a Weekly journal 0f practical information, art, science, mechanics, chemistry, and manufactures.

|  | NEW YORK, FEBRUARY 23, 1895 | [ ${ }^{\text {W }}$ WEEKL |
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THE NEW BRIDGE OVER THE EAST RIVER AT BLACKWELL'S ISLAND, NEW YORK.
The erection of a bridge across the East River at Blackwell's Island is an old project, which at last is being carried out. The city of Brooklyn, one of the largest municipalities in the United States, and Long Island, which includes some of the most thickly settled suburbs of the city of New York, depend upon one bridge and upon ferryboats for communication with the metropolis. The estuary called the last River,
which separates the cities, is very variable in width, and at Black well's Island it is divided into two sepaand at Black well's 1sland it is divided into two separate channels of approximately even width, so that
there is good ground for the erection of intermediate there is good ground for the erection of intermediate
piers, which will be without objection, as they will not
overhanging cantilevers and connecting trusses. In the six piers, 810,000 cubic feet of stone will be used, the anchor piers alone representing 216,000 cubic feet. 'There are three main spans. The central one, which crosses Blackwell's Island, is to be 615 feet, and each river span will be 846 feet long. The trusses are of the American type or pin connected. Their size may be conjectured from the statement that some of the pins will be 125 feet deep. Fifty-three million pounds of steel will enter into the construction of the bridge proper and $25,000,000$ pounds into that of the viaducts. proper and $25,000,000$ pounds into that of the viaducts.
The structure will be, it is said, the heaviest bridge The structure will be, it is sai
per lineal foot ever constructed. per lineal foot ever constructed.
The truss work is under cont T


THE NEW BRIDGE OVER THE EAST RIVER AT BLACKWELL'S ISLAND, NEW YORK.
obstruct the channel. We illustrate in this issue the $\mid$ Bridge and Construction Company, of Philadelphia, new bridge, work on which is now in active progress. Pa

The bridge is of the cantilever type. It comprises steel trusses carried on Connecticut granite piers. There are to be four railroad tracks, a carriage-way, and a foot-path. Starting with its approaches about a mile from the heart of Long Island City, it is to run across the southern end of Blackwell's Island and lead to a terminal station at Third A venue and 64th Street, in this city. The Secretary of War at first required a clear height of 150 feet above the river level, but con sented to a reduction of height to 135 feet, which is the same as that of the present suspension bridge acros the river three miles below.

There are four main piers, each of which is to be 86 by 45 feet in cross-sectional area. The piers are arched. Back of the main piers come the anchor piers, one for each end of the bridge, to which the trusses are tied down to withstand the strain brought by the

Pa .

The terminal station in New York is to cover a full block between Second and Third Avenues in the neighborhood of Sixty-fourth Street. The main floor will contain 12 lines of track. The level of this floor will be 25 feet above that of the ele vated railroad. Connections will be made with both Second and Third Avenue elevated roads.
The ground floor will be a market. Long Island is one of the kitchen gardens of New York, and the market will for that reason be under peculiarly good auspices. The basement will be devoted to boilers and machinery, and in a sub-hasement will be extensiv old storage rooms.
The bridge will connect with the Brooklyn elevated and surface roads, and will therefore bring the cities on the opposite sides of the East River in most comon the opposite sides of the East River in most com-
plete intercommunication. The Long Island Railroad

To the right and in the distance is the present suspension bridge. In the background are seen the heiphts of Long Island, while to the right and on the distant shore is Brooklyn. If all the region about New York is united to form what is known as the Greater New York, the bridge will be a potent factor in establishing a true unity.

## An ocean Steamer Disabled.

Much anxiety was caused recently in New York and Paris by the delay in the arrival of the French line steamer Gascogne, a large ship of the first class. She, howe ver, steamed slowly into port, eight days behind time from Havre, and her arrival was the occasion of much rejoicing. The detention was due to the breaking of the piston of one of her compound engines. It was necessary to disconnect the engine and extend the steam pipes so as to unite the remaining engines. It proved to be a tedious and difficult job.

## Srientifit Amman.

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## o. d. Munv.

A. E. BEACH.
terms for the scientific american.




Building Edition.

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any failure, delay, or irreularitv in receipt of papers.
NEW YORK. SATURDAY, FEBRUARY 23, 1895.


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SCIENTIFIC AMERICAN SUPPLEMENT No. 999.

