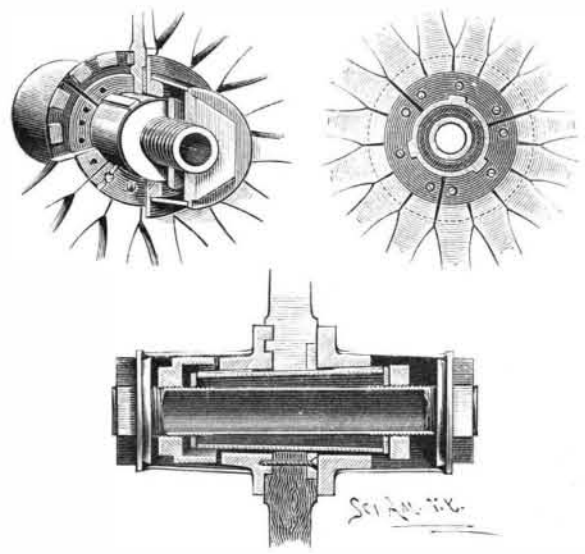
and is fitted with a steam windlass forward, and hand and steam steering gear aft, with a small steering wheel on the bridge amidships. All the deck fittings are of manganese bronze. There is a large steel deck house amidships, covered with teak, inclosing the engine and boiler space, deck saloon, and smoking room, and in addition affording entrances to the cabins forward and aft. The accommodation is well planned, and the decorations and furnishings do credit to the artistic taste of the late owner.

The accommodation for the officers and crew is provided aft, and for the former it includes a general mess room and cabin for each.—*Engineering.*

A NEW WHEEL HUB.

The engraving shows in three sectional views a novel wheel hub, in which the inner ends of the spokes rest upon a slightly elastic support, and in which the wheel is made expansible within certain limits to give it the required amount of "dish," and also to cause it to closely fit the tire.

A spindle box forming the central or foundation part of the hub is provided at opposite ends with an exterior screw thread for receiving at one end a plain nut and upon the other a cup-shaped nut. Between these two nuts is placed a conical sleeve of elastic material, and upon the conical sleeve are arranged flanges, each of which is formed in three segments. One of the flanges is furnished with inwardly-projecting lugs for locking the spokes. The spokes are connected by means of a segmental flange secured by bolts passing through alternate spokes into the flange upon the smaller end of the conical sleeve. The segmental flanges are arranged to register with each other, so as to permit of the expansion of the wheel. Metallic shells are slipped over the bosses of the segmental flanges and held in place by nuts upon the ends of the spindle box. A cup-shaped nut in the interior of the shell



HALL'S WHEEL HUB.

bears upon the boss of the segmental flange on the smaller end of the elastic sleeve.

When it is desired to expand the hub, the segmental flanges are moved forward by turning the cup-shaped nut. The conical elastic sleeve is provided with longitudinal ribs which fit in corresponding grooves in the other parts, and hold the parts in their proper relative positions.

The lower view shows the hub in section; the upper right hand view shows the parts before the flanges are applied, and the upper left hand view represents the hub with parts broken away to show the interior construction.

This invention is patented by Mr. Thaddeus M. Hall, of Grenada, Colorado; and Messrs. L. W. Markham and Thomas H. Cecil, of Lamar, Colorado, are owners of one-half of the invention.

New Green Vegetable Coloring Matter.

