Persistence of the Different Colors on the Retina.

Light has been hitherto considered as divisible only into the various colored rays by single, and into polarized rays, by double refraction; a new distinction has been discovered, founded on the varied persistence of the impressions made by the different rays on the retina.

It has long been known that the impression made by light does not cease with the cause that produces it. And it has been found that luminous impressions repeated at intervals of time appear to the eye continuous. It is on account of such apparent continuity, that a stick lighted at one end and made to revolve rapidly round the other as a center, seems to describe a circle of fire. The apparent continuity of sensations which are in reality intermitting, is not confined to those connected with vision; sounds repeated at very short intervals appear to be uninterrupted. In fact, every sound, however sharp, is but a series of different vibrations.

The consideration of these facts leads to practical conclusions. If, in ornamentation and music, the sensation of a second color, or sound, may be produced before that of the first has disappeared, the co-existence of colors or sounds, which are primarily intended to act only in succession, must be kept in view; and the sound or the colors must be such as to produce in the one case musical, and in the other pictorial harmony.

M. Laborde has lately communicated to the Academy of Sciences researches on this subject in connection with colors; and the conclusions to which they lead are very curious. He has found that the retina decomposes the rays of light in a manner different from that either of the prism or the double-refracting crystal. These disperse the rays with reference to different points of space, the retina disperses them with reference to different points of time.

In the experiments which were made, the light of the sun was received on a mirror which reflected it horizontally through a chink formed in the shutter of a darkened chamber. This chink was about the tenth of an inch wide, and the fifth of an inch high Very near it, and within the chamber, was placed a metallic disk, around the edge of which were formed openings corresponding with, and of nearly the same dimensions as that in the darkened chamber. These openings were at considerable intervals; the disk was made to revolve by clockwork; and a means by which the operator, though at a distance, could moderate, accelerate, or arrest the revolution of the disk, was provided. Across the path of the luminous ray, and at the distance of about three feet, was fixed a plate of roughened glass, behind which the experimentalist observed the modifications of the light. The disk being set in motion, the luminous ray reappeared at certain known intervals. When it was made to reappear slowly, it seemed of a uniform white color; but when it reappeared at shorter intervals the edges began to be colored; and as the velocity of rotation was increased, the image passed successively through the following tints—blue, green, rose-color, white, green, blue. After the latter blue no increase of velocity produced anything but white.

It thus appears that some of the colored rays cause a more lasting impression on the retina than others.—*The Scientific Review.*

The Channel Tunnel.

A writer in a late number of *Chambers's Journal* enumerates no less than eight different projects for uniting England and France by uninterrupted communication. The first was proposed by a Frenchman named Mathieu, at the commencement of the century. His was a tunnel for a line of diligences. A few years later the plan, which had been lost sight of in the hostilities between the two countries, was revived by MM. Franchot and De Mottray, who proposed a cast-iron tube on the bed of the sea. M. Payerne suggested an improvement in a tunnel of brick masonry and concrete. After the introduction of railways a French engineer named Favre, proposed a tunnel for steam carriages. Two Englishmen followed with a proposition for a triple tunnel. In 1857 Thome de Gamond advocated a series of shafts, lighthouses, quays, etc., in connection with a tunnel. Five years ago, J. F Smith, an Englishman, planned a wrought-iron tube to be suspended by piers some forty feet beneath the surface, a gigantic Victoria or Britannia bridge, or tunnel, sub-aqueous. At present Mr. Hawkshaw, the eminent London engineer, is boring to ascertain the character of the strata beneath the channel, to demonstrate the feasibility of a tunnel; while Mr. Fowler, the engineer of the Metropolitan Underground Railway, of London, proposes immense ferry boats sufficient to take a whole train on board.

This last appears to be the most feasible and practicable scheme. The difficulties to be surmounted in the excavation of a tunnel, its cost, the danger of injury to the structure, and the popular opposition to travel by such a route, are obstacles which are almost insurmountable.

