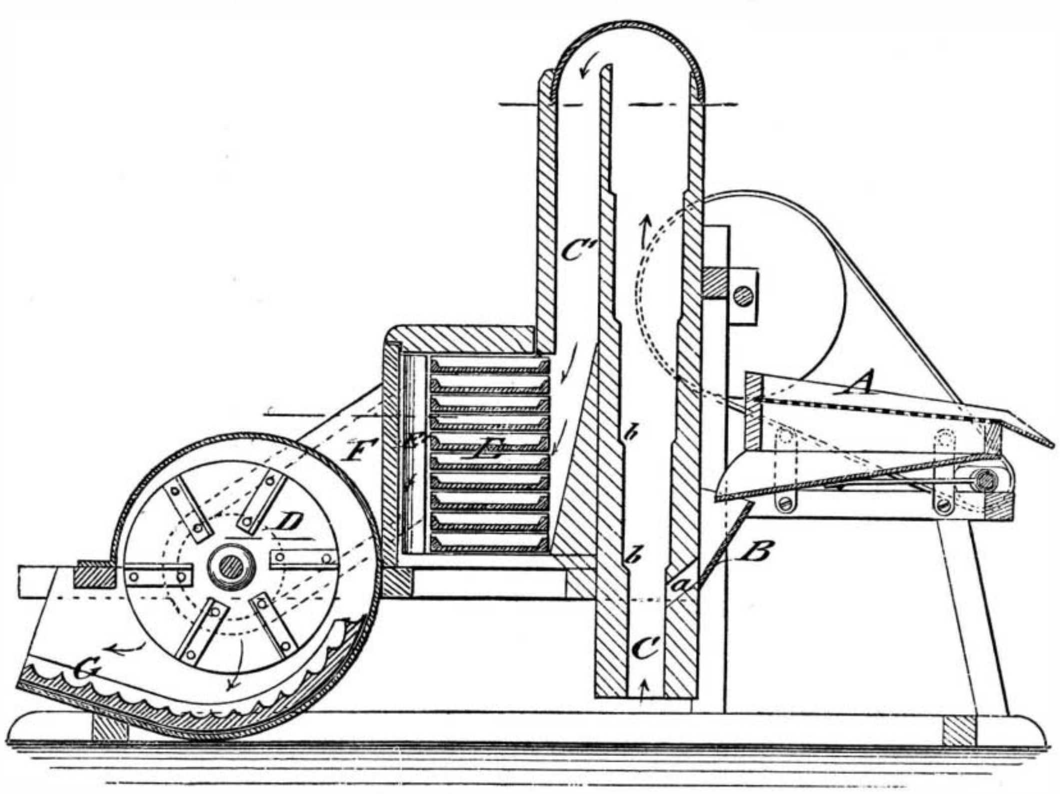
IMPROVED AMALGAMATING APPARATUS.

The improved apparatus illustrated herewith is for separating gold from sand and other impurities by means of a suction blast. A represents a reciprocating screen, on which the gold-bearing sand is placed. The bottom of the screen is inclined in opposite direction to the perforated part, and conveys the material into a hopper, B, of the upright suction tube, C, from where it passes through an aperture, *a*, into the lower part of the same to be acted upon directly by a suction blast from below, the blast being created by a suction fan, D. The air enters through the open bottom end of the suction tube, which is made with inclined steps, *b*, that produce the gradual widening of the tube toward the top end. These steps serve to throw the sand, dirt, or other substances that slide down at the side of the tube back into the current of air, to be acted upon and carried in upward direction. The heavier gold particles drop down into a suitable receptacle below the bottom opening of the suction tube, while the lighter ones pass with the sand along the semicircular top part of the tube, and over the partition wall into the downward extending tube, C′, that conveys the sand, in connection with a steeply inclined bottom, to a series of amalgamating pans, E, that are filled with quicksilver, and placed so closely together that the total width of the narrow spaces or interstices between the pans is equal to the width of the entrance opening of the suction tube. The gold-bearing sand is thus carried with considerable power through the spaces between the pans, the fine gold particles being absorbed by the passage in close proximity, and the affinity to the quicksilver.