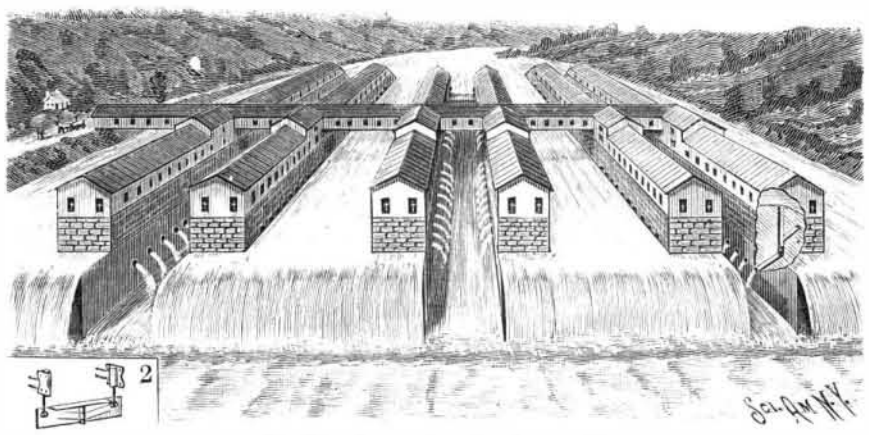
In a paper presented to the Royal Society of Edinburgh, Mr. C. M. Smith describes a green coloring matter obtained from the bitter green pulp of *Trichosanthes palmata.* The spectrum of the alcoholic solution of this substance differs from that of chlorophyl in its first absorption band having its center nearly midway between the two chief bands in the spectrum of true chlorophyl, while the bands III, IV, and V are probably coincident with corresponding chlorophyl bands. The behavior of this substance with ammonium sulphide differs altogether from that of chlorophyl. It appears to be a substance in which the "blue chlorophyl" of Sorby, or the "green chlorophyl" of Stokes, is replaced by some other substance easily decomposed by reducing agents and by acids.

Mr. C. B. Atwell records, in the *Botanical Gazette,* the occurrence of true chlorophyl in the embryo of *Tilia americana* and *Ipomœa purpurea.* In the latter species the chlorophyl makes its appearance as soon as the first traces of cotyledons can be recognized in a cross section of the seed, and it is abundant in the capsule while the seeds are developing.

IMPROVEMENT IN THE UTILIZATION OF WATER POWER.

We give an engraving of a novel device for utilizing the power of the falls of rivers and other watercourses where the fall is sufficient to permit of the application of the invention.

As will be seen by a reference to the illustration, a number of sluices or cuts are made in the river bed, which extend up the river. The walls of these cuts are lined with masonry which extends above the river bed to a point above the high water line, and upon these walls are built the mills or power houses. The spaces between the power houses or mills serve as canals or flumes for supplying water to the turbines located in the power houses. The penstocks for supplying water to the turbines are made by boring holes in the bed of the river and continuing them upwardly through the walls. A number of these penstocks are provided, and each one communicates with an inlet from the flumes, and at the lower end of the penstock is arranged an outlet for discharging the water from the turbine into the cut or tail-race between the buildings. Truss gates like that shown in detail in Fig. 2 are placed at the upper ends of the cuts or tail-races, to shut off the water, and cause it to flow around the power houses. Covered bridges extend between the power houses and communicate with them through stairways, the bridges being built on the top of the houses so as to be out of the way of any floating material that may come down the stream. The upper ends of the walls upon which the houses rest are provided with suitable ice breakers, and the gates at the head of the tail-races are made sufficiently strong to withstand any pressure that may be brought to bear upon them.



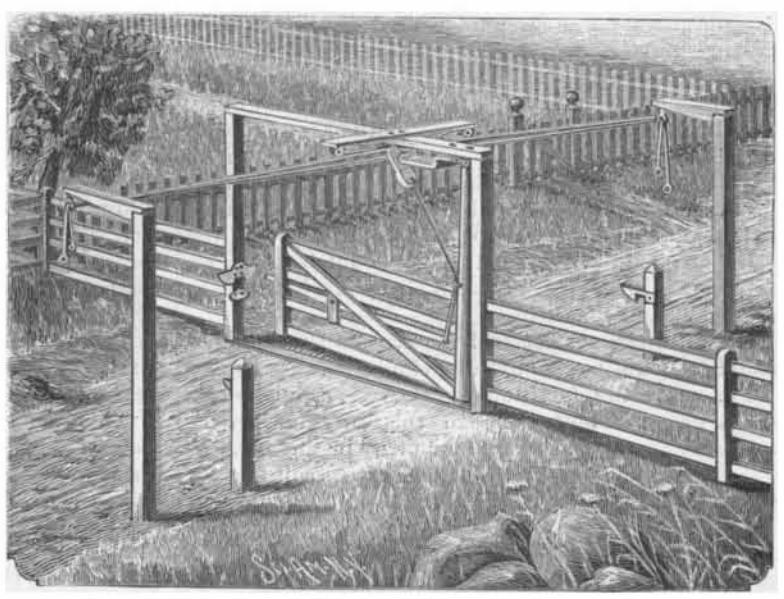
HIGH-GRADE WATER POWER UTILIZER.