SCHNEIDER'S ARTIFICIAL LEG.

The casualties of the war have created a great demand for artificial limbs, which has directed invention toward their improvement. The annexed engraving gives a view of a light and apparently successful substitute for the natural leg where the amputation has been performed below the knee joint

The sheaths, A, envelop the leg and stump, and are secured by lacings or some equivalent device. Attached to their sides are supports of iron or steel, jointed at B, to give the proper movement at the knee. The lower supports are attached to the sides of a foot, C, having a swell to compare with that of the ankle joint on the natural limb. This foot is intended to be worn in a boot or shoe. The movements of the foot are governed by strips of shirred rubber, D, one attached to the instep and two others to the heel. They can be adjusted by means of buckles, as shown.

This improvement was patented by Jacob Schneider, Aug. 15, 1865. State and county rights and further particulars can be obtained by applying to Jacob Fricke, 110 East Pearl street, Cincinnati, Ohio.

J. NORTON writes to the editor of Saunders' *News Letter*, Dublin, Ireland, that he used an ogival-headed iron shot, in a trial at Woolwich Arsenal, more than thirty years ago, and the flat-headed steel shot at the same time. Specimens of these projectiles he deposited in the museum of the Royal United Service Institution. He says he cast iron shot in iron molds in 1826, thereby antedating Palliser twenty years.

THE British Admiralty have adopted zinc as a sheating for the bottoms of the new iron ships now building.

THE Census Bureau estimates the present population of this country at 35,000,000.

Correspondence

American Iron and Steel.

MESSRS. EDITORS:—I notice in your issue of Oct. 6th an article on "Steel from American Iron," ascribing the deficiency in quality of American steel to the quality of iron used. Of the Cranberry ore, of North Carolina and East Tennesee, you may have heard. This ore will make an iron as tough as the best Swede, but it is very far from market. In the good, slow, old State of North Carolina there are ores from which can be made an article of iron that may be converted into a steel as good as any English, and these ores are easily accessible. I have now in my possession samples of such ores and will be pleased to give them to any one who may send their address to me. The wrought iron made from the ore in the ordinary Catalan forge, stood a test, in Washington City, of 72,000 lbs. to the cubic inch. The mine is located convenient to transportation, and one-third of the ore bed with 15,000 acres of well-timbered land, is offered for sale. My opinion is that the pig might easily be delivered in New York for $30 per tun, including all expenses.

Further east, on the Cape Fear River, is an immense deposit of iron ore, pronounced to be the largest east of the Missouri Iron Mountain. It was worked by two companies during the war; both making pig metal. It is immediately on the Cape Fear River. with two or three locations of great water power near it; navigation to Egypt, where connection by railroad to Fayetteville is perfect and cheap. The ore is specular oxide of iron.

One of the furnaces which worked this ore is worthy of mention from its peculiar construction, It was designed and constructed by two practical Scotch iron makers, part owners. The boshes were lined with agalmatolite, silicate of alumina, and were built up their hight of stone. Above was a mere pen of logs strongly dovetailed, the inner lining of the furnace brick, and between the logs brick clay was packed. This furnace cost about $100,000 in Confederate money, including houses, opening, canal boats, water wheel, etc Its capacity was about four tuns a day. The iron was pronounced the best for car wheels ever obtained from American ore.

The other furnace was located twenty miles from the bed, was worked by steam power, but for some reason never made quite so good iron. It is still in operation. The first was burned after Lee's surrender.

H. E. C.

Preservation of Wood.

MESSRS. EDITORS:—I notice in your last paper that the remarks I furnished you have called forth a lengthy communication from a correspondent, who partially agrees with me concerning the effects of charring the wood, but feels himself justified—by reference to weighty authorities—in being skeptical as to my other assertions. I will not occupy your valuable space by controverting such authorities as Ure and others, but will endeavor to show your correspondent how he can convince himself, by experiment, of the fact that living organisms (fungi or animaculæ) are the originators of all fermentation and putrefaction, and that where these germs have been destroyed, and the access of fresh germs is shut off, no putrefaction or fermentation will take place.