A central tapering partition, E′, at the opposite side of the pans, divides the current and conveys the sand sidewise through the side ducts, F, to the center of the suction fan, from where the same is thrown by centrifugal power on a curved and tangential fluted pan, G, at the bottom of the fan casing. The remaining particles of gold are amalgamated in the fluted pan, and the light impurities thrown to the outside of the casing. Thus the gold particles are separated in their course through the apparatus, the heavier ones being dropped in the suction tube, while the lighter ones are amalgamated in the pans, and the remaining ones, that are mechanically carried along, in the fluted pan at the mouth of the fan casing.

This machine was patented through the Scientific American Patent Agency, July 4, 1876, by Mr. Thomas W. Irwin, of Port Madison, Wash. Ter.

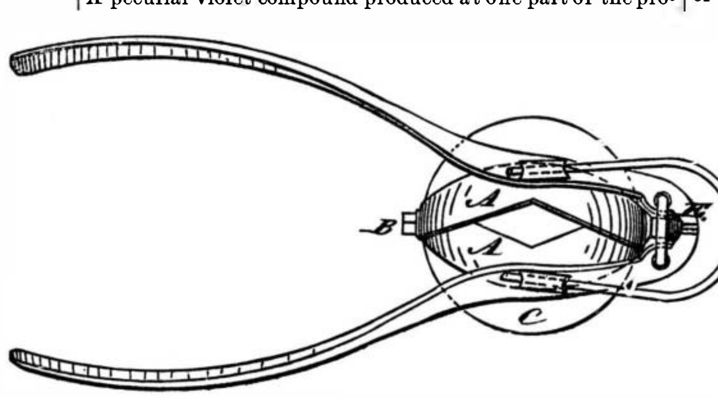


IRVIN'S AMALGAMATING APPARATUS.

NEW LAMPWICK TRIMMERS.

Mr. John Bannihr, of Hempstead, N. Y. has patented (July 4, 1876) through the Scientific American Patent Agency, a novel improvement in lamp wick trimmers, which is represented in the accompanying engraving.

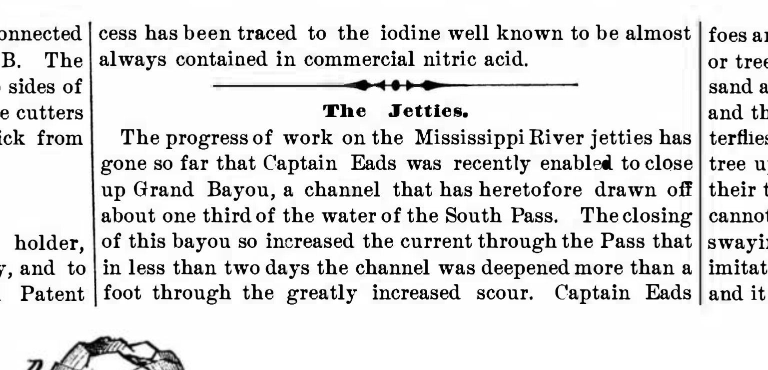
The shear cutters, A, are contrived to cut alike and at the same time from both edges of the wick to the center, whereby the wick is trimmed better and more uniformly than when cut across from one edge to the other. The cutters, which are curved for trimming the wick in form for an oval burner, are extended down at the ends a suitable distance below the point of cutting, and pivoted together at both ends, B, and also to a supporting ring, C, that rests on the burner some distance below the top for a steadying support, and for a gage to govern the hight of the cutting above the top of the burner The levers for working the cutters are pivoted to the standard, E, mounted on the ring, C, and are connected to the cutters at the center between the pivots, B. The edges of the cutters are shaped in the form of two sides of a triangle, the apex of which is at the center of the cutters lengthwise, thus enabling them to shear-cut the wick from its edges to its center.



BANNIHR'S LAMPWICK TRIMMER.

A NEW EGG HOLDER.