This invention has been patented by Messrs. A. H. & A. Quain and G. P. Warner. Further information may be obtained by addressing Mr. A. H. Quain, Scio, Oregon.

A NEW FARM GATE.

We give herewith an engraving of a farm gate provided with simple and effective mechanism for unlatching and opening, and closing and latching the gate from either side, and for locking the gate in an open position. The gate is pivoted in a frame formed of the posts, a sill, and a cross bar connecting the tops of the posts, and the pivoted stile of the gate is extended to the upper cross bar. The inventor preferably extends a pivot from the center of the stile into the sill, but in some cases he uses ordinary hinges. In the gate is pivoted a long latch which extends from the free end toward the pivoted end, the end of the latch nearest the end of the gate being made heavier so as to cause the latch to close by its own gravity. To the gate post is secured a notched plate having beveled ends for receiving the projecting end of the latch.

To the upper bar of the frame in which the gate is pivoted is fulcrumed a lever carrying a toothed sector which engages a pinion on the upper end of the pivoted stile, and to the free end of this lever is pivoted a trip bar, the lower end of which is connected by a cord with the inner end of the gate latch, the cord passing though a guiding loop projecting from the stile of the gate. To the upper end of the trip bar are attached four cords, arranged in pairs, which extend in opposite directions. One cord of each pair extends through an eye supported by an arm attached to a post a short distance from the gate. The other cords pass over pulleys which reverse their direction; these also pass through the eyes supported by the posts. By pulling one of the cords, the trip bar is tilted, thus lifting the longer arm of the latch, and releasing the gate, at the same time a further movement of the cord operates the sector lever and swings the gate. Catches are provided for holding the gate open, and the operation of closing the gate is the reverse of that just described. This invention has been patented by Mr. Charles Oesterling, Barnhart's Mills, Pa.



OESTERLING'S IMPROVED GATE.

Richard Francis Burton.

Sir Richard Francis Burton, the famous African explorer, died on October 20 at Trieste. Sir Richard was born in 1821 in Hertfordshire, England, graduated at Oxford, and in 1842 joined the East Indian service. He commenced his explorations in the Neilgherry Hills, in India, and then acquired a wide acquaintance with Eastern languages. In 1851 he visited Mecca and Medina as a wandering dervish and wrote up his travels. He later visited East Africa, served in the Crimean war, and in 1856, with Capt. Speke, penetrated to the lake regions of Central Africa and discovered Lake Tanganyika. Since 1872 he had been British consul at Trieste. He published in all over fifty books of travels in Africa, the United States, Brazil, Palestine, Arabia, India, etc.

New Bleaching Fluid.

Ozonin, a bleaching fluid, patented by L. Schreiner, is made as follows: 125 parts resin are dissolved in 200 parts oil of turpentine, to this solution is added a solution of 22·5 parts potassium hydrate in 40 parts water, also 90 parts hydrogen peroxide. The resulting jelly exposed to light changes in 2 or 3 days into a thin fluid called ozonin, this same change takes place in the dark, but then requires some weeks for its completion. An emulsion of one gramme ozonin in one liter water acts as an energetic bleaching agent on fibers, wood, straw, cork, paper, also on solutions of gums and soaps; the bleaching effect is as energetic in acid as in alkaline solutions.—*Chemiker Ztg.*, 1890, 1004.

A Process for Recovering Tin.

The French Society for the Encouragement of National Industry have given the prize allotted for the utilization of works' residues to M. Martinon, for his process of recovering the tin contained in the wash waters from silks which have been treated with bichloride of tin, for the purpose of giving weight. By adding milk of lime to the water, and by properly agitating, the tin settles down in a few hours in the state of oxide, which can be readily collected and disposed of. This economy is said, for Lyons alone, to effect an annual saving of $60,000.

HUDSON MAXIM, of Pittsfield, Mass., brother of Hiram Maxim, the well known inventor, has developed a new smokeless powder for guns, that has, so far as tested, merited the eager attention of army officers. The production of a new small caliber rifle is entirely dependent upon the result of tests of this class of powder, and at present the tests made with the Maxim powder give gratifying evidences of success.