Take two glass bottles and fill them partially with a fluid that will easily ferment or decompose, carefully cork each bottle and insert in each a glass tube about six inches long, drawn out to a point. Bring the contents of both bottles to the boiling point, and after the steam has blown off, close the tubes by a blow-pipe quickly.

Now, having hermetically sealed up your bottles, the fluid contained will remain good for any length of time, because, first, the germs are all destroyed, by boiling, and, secondly a vacuum has been formed. If, after some time, the glass tube is broken so as to admit a quantity of air as before, so that it may become thoroughly heated by slowly passing through the red hot tube close the opening and let this also remain for any length of time. On examination the contents of the first bottle will be found in a state of putrefaction and the microscope will reveal organic life, but no such change can be detected in the second.

Now, it is evident, that in the air which passed through the red hot tube, the vitality of the parasitic germs floating in the air were destroyed. The experiment thus proves incontestibly that these germs are absolutely necessary to give the first impulse to decomposition, also, that the rapidity is dependent on the quantity of germs present or introduced artificially, or the quantity of soluble albumen present and temperature. No germ is capable of retaining its vitality at the boiling heat of water, and where the albuminous substances have been coagulated or decomposed by a higher degree of heat, though not high enough to char the wood, the conditions for decay will be reduced to a minimum, and only a very long exposure to moisture will affect it, for the fiber is scarcely subject at all to decomposition unless in contact with decaying albuminoids. HENRY STURZ.

New York, Oct. 3, 1866.

A Universal Signal Code.

MESSRS. EDITORS:—In the SCIENTIFIC AMERICAN of September 1st, I had the honor to suggest a plan by which a simple system of signals could be obtained for general use. That article having attracted some attention, permit me to say a few words more on the same subject.

The plan proposed by Mr. J. Wyatt Reid, in your issue of September 8th, is, in my opinion, altogether too complicated for general use, however good it may be for the purpose for which it was originally intended. It requires four flags of different colors, a four-sheaved signal block and halliards, a flag-staff, and, in some instances, a dictionary. It might work well on shipboard or at permanent signal stations, but for adventurers, surveyors, builders, manufacturers, and others, it would be impracticable. What is wanted is a system of universal application, even if there are no flags or halliards within a thousand miles.

The plan proposed by Mr. Solon Robinson, in your issue of September 15th, is much better, but any one who has been connected with the Signal service would tell him that there is a much simpler method. Being compelled by an oath of secrecy to abstain from any explanations concerning how this is accomplished, I am anxious that the Government should confer a favor on the nation and the world by making public a code for general use. By means of a general dictionary containing the ordinary words of all languages this code could be made an international one.

Permit me to suggest, in addition, that the proposed system is entirely practicable, having been used during the late war with perfect success, and having been the subject of the praise of every General and Admiral in the United States service.

GEO. C. ROUND.

Binghamton, N. Y., Oct. 3, 1866.

[Probably the Government could, without detriment to its own interests, make public a system by which communication could be maintained between parties separated by distance, as a system of ciphers could be readily adapted for secret service. It seems as though a plan of this sort might be rendered useful and of great benefit in case of shipwreck, and in other situations where human life or property might be in danger.—EDS.

A New Way of Cutting Glass.

MESSRS. EDITORS:—It frequently happens that chemists and others wish to utilize some bottle or piece of broken glass apparatus, by cutting it in a certain manner. As some persons experience great difficulties in doing this, I will communicate to you, for the benefit of such, a very simple means by which glass can be easily cut in any direction.