The annexed engraving represents a simple egg holder, devised by Mr. Henri Guilbeault, of New York city, and to him patented through the Scientific American Patent Agency, July 4, 1876. It consists of a cup, B, of suitable form, with a ring, D, and spring tongs, A. The parts are combined, as shown, in such manner that an egg placed in the cup may be securely held by bringing the ring down upon the egg by sliding a double button, C, which connects the jaws of the tongs, through slots made in them for that purpose. The egg is thus held while it is being eaten from the shell.



GUILBEAULT'S EGG HOLDER

A New Chicago Rolling Mill.

The Joseph H. Brown Iron and Steel Company, of Chicago, are nearly ready to begin operations in their merchant mill. All finishing trains, except the 22 inch beam mill, are ready to operate, except making steam connections. The puddling and heating furnaces are ready to work and the boilers in place. The bar mill and 9 inch train are in position, as well as the top and bottom mill. They are building a blast furnace 18 feet by 80 feet. This will be, when completed, one of the most complete establishments in the West. It has six double puddling furnaces (Siemens) with a daily capacity of eight tuns each on double turn; two scrap furnaces (Siemens) with a capacity of 20 tuns each per day; and five Siemens' heating furnaces, 32 gas producers, a 22 inch beam mill to roll 90 feet long; 16 inch bar, with six stands of rolls; 9 inch guide; 20 inch top and bottom mill; 20 inch muck train · all these are three high. There are sixteen 40-inch boilers, with 40 3-inch flues in each. They also have drawings for a complete Bessemer plant.—*Iron Age.*

Purifying Carbon Disulphide.

Recent chemical investigations seem to have included the whole range of photographic materials, and, in addition to those already named, we find our notes call attention to a mode of purifying the most useful material for dissolving india rubber—carbon disulphide. In the state most commonly presented, it possesses such an intensely fœtid odor as to make its use unbearable; the new process promises a product in a very pure condition. The method of purification consists in mixing fuming nitric acid with a sample of the disulphide distilled off palm oil, and then adding distilled water, filtering, and distilling between 50° and 60°. A peculiar violet compound produced at one part of the process has been traced to the iodine well known to be almost always contained in commercial nitric acid.

The Jetties.

The progress of work on the Mississippi River jetties has gone so far that Captain Eads was recently enabled to close up Grand Bayou, a channel that has heretofore drawn off about one third of the water of the South Pass. The closing of this bayou so increased the current through the Pass that in less than two days the channel was deepened more than a foot through the greatly increased scour. Captain Eads thinks that this will soon tell on the main bar; and in fact the pilots say its effect is already so marked that they can take over the main bar any vessel drawing twenty feet of water. If this be the case, the work on the jetties has already accomplished much more for the South Pass than many years of laborious and expensive dredging have been able to do for the Southwest Pass.—*Philadelphia Ledger.*

The Resources of Animals.

Animals, even of the least important species, sometimes resort to shifts and expedients, to defend and support their existence, so curious as to astonish even those observers who are most familiar with their habits. The little gossamer spider, having no wings, still finds its home in the upper air. Weaving a tiny kite of web and flying it aloft by unwinding a thin kite string from its spinneret, it finally fastens the lower end to a twig, and climbs fearlessly up the filament, till at last it sits far above the earth and catches midges upon its floating raft in the air. This little forager has been found sailing in the air nearly a mile high by balloonists!

The male spider has usually a very poor show for liberty or even for life. Small and lean, weak and cowardly, a mere speck by the side of his big blushing sweetheart, she generally catches him when he first comes courting, spears him with her fierce mandibles, gnaws the quivering flesh off his bones, and flings his polished skeleton into the sewer. She is heartless and ferocious —a coquette and a warrior. Woman's rights are carried to an extreme. The husband is not allowed to vote or to govern his own family. Before his brood of 1,000 children have climbed merrily upon their mother's back, she has generally made a breakfast off him, and his bones bleach in the back yard.