ONE of our leading doctors says a potato is most digestible if boiled in its jacket.

Celluloid as a Drawing and Printing Material.

[THE LITHOGRAPHIC ART JOURNAL.]

Some experiments have lately been made here with celluloid as a material for drawing and printing upon, in connection with photographic processes of reproduction, and a brief account of the results may not be uninteresting.

The advantages celluloid possesses as a drawing material are:

1. Its great translucency, which enables tracings to be easily made upon it, and also renders it an excellent material for being used as transparency, either a transmitted positive or negative, for photographic printing.

2 Its impermeability to and unabsorbativeness of water or moisture, which render it quite free from any liability to be affected like paper by hygrometric changes, or to be attacked by mildew and damp.

3. The fine matt surface, which takes pencil, chalk, or ink very readily, and can easily be renewed, if necessary, by graining with fine sand or emery powder.

4. The facility with which drawings can be washed off and renewed for purposes of correction, or for making new drawings. The surface can also easily be kept clean and free from dirt.

I have tried the material as obtained from America in three thicknesses, the $\frac{5}{1000}$, $\frac{10}{1000}$, and $\frac{20}{1000}$ of an inch thick. The first is about the thickness of thin paper, and is almost free from color; the second, which seems to be the kind in ordinary use for negatives, etc., is about the thickness of a sheet of stout writing paper, and shows a light buff color if laid on white paper; the third is about the thickness of an ordinary playing card, and shows a strong buff color over white paper.

On account of its freedom from color and great flexibility, which would permit of its being rolled without damage, the thinnest kind would probably be found the most suitable for drawing upon; but as the surface of the sample sent me was not so evenly grained as the others, I used the medium kind for the trials. It was found that a soft blacklead pencil worked very pleasantly on the matt surface, and gave a fair opacity of line when viewed through the film, so that pencil drawings on this material might be copied in fac-simile very easily by various photographic processes. Black chalk also works very well, and gives more opacity in the lines than the lead pencil does. The softer kinds work better than the hard. With the latter, as with hard lead pencils, there is a tendency to make lines which polish the surface, and render it transparent when viewed through the film.

India ink drawings in line can be made with perfect fineness and delicacy with pen or brush; but, so far as I have tried, it is not easy to produce shaded or colored tints in washes; the surface of the material is too unabsorbent, and cut shades are produced on drying. Stippling or work with the air brush would probably answer better for shaded drawings in India ink or color.

Our trials have already shown that drawings in pen and ink, and in chalk, on celluloid can be reproduced very effectively on copper by the photo-etching processes, either by the direct methods, in which asphaltum or bichromated albumen is used as the sensitive surface, or in the manner used for half tone heliogravure work with carbon tissue. In the latter case the drawing must be reversed, unless the film of celluloid is thin enough to allow the drawing to be printed with sufficient sharpness through the film. The drawings would also be suitable for reproduction by certain of the block processes now in use. For all fac-simile work, negatives could easily be obtained by contact printing on dry plates.

The drawings can, in fact, be reproduced by any of the photographic processes now used for reproducing tracings; and as the material is perfectly free from all inequality of grain, is sold in large sheets, and will soon be obtainable in continuous rolls, it seems likely that it might well replace tracing cloth or paper for all copying or tracing purposes, and especially for photographic work. If not required to be kept, the drawings can be washed off, and the same materials used over and over again. For sketching purposes the celluloid would be very useful, and could be made up into blocks like paper. It would keep much better in damp climates than paper.

For drawings for decorative purposes the material could no doubt be also usefully employed.

For preparing factitious negatives, celluloid also offers great advantages. In this way an artist's original drawing in India ink or other pigment can at once be turned into a reverse negative suitable for photo-mechanical printing by the collotype processes, or by any of the block processes, depending on a direct photographic impression made on a zinc plate coated with asphaltum or bichromated albumen or gelatine. For this style of work, lamp or ivory black, with a little gum, is the best ink to draw with. As soon as the drawing is completed, it is evenly coated with a mixture of lamp black and gold size, as suggested by Major Gore, R. E., or with printing ink and turpentine and a little gold size, so that it may dry quickly. As soon as this is the case, but not before, the film is placed in water, which will at once clear the ink off the lines of the drawing, leaving them quite transparent against the opaque ground. For fine work a little clearing with a sponge may be necessary.

