame, it will give out more heat in the latter case, but less light. The white flame of gas light does not depend upon the intensity of the heat, but the time and space, to allow the solid particles of carbon in the gas to be become incandescent. That the carbon can be consumed (converted by oxygen into C. O.^{2}) during combustion without producing white light, is something which Mr. Mascher's experiment went to prove, and this contrary to the views generally entertained respecting gas illumination in one case, and respiration is a conclusive proof of the same fact in another case. As the white light was depreciated in intensity, by those experiments, the heat was increased. By the undulating theory of light, the blue waves are shorter and more rapid than the red and the yellow, and this has its parallel in the gas flame when the pressure is increased. The way to prove this is to take the socket of a common gas burner, and cover it with a disc of fine wire gauze. The gas will burn above the wire gauze with a yellow flame, which gives more light than a blue flame; by converting this yellow into a blue flame, the heat will increase but the light will decrease. Now, whether is the greatest amount of heat produced by the most perfect combustion, or the greatest amount of light? Some may say, "the most perfect combustion produces both the greatest amount of heat and light," and yet here is an experiment which proves that the heat is increased in a gas flame at the expense of the light. The yellow flame above the wire gauze is converted into the blue flame by blowing into it with a blow-pipe. This device is well known to all jewellers, and has long been employed by them for soldering. A heat can thus be produced so intense as to melt gold rapidly. The fact is, however, that light can be produced independent of what is understood as combustion, that is, the chemical union of oxygen with carbon to produce carbonic acid gas by a flame. No carbonic acid gas is formed by the electric light, which is the most brilliant of all, hence from this we may infer that those sages of the British Association who have forebodings of the sun's light decreasing, may rest contented, for in Nature, provision is made for the production of light *ad infinitum*.

Large Ships - Ancient and Modern.

As the question of large ships appears to engage no small amount of public attention at present, by the construction of the "Great Republic," and the proposed mammoth steamer of the "Eastern Steam Navigation Company" in England, it may not be uninteresting to devote some space to more than a mere passing notice of the subject.

Some ships were built by the ancients, which for mass far surpassed any now afloat. One was constructed for Ptolemy Philopater, which was 420 feet long, 56 feet broad, and 72 feet deep, and of 6,445 tons burden. The "Great Republic" is 325 feet in length, 58 feet in width, and 39 feet in depth, with a registered burden of 4,500 tons but it is capable of carrying more than 6,000 tons of cargo. It is recorded that Archimedes—who was perhaps the greatest mechanical genius that ever lived—constructed a ship for Hiero, King of Syracuse, of such large dimensions that none of the harbors in Sicily, or Greece could receive it. Noah's ark, by those who are curious in such things, has been calculated to have contained 1,500,000 cubic feet, and was of 11,905 tons burden. As this vessel was of antedeluvian origin, it may be allowed to stand out as a giant representative of nautical architecture, belonging to the age of giant men, but architects are now determined to surpass even the great father of their calling, by constructing a steamship of 22,942 tons burden, and of an external bulk of 2,973,593 cubic feet. This is the vessel to which we have alluded; it is to be built of iron, a substance which would have been deemed by the ancients better adapted for sinking than swimming. The largest mercantile steamships afloat at present, are those of the Collins Line; the "Arctic" being 3,000 tons burden—the only exception to these is the Great Britain, which is 3,445 tons burden. There is one—the Hymalaya—now in the course of construction, by the Cunard Company, which is to be of 3,532 tons burden. A remarkable difference between modern and ancient times, in state and condition, is exemplified in the "Great Republic." It is the property of a private American citizen; the wealth and resources of all Sicily was called into requisition to construct Hiero's leviathian.

Two hundred years ago the largest vessels were about 80 tons burden, and with a vessel of 60 tons Columbus crossed the Atlantic and discovered our continent. Ten years ago the largest merchant ships afloat were of no greater tonnage than from ten to twelve hundred tons burden, while at the present moment the general tonnage of new built ships range about double that amount. It would therefore seem as if the bent of the nautical mind was in favor of "large ships." There is a line of demarcation, however, in magnitude, beyond which ships cannot be constructed either with safety or profit. The latter consideration entirely depends on the length of voyage, the former on the strength and combination of materials employed in the construction; and the manageableness of the ships at sea. For long voyages, large ships are the most economical, for short voyages on all ones. The other consideration, *safety*, Griffith, on page 114 of his "Ship Builders Manual," says, "shipbuilders are mistaken when they assume a large ship to be equally strong with a small one, and as vessels are increased in size, the leverage of the spars tell with more effect. As a consequence, the liability to the damage of cargoes in large vessels is greater than smaller o es, more particularly clipper hips, because of their increased length." Here is a statement which afford s me solution to the complaints from San Francisco, of the great damage sustained by cargoes in recently constructed large clipper ships which have made voyages to that place. "Some other measures,' says the same work, "must be adopted for strengthening such vessels." New improvements, therefore, are demanded in the combination of materials in the construction of large ships. The "Great Republic" is stated to be not only the largest but the strongest built ship in the world, and no doubt the boundary line of safety for large ships is far from being reached yet, but where that line is, we cannot tell, nor do we find any satisfactory information on the subject in any of the works we have consulted. Large vessels cannot be managed in a rough sea so well as small ones; they are not so obedient to the helm. As Napoleon said in respect to Generals, "there was only one in Europe beside himself who could manœuvre 100,000 men," so it may be said of sea captains; it certainly requires greater mental capacity to command a large than a small ship. Revolving the subject of large ships over and over, and taking into consideration the great advances which have been made in the size of ships since the Galleon of Columbus touched the Columbian shore, it is our opinion that we shall yet see much larger ships in our harbor than any which now float there; the "Great Republic" is a shadow of "coming events."

Beware of Putting "Patent" on an Unpatented Article.

On the 9th inst., as we learn by our Boston cotemporaries, a very important patent case was tried before Judge Sprague, in the U. S. Circuit Court in that city. The complainant was J. R. Nichols, the defendant J. Newell and others. The suit was brought against defendants for putting the word *patent* on certain articles which were not patented, in violation of the patent law, which make a fineable offence of $100 for every case—one half of the fine goes to the informer. The defendant was fined $400. The articles against which complaint was made, were camphene lamps and cans. Both parties are well known to our readers.

Dr. Bridgeman says that the last census of China which he saw in print was for the year 1813, which made the population of the Empire more than 361,000,000. He is confident that the present population cannot be less than 400,000,000.

Henry Ramsey, C. E., of Schenectady, N. Y., has been appointed State Engineer.