Then there is the hermit crab, the pugnacious crustacean that can seldom succeed in preserving its own life at all except by finding the shell of some large snail or whelk to crawl into. Having a bulky and soft abdomen, it is peculiarly vulnerable to attack from predacious fishes and crabs, and its only safety is in covering its salient extremity. If it finds an eligible snail shell empty, it immediately takes possession by backing its exposed body in and fastening the shell on by the posterior hooks, leaving its head and legs outside. Then it drags the shell around till it is outgrown, when it seeks another. If it finds none unoccupied it frequently kills a living snail, eats him, and unceremoniously takes possession of his house. Or it attacks a tenant crab, the winner of the combat retaining the premises. The loss of an eye or a claw is by no means a mortal injury, or even a permanent crippling, as the mutilation heals, and the eye or limb reappears as good as ever.

Speaking of crustaceans, did you ever see a long or soft-shell clam in his native wilds? Do you know what that exposed proboscis is which you call the neck? It is a double-acting muscular pump, with two pipes and valves, through one of which salt water is drawn and through the other expelled. It drenches the gills, which retain as food any bit of nutriment that may float in, when the filtered water is passed out through the other valve. And that dark lump in the clam, which you have often rejected, madam, as the stomach, is not the receptacle of food at all, but merely an excellent enlarged liver, which epicures might, without torturing the humble bivalve, make into a *paté de foie gras.*

Most animals that are in danger from predacious foes are of a natural tint, resembling the hues of the earth or trees upon which they live. Partridges, quails, and other sand and heath birds are brown, like their dwelling place, and the color serves to conceal and protect them. Some butterflies and locusts are exactly the shape of the leaves of the tree upon which they cling, so that they are not visible in their true character. Where a hundred have settled you cannot see one, only the leaves clinging to the branches and swaying in the wind. Not only the color of the leaves is imitated, but the venation, to the most minute particular; and it is only when you strike the bush with a stick that the "leaves" rise and flutter away. Some of these leaf insects, as they are called, change their colors with the season of the year—green in spring, brighter in summer, and brown in autumn, like the true leaf. Even the imperfections of the leaves are mimicked—those characteristic mark ings and erasions of the leaf which result from the attacks of minute insects. The decay or dying leaves is so imitated that, as Mr. Wallace remarks, "it is impossible to avoid thinking, at first sight, that the butterflies themselves have been attacked by real fungi."

In the turbulent brooks of Connecticut, and probably of other States, is found an ingenious little insect, that the rural people know as a bundle-bug, an inch or two long, which protects itself from predacious fishes by gluing to his sides small sticks, somewhat longer than his body, until he is encased in an irregular wooden cylinder—a jagged and clumsy boat in which he alternately floats and crawls. This carpenter worm leaves an orifice for his head and legs, and his artificial shell seems a thorough shield.

The medusa or jelly fish of our seacoast is well known to all sea bathers; and its phosphorescence often reveals its whereabouts to steamboat travelers. It is as large as a tea plate, flat, gelatinous, and translucent; with the convex portion forward, it pushes its way through the water as if it were a small parasol—a white fringe a yard long, waving backward from the edge, assisting the resemblance. This creature has hardly any life; it seems to have only one organ, which receives and ejects food, and its movement through the water is by a series of convulsive jerks. Lift it out of the water and it drops through the fingers like thin jelly. But in its native element it has the power of sharply stinging with its fringe, from which it is called nettle fish. This fringe, when microscopically examined, is found to be filled with minute sacks, each of which contain a microscopic arrow ready to discharge. Friction bursts the cells and causes the discharge of myriads of arrows into any soft flesh that may be the cause of the disturbance. The harm is not great to any robust organism, but it must be sufficient to shock and paralyze some of the inferior fishes.—*Graphic.*

Correspondence.

How to Straighten a Shaft.

We frequently receive letters from our subscribers detailing some experiment they have made, or some new wrinkle in the detail of manufacture, or concerning a novel device they have found to answer for some particular purpose; for all such communications our correspondents have our thanks.