The new films have been tried as a printing surface in place of stone or zinc, and have been found to answer fairly well, excepting that it is very difficult to keep the ground clear and white, and free from a slight dirty tint. Gum and gelatine, with various acids, and with bichromate of potash, have been tried as "etching" preparations, but so far without effect. If with further trial this defect can be overcome, the films might be very valuable as a substitute for stone or zinc in printing. With the delicate cream color of the stone, which is so much pleasanter for draughtsman's work than the dark gray color of the zinc plates, they possess all the lightness, portability, and infrangibility of the latter, without their liability to corrosion. Their ready flexibility would be of value in printing from curved surfaces.

I have not yet had an opportunity of trying the films as a support for the gelatine printing surface in collotype work, but it seems most probable that the thicker kind of celluloid ($\frac{1}{50}$ of an inch thick) would be suitable for this purpose, and would have the great advantage over glass plates of not being liable to break. The transparency of the films would admit of the sunning of the gelatine coating from the back in exactly the same way as with glass plates. Thin films of this material coated with insoluble gelatine might be useful for printing in the "Autocopyist."

The celluloid films can be printed on from stone or zinc fairly well, though the ink takes some time to become thoroughly dry. Printing from copper plates was not found to answer. Type can also be printed from, but the impressions obtained were not very good, and the type indents the films very much, but further trial might give better results. Such prints from type would be useful in a variety of ways for typing names and titles, etc., on heliogravure plates, and for many miscellaneous purposes. The impressions from type are rather too weak to use at once for photographic printing, but they can easily be strengthened by brushing over them some red bronze powder.

For drawing with lithographic transfer ink the material does not seem at all suited. The ink works heavily in drawing and spreads in transfer. But celluloid forms a good material for dry point etching or printing in the copper plate press, and by heating it and pressing it into a cast from a form of type, stereotype blocks can be made which stand the wear of printing well; these applications I have not, however, yet tried.

The acquisition of a material like celluloid, obtainable in sheets of large size and fine surface, which is practically transparent, inextensible, and unabsorbent of moisture, and not readily acted on by most acids (acetic acid attacks it), is a great advance for all work connected with photography and printing, and it seems probable that we may see a very large extension of its use in these directions before long.

J. WATERHOUSE.

Queer Kinds of Coins—Interesting by Reason of Their Age and for Other Causes.

"Here is the oldest coin ever made in the world," said a collector to a reporter for the Washington *Star* one day recently. "It was made about the year 700 B.C. in Ægina, and you will observe that the design in high relief represents a tortoise crawling across the face of the piece. You will not find any date upon it, because no coin were dated prior to 400 years ago. The most beautiful coin ever made, in my opinion, is this silver piece of Macedonia, which was current in Macedon, now Constantinople, 500 years before Christ, or 200 years earlier than the time of Alexander the Great. Though its face value is only fifty-three cents, the coin is worth a price to-day that would astonish you.

"Here is a specimen of the coin of smallest value ever issued. It is the 'mite,' so called, such as the widow of the Bible story dropped into the slot for the poor, though it was her last one. One-fiftieth of a cent it was worth, and you observe that its shape is hexagonal. Close by you will notice a piece of money worth $220. It is simply a rectangular piece of gold, stamped with the characters of China, from which country it comes. Lumps of gold are used in China for currency of large denominations.

"This coin with the head of the beautiful woman upon it, so exquisitely designed, was minted in Egypt during the reign of Ptolemy Philadelphus, 2249 years before Christ. The lovely head is a likeness of Ptolemy's wife and queen, Arsenoe, who was grandmother by six removes to the famous Cleopatra. I put it that way because there were in reality several Cleopatras, though most people imagine there was but one.