Take of powdered gum tragacanth, one-eighth of an ounce, dissolve it in sufficient water to form a middling-thick paste, then dissolve one-fourth of an ounce of finely-powdered gum benzoin in the least possible quantity of strong alcohol; mix both solutions thoroughly and add to this a sufficient quantity of finely-powdered beech wood charcoal to form a doughy mass a little thinner than pill compositions. Out of the above mass roll little sticks about four inches long and three lines thick, and let them dry spontaneously. If, after being thoroughly dried, one of these sticks is ignited, it burns to a fine point until it is entirely consumed.

The glass to be cut is first scratched deeply with a diamond, then one of the above sticks is ignited and held, with a very slight pressure, on the crack, in the direction the cut is to proceed, and it will be found that the cut will follow in any direction the "taper" may be drawn. The taper must be withdrawn every few seconds and brought to a more lively burn by brisk blowing, as it is cooled by the contact of the glass.

This method is very successful. I have cut "spirals" two-thirds of a line in width, out of thin glass tubes, by this process. Lamp chimneys having cracks may be thus cut with rapidity and ease.

V. G. B.

Brooklyn, N. Y., Oct. 8, 1866.

Shot Guns.

MESSRS. EDITORS:—Your correspondent "J. Richards," of Ohio, wants to know "what will make a gun shoot close." I can tell him: Clean the muzzle inside down a quarter of an inch or more, then warm it over an alcohol lamp, and with a tinman's soldering iron and fluid, tin over the inside to the thickness of thin card paper. Trim it out smooth, leaving it of equal thickness all round, and he will be astonished at the improved shooting of his scattering gun. I have found, by experimenting, that the shooting qualities of a gun are mainly in the muzzle, and there perfection is wanted. I claim the above as my invention, though I never have asked for a patent. A gun treated in this way will not only shoot close, but will drive the shot with much greater force. S. M. BLAKE.

Bellows Falls, Vt.

EXPERIMENTS IN RAISING VESSELS.

[From our Foreign Correspondent.

MESSRS. EDITORS:—Not long since an important trial was made of an apparatus invented by M. Eyber, a Prussian engineer, designed for raising sunken vessels. The general appearance of the machine is that of an elongated ellipsoid, thirty feet in length by twelve feet high, covered with a waterproof pliant fabric, a square centimeter of which will sustain a tension of one thousand pounds. Around the whole structure is stretched a cord net, the ends of which are to be attached to the wreck. By this means the weight—which may amount to more than one hundred tuns—is distributed equally over the whole surface of the apparatus.

From official sources, we are safe in estimating the average number of trading vessels annually lost upon our coasts as high as fifteen hundred. The ocean has thus become literally paved with numberless fleets, lying for the most part not far from land, in comparatively shallow water. Independently of the cargoes, the recovery of the wrecks alone is an important work, for being usually imbedded in the mud, the wood-work remains uninjured by the sea worm, and the iron work suffers but little from rust or other causes. For recovering these sunken vessels hydraulic cranes, placed on rafts, are often employed, but the power furnished by any single crane would be quite insufficient for raising a small packet-boat weighing but 800,000 pounds, while the use of a system of cranes is not possible, for the least rough sea would destroy the whole structure. Chaplets formed of casks are also impracticable, for in such a system if a single cask is broken by the waves the equilibrium of the whole is destroyed, and the wreck, even if partly raised, will be again lost.

India-rubber bags have been tried and failed as did the casks; they are too lightly constructed; moreover, the cloth can never furnish sufficient resistance to the weight of the water, for if inflated when at a great depth, then re-ascending, the inside pressure will prove greater than the outside, and the bag will burst in consequence.

The use of iron boxes and, indeed, many other methods, have been resorted to, but for one reason or another they have failed in satisfactorily accomplishing the object sought.