Although the large number of such communications precludes the possibility of our answering or publishing all, yet we convert as many as possible to the benefit of our readers. We are sometimes surprised to observe how completely the information forwarded to us on a given subject will answer an inquiry made on the same subject by some other correspondent. For example, A. F. writes: "You will do me a great favor if you will tell me how to straighten an iron shaft, 2½ inches in diameter, that is slightly bent, and will not work without binding in the bearings."

The same mail brought a letter from J. J. H., who writes:

To the Editor of the Scientific American:

"The following is a good way to straighten shafts that have been sprung by heat or otherwise. Lay the shaft on bearings at each end, with the arched side up, about 1 foot from the ground; then build a fire (wood will answer) under the part or parts to be straightened. When hot, chill the the top side, which is to be straightened, with water, which can be best done with a swab; continue the heating and chilling till the work is complete. Allow the heat to come back to the top side between each chilling, to quicken the process, and to ascertain when complete. After the shaft is hot, a very little fire will be required to continue the heat. I think that any kind or size of metal shafting can be straightened by this process. I made the experiment on a wrought iron shaft 5 inches in diameter and 12 feet long, that was sprung 3 inches by being burnt in a mill. It was was only 2 hours from the time I built the fire under it till it was perfectly straight. J. J. HILL.

Hayden's Ferry, Arizona, July 1, 1876.

[For the Scientific American.]

THE DEVELOPMENT OF SPEECH.

As the seventeenth century was preëminently one of revolutions, the present is one of evolution. Everything is supposed to have been evolved from something else, man from monkeys, articulate speech from inarticulate cries, writing from hieroglyphics, etc. A few weeks since the American Philological Society met in New York city, and among their discussions were some of much interest. Professor Harkness read a paper in which he stated that comparative philology had proved that all the known languages and dialects have been evolved from one parent tongue, whether by differentiation, natural selection, and survival of the fittest, or by other processes. Darwin, in his "Descent of Man," draws some of his most forcible arguments from the resemblance of the human fetus to the full grown ape and other animals. The unspoken language, the inarticulate cries of infants, has not, so far as we are aware, been carefully studied, and compared to the cries of birds and animals. H. Taine has recently directed attention to this subject by an article on "Lingual Development in Babyhood," published in the *Revue Philosophique*. But M. Taine passes over the multitude of different cries and exclamations, consisting, as he says, exclusively of vowel sounds, and expects articulate speech. Some of his observations are, however, valuable and interesting, as being the first that have been accurately made and intelligently recorded. We hope that these observations will be repeated by others, so that in time the mass of facts will be large enough to enable us to generalize upon them, and eliminate the personal factors which vitiate the conclusions drawn from too limited a number of facts. Idiosyncrasies in children are probably as common as elsewhere; abnormal development must not be mistaken for a normal condition; one child will differ so greatly from some other child that we shall at first incline to think there is no common ground between them; but as observations increase, the facts will gradually fall into system, and order come out of chaos.

From a study of the speech of babyhood we shall learn not only how language is formed, but shall see in it the gradual unfolding of the intellect. Babies' selections of words are instructive to the biologist; the order in which they acquire the power of pronouncing the consonants is an interesting study for the phonetic scholar. Why, for instance, can every infant pronounce the word no, for several months before it can say yes? That the English sounds of th are difficult for our children is not surprising; but why are our sounds of j and ch, which few foreigners ever succeed in uttering correctly, easier for a child to pronounce than w, or f, or g? Yet we have heard a boy of three years say jay for way, chun for fun, and jajy for wagon. Again, an American child, who has heard no language but English, will sometimes introduce into our words the most difficult vowel sounds of other languages, such as the unpronounceable German ö and ü, or French eu and u, which he has never heard.