"Here is a gold piece that was issued by Darius the Great before the children of Israel returned from the captivity. This is something comparatively modern—the 'marriage piece' of Ferdinand and Isabella, issued to celebrate their union some time before Columbus discovered America. Here is the smallest coin ever issued—the thirty-second of a ducat, minted in the year 1560 A. D. in the free city of Nuremberg. It was worth 7¼ cents. By the way, it was the Swiss who first put dates on their coins.

"Perhaps the funniest coins in the world are these roundish irregular lumps of silver from Siam, running down from the bigness of a walnut to the size of a buckshot, according to value represented. You will notice from the display of United States coins in this other case that during the first year when we coined money in this country, in 1792, we had nothing but copper. In 1794 we obtained some silver from Mexico, and two kinds of silver coins appear. Not till 1765 did we have gold coins, consequent upon the discovery of that precious metal in different parts of the United States."

Headache and Aching of the Eyes.

Eye strain should be the first thought suggested by any complaint of headache, for in our day and civilization it is by far the most common cause of that symptom. It enters as a factor into the causation of nearly all headaches not due to pyrexia, toxæmia or diseases of the brain or its membranes. The simple existence of headache, therefore, should suggest eye strain, but frequently a careful inquiry as to the manner and time of occurrence of the attack and the location of the severest pain will be almost conclusive as to the origin of the trouble.

Often it comes on whenever the eyes are used, and is absent when the eyes have had a proper season of rest. The occasions of most severe requirement in the direction of eye work are the doing of anything requiring accurate near vision, taxing both the accommodation and the convergence, or traveling, shopping, attendance at public gatherings, which entail more use of the eyes than the patient is at the time conscious of, and often under unfavorable conditions.

In hyperopia in young people, the accommodation is in excessive use so long as the eyes are open and the attention fixed on any visible object, and hyperopia is the most common cause of constant headache. The writer was formerly subject to a constant headache whenever confined to the house, and regarded it as caused by breathing vitiated air, until it was quite cured by the correction of his hyperopic astigmatism. Many persons have the same idea as to the causation of the headaches they always experience when attending the theater or other place of public amusement, and which are really due to eye strain. Others ascribe these headaches, and those experienced in traveling and shopping, to exhaustion. This is nearer the truth, only they commonly have in mind a condition of general exhaustion, whereas it is largely one of local exhaustion of the special nervous apparatus concerned in the act of seeing.

Congestion, irritability, or inflammation of the eyes and their appendages, should always suggest the suspicion of eye strain. A single attack or manifestation of this kind has no special significance, but repeated attacks of inflammation, or prolonged congestion, or irritability are exceedingly suggestive of a continuing cause, and the most common of these is the one now under discussion. No case of chronic inflammation of the margins of the lids, or of recurring conjunctivitis, or repeated sties, has justice done to it until it has been carefully investigated for eye strain. Persons at the period when they begin to feel the effects of the loss of accommodation in presbyopia or absolute hyperopia suffer from repeated attacks of conjunctivitis, which they commonly ascribe to "taking cold in the eye," but which are cut short by use of the appropriate lenses, and which, if unchecked, would tend to establish a chronic catarrhal condition, which is a chief discomfort in the lives of many people.

I should like, also, adds the editor of the *Times and Register*, in a recent issue, to call attention to car sickness in connection with eye strain. I have had eight or nine cases of this kind, all of which were relieved by glasses. One case was that of a gentleman who every journey had car sickness. While he had the mydriatic in his eyes he went to Washington, and suffered no inconvenience whatever. Subsequently, after he had glasses, he made a trip to St. Paul without any of the former trouble. Recently I have had two cases—one that of a girl who could not ride a short distance in the street cars without vomiting. I found a decided degree of hyperopic astigmatism. With the mydriatic in her eyes she rode home without her usual trouble.

A strange thing with reference to eye strain is that it often exists to an exceptional degree without showing any symptoms in the eye. The patient will often say that the eyes are perfectly good and have never caused any irritation. The reflexes seem to have settled in some other place. This is an interesting pathological and physiological question.

CONGRESS has passed an appropriation of $350,000 for the purchase of the Portage Lake and River Improvement Co.'s canal and the Lake Superior Ship Canal Railway and Iron Co.'s canal. These works connect Portage Lake with Lake Superior, and will now be made free from tolls. The copper-mining industries will be greatly benefited by this action of Congress.