After many years of study and investigation, M. Eyber has invented this submarine machine for raising vessels, pronounced by competent authorities in every way superior to any mode now in existence. The funds necessary for building the first *Narwal*, as the inventor has named it, were furnished by the Imperial Administration, the general Trans-atlantic Company, and a committee from the maritime insurance companies. The Emperor has granted M. Eyber an audience, and has also shown him special marks of favor.

The trial trip for testing the value of the invention took place as above, on Cazaua lake, in the presence of the Prefect of Puy de Dome, the Sous Prefect of Riom, the Commanding General, other civil military and naval officers, and a large concourse of people. The experiments were perfectly successful, the *Narwal* rising gracefully to the surface of the lake having attached an immense boulder weighing sixty tuns.

The Government was represented at this trial by a naval engineer, M. Lisbonne, sent by the Minister de la Marine. In his official report he speaks thus favorably of the working of the apparatus: The "results of the experiments made on Cazaua lake, prove the machine of M. Eyber in every way superior to any that have hitherto been devised.

The use of an elastic air and water-tight fabric, is peculiarly adapted for submarine apparatus. The regularity and easy working of the machine, and above all the immense power it is capable of exerting, have been demonstrated in these experiments, but so far as relates to the raising of vessels, actual trial alone can testify. C. D.

Paris, Sept. 18, 1866.

Notes and Queries

T. J. M., of Minn.—On account of the convexity of the earth, seven or eight inches of the lower part of an object is concealed from an eye at the distance of a mile, and looking from the surface. But it does not follow that at ten miles only seventy inches would be concealed. We refer you to the properties of secants in trigonometry.

M. M. B., of Del.—The method of finding the hight which a ball fired upward will reach is very simple. You only need to know the number of seconds of interval between the firing and reaching the ground again. Multiply the square of half the number by 16. Thus, if the interval be 10 seconds, the hight was

$$5^2 \text{ or } 25 \times 16 = 400 \text{ feet.}$$

W. L. F., of Ill.—Iron to be coppered by the battery should be cleaned with very great care. If the work is important it is well to give it a preliminary coat of pure iron by the battery; this last is almost indispensable for cast-iron work. The coppering solution for iron is cyanide of copper dissolved in cyanide of potassium. After the object is covered, the coating is thickened in the ordinary sulphate of copper solution.

J. B. E., of N. Y.—A varnish made of Canada balsam is an excellent transfer varnish, equally effective on glass and other surfaces.

E. H. L., of Ohio.—Kinkel and Hubbe's propeller is in principle nearly the same as the well known Barker mill, and therefore does not require a lengthy discussion in this paper.

W. D. A., of N. Y.—We are not aware that any thing further than what you refer to has been published on the new bleaching process. You can procure the chemicals from any of our wholesale druggists.

J. B. F., of Conn.—To make permanganate of potash, take 10 parts caustic potash, 8 parts peroxide of manganese, and 7 parts chlorate of potash. Dissolve the soda in the smallest quantity of water, then add and triturate the other ingredients; evaporate to dryness; ignite at a low red heat, when cold dissolve in water, and you have a solution of permanganate of potash. To make permanganate of soda use caustic soda and chlorate of soda instead of potash and chlorate of potash in the above formula.

G. A. of Ill.—Receipt for black ink, 12 oz. bruised galls, 1 gallon cold water; after digesting a day or two, add 6 oz. copperas and 6 oz. gum arabic, and a few drops of creosote or oil of cloves. Let soak with occasional rousing up for two or three weeks, then strain from the sediment.

G. H. S., of Mass.—If the mold in which you cast your bronze is too tight, the result will be a porous casting. It should be permeable to the gases generated by the contact of the metal with the sand, or they will be confined and "blow", the casting. Possibly you use too much loam and not enough of sand in the composition of your molds. Perhaps your metal is not poured at the right temperature. When the zinc gives off a flame from the top of the crucible, the metal should be poured.

W. R., of N. Y.—The horse-power of stationary and portable engines is the same in this country and England, and is used to denote the estimated working capacity of the engines.