M. Taine says that the little girl on whom his observations were made began to attach a meaning to certain words before she pronounced any word to which she attached any meaning. This will, we think, agree with the experience of most parents, and is not strange, for animals learn to understand our language which they can never speak. The first word pronounced by her was papa, but for a time she did not comprehend its meaning. At the age of fourteen months and three weeks, he says, she could pronounce mama, tété (nurse), oua-oua (dog), koko (hen, cock), dada (horse wagon), mia (cat), kaka, and tem. To the latter word she gave a very extensive signification, such as give, take, see, look; it seemed to be a word coined to express her principal desires. Another child, observed by the writer, began with the word no, which was spoken very emphatically in reply to any question, and without a definite idea attaching to it. The same may be said of another common expression used by her, "don't do it;" she soon after learned to say mama, bowwow (dog), and dink (drink). At the age of fifteen months she began to imitate, repeating almost everything she was told to, and here the habit of generalization was again apparent. She was told, on seeing an ice wagon pass, to say ice. She can pronounce it nicely, and says it every time she sees a horse and wagon, showing that she has extended its meaning to all wagons, and probably to horses also. Another curious case came under our notice sometime since of a little boy who applied the term dady to every man he saw, and also to chickens, dogs, horses, etc., much to the annoyance of his mother.

In a paper read at the Bristol meeting of the British Association, D. A. Spalding advanced the idea that the progress of the infant is but the unfolding of inherited powers. He makes no application of this principle to the power of speech, although he might have done so, and we are inclined to believe that, just as a child learns to walk as soon as his limbs are strong enough to safely support him, so he will learn to talk as soon as the brain is sufficiently developed to evolve ideas requiring expression, subject, of course, to the law that perfection is only gained by practice. E. J. H.

[For the Scientific American.]

THE FIRST CHINESE RAILWAY.

The Japanese have readily taken to the mechanical, scientific, and other improvements to which intercourse with the rest of the world has introduced them. For ages they were more exclusive than the Chinese; but now that the barrier is broken down, the Japanese make the most of their opportunity; and they really seemed to have learned and adopted more foreign notions in a few decades than the Chinese have acquired in centuries.

But the iron horse has at last been domesticated in China; and if the old conservatives of the Celestial Empire ever read anything but Chinese classics, they would class the locomotive with that wooden horse which stands as the representative of treacherous gifts. If the locomotive does not revolutionize China in the end, its power has certainly been overrated. The trial trip was taken on a short road out of Shanghai, on June 30 last, and on July 3 regular travel commenced, six trains running each way daily, and the receipts being highly satisfactory. Six daily trains over a road only five miles long is not a very heavy day's work; but with the Chinese, in making innovations, it is wise to make haste slowly.

The first railroad in China, from Shanghai to Woosung, is ten miles long; but the road was only completed to Kangwan, half the distance, when it was opened with much ceremony, the pleasantest part of the programme being on the second day, when the natives were allowed to travel free, and appear to have received that proposition as heartily as any dead heads among the outside barbarians could have done. It is three years or more since the British and continental ironmasters, in session at Liége, took China into their calculations as a possible market for iron, locomotives, cars, and all the mechanical paraphernalia of railways. The first idea was to present the Emperor of China with a small specimen railway; but Chinese red tape—as much more complicated as a Chinese puzzle is more puzzling than any other—prevented the plan from being successful. The next movement, and it would seem a feasible one, was for the foreign residents to buy ground for a carriage road, from Shanghai to Woosung. Englishmen must have their drives, and there could be no harm in that. Then railroad estimates were made; but the first were at too high a figure. It would not do to risk much on an enterprise upon which the Chinese dragon might pounce, and, with a whisk of his tail, demolish. So the estimates were cut down to a single track, of very narrow gage, 2 feet 6 inches, very light rail, 27 lbs.; a toy locomotive, weighing only 1½ tuns, running at a maximum speed of only 15 miles per hour. The road was commenced in January, and in the months which have elapsed the projectors have gained in confidence. They have built for the road two engines, the "Flowery Land" and the "Celestial Empire," weighing each 9 tuns; they have eight inch cylinders and ten inches stroke, have each six wheels, and side tanks.

With a sagacious eye to the consequences of an explosion upon the Chinese temperament, the boilers were tested to 200 lbs. to the square inch. And, for a little while at any rate, the speed will be kept down, and the chances of collision or track jumping will be studiously guarded against. Even to cut off a Chinaman's queue would be fatal to the enterprise; and at this late day in the history of railroads, the problem of safety is made prominent above that of speed. It were much to be wished, for the sake of the public, that Britons and Americans were so far Chinese that to kill one would be a disaster worth consideration, as well financially as morally. If we learn safety in railway traffic from the first Chinese railway, it will be a first class investment for the traveling world. And if, from this small beginning, the iron interests should receive a much needed impetus, that, too, would be a welcome event. *

THE IMPACT OF LIGHT.

ABSTRACT OF A LECTURE BY CAPTAIN ABNEY, R. E., F. R. S., AT THE LOAN COLLECTION, SOUTH KENSINGTON.

Astronomy was the religion of the world's infancy, and it can hardly be a matter of surprise that untutored yet inquiring minds, unaided by any distinct revelation, should have attributed to the glorious orb, the center of our solar system, the possession of divine attributes, and, as they gazed upon the wondrous effects of his magical painting, that they should have offered to him their adoration and worship, and carefully noted any phenomena due to him. Thus probably

THE FIRST PHOTOGRAPHIC ACTION

noticed would be at a very early period of human existence, when the exposure of the epidermis to his rays caused what is known to us as tan, whilst the parts of the body covered would remain of their pristine whiteness. A photographic action which would be remarked at a later date would be the fading of colors in the sunlight. Ribbons, silks, curtains, and similar fabrics of a colored nature undergo a change in tint when exposed to it.

RIBBONS CHANGED BY LIGHT.

I have here a specimen of a pink trimming used by the fair sex, and the lady who presented me with it informed me that it was "a most abominable take-in," as the color "goes" after two days' wear. Her ideas on the subject and my own somewhat differed, for to me it presented a capital opportunity of using the material as a means for obtaining a photographic print in a moderate time I have here two results of the exposure of this stuff to the sunlight. One was exposed beneath a negative of an anatomical subject, and we have the image represented as white upon a pink ground. The other subject is a map. An ordinary map was superposed over a square piece of the stuff, and placed in sunlight whilst in contact. We have in this case the lines of the map represented as pink on a white ground, from which the color had faded.

CHEMICAL CHANGES CAUSED BY LIGHT.

The general opinion is, I believe, that the color is given off somewhat similarly to the scent from a rose. Were this entirely the case, the light would not act as it does, but, beneath the negative or map, the color would bleach uniformly. The bleaching seems to be a really chemical change in the dye, due to the impact of light. There are many other bodies besides dyes which change in light, and some of them are of the most unlikely nature. I had intended to show you to-night the change that takes place in glass by exposure to light for long periods. My friend, Mr. Dallmeyer, has in his possession specimens of brown and flint glass, which have markedly changed color in those halves of the prisms purposely exposed to solar influences. In some cases there is a "yellowing" of the body, and in others a decided "purpling."

WHAT LIGHT IS.

It is, however, only those bodies which change rapidly in the light that are utilized in photography. The most common amongst these are various compounds of silver, for they are peculiarly sensitive to the action of light. Nearly every silver compound is more or less changed by it, and when I say changed I mean altered in chemical composition When we reflect what light is we can better understand its action. Light, as experiment, confirmed by mathematical investigation, tells us, is caused by a series of waves issuing from the luminous source, not, indeed, trembling in our tangible atmosphere, but in a subtler and infinitely less dense medium, which pervades all space, and which exists even in the interior of the densest solids and liquids. These waves of ether, as this medium is called, batter against and try to insinuate themselves amongst the molecules of any body exposed to their action, a good many millions of millions of them impinging every second against it. Surely it is not surprising to think, small though the lengths of these waves be, that this persistent battering should in some instances be able to drive away from each of the molecules some one of the atoms of which they are composed.

HOW LIGHT ACTS UPON SILVER CHLORIDE

Take as a type that salt of silver which was, perhaps, the first known to change in the presence of light-silver chloride. For our purpose we may represent each of its molecules as