## For the Weelk Ending February 23, 1895.

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 V1. ${ }^{\text {th }}$












## the commercial synthesis of carbon and

 HYDROGEN.The real and prospective triumphs of chemistry have been in the field of synthesis or the building up of compounds. It is always an easier task for man to destroy than to build. Going back to the days of the alchemists, we recognize in their attempts to discover the philosopher's stone what was really a search for the formation of gold, and in their attempts to discover the elixir vite we can picture them as attempting the creation of life, or at least the prolongation of vital energy beyond its natural period, amounting to the synthesis of life itself. It is now but little over a cen-
tury since modern chemistry had its birth in the distury since modern chemistry had its birth in the discovery of oxygen, something which did a way with the old phlogiston theory. Oxygen was produced by heating mercuric oxide, so that the
hemistry was a destru, process.
As chemistry advanced, the work of the great chemists early took the form of analysis, Scheele and Ber zelius being among those who set the example of patient, laborious analytical work, while the great field of synthesis remained comparatively untouched. It was in 1828 that Woehler made his famous synthesis of urea from ammonium cyanate, producing thus a com pound in every sense organic by purely chemical pro cesses. Later the synthesis of cyanogen from carbon and nitrogen was effected. This made it possible to start with solid carbon and gaseous nitrogen and produce urea. A few years after this came Berzelius' dis covery that it was possible to synthesize carbon and hydrogen. This experiment was really due to an accident incident to the production of potassium. Again Woehler, in his work on calcium, succeeded in pro-
ducing a compound of calcium and carbon, which, ducing a compound of calcium and carbon, which, treated with water, evolved the hydrocarbon acetylene.
But all this represents what may be termed laboratory work; there was nothing practical in it. If we look all through chemistry, we will find that the one great desire of the chemists, a desire whose accomplish ment seemed so far off that they did not dare to hope
for it, was the synthesis of carbon hydrogen. This for it, was the synthesis of carbon hydrogen. This synthesis leads to everything. Millions of cubic feet of gas are annually delivered from our gas works for the purpose of producing light. The luminosity of the gas is due to the presence therein of hydrocarbons, and these hydrocarbons have to be formed by destruction. Coal or naphtha, both products originating in the workshops of nature, are destructively distilled to give the necessary illuminating constituents to the gas. One of the most colossal companies the world ever saw is the Standard Oil Company, of America, whoso oporatinns oonsiot simply in the exploitation of nature's enormous store of hydrocarbons, represented by pe-
troleum. Among the late achievements in the fields of chemistry none has received more attention, and excited more popular admiration, than the production of coal tar colors, butat the basis of all these comes the inevitable hydrocarbon, and the coal tar of the gas companies with its store of benzone and similar products has been drawn upon for the production of dyes for the textile goods of the world. If we come into the field of hygiene, we find the new medicines made from hydrocarbons originally.
But at last it seems as if the great synthesis had been accomplished, and the electric furnace, the pro ducer of aluminum and silicon alloys, of carborundum, which almost rivals the diamond in hardness, now figures as the agent in effecting the synthesis of carbon and hydrogen. By exposing a mixture of lime and an thracite coal to the electric are a heavy semi-metalli mass is produced. At first it was produced by an ac cident and the material was thrown away, some of it into a bucket containing water. A gas of power ful odor was produced which was found to be com bustible, which proved to be acetylene, and at last the problem of a century of chemistry was solved, and solved by pure accident. It is interesting to note that in the iron industry the same synthesis is made possible. Cast iron is a combination of iron and carbon. Treated with acid, the iron dissolves, and the carbon unites with the hydrogen of the acid and hydrocarbon gas is evolved. This fact is taken advantage of in the analysis of cast iron in order to distinguish between the combined and uncombined carbon, but like the potas sium production of acetylene, there is nothing practi. cal in it. But the new process seems to be practical. The calcium carbide is comparatively cheap. A stick of the solid material represents a producer of illumi vert non-luminous water gas to gas of the finest quality. If the material is immersed in water, the quality. If the material is immersed in water, the converted into the so-called coal tar colors, and can be made the starting point for the numberless series o organic compounds now produced in the technical fac tories.
The possibilities of the discovery are perfectly daz zling. Undoubtedly coal tar colors will for many years continue to be coal tar colors; bituminous coal and naphtha will continue to be sources of commer

But the enlightened mind judges of the greatness of disco very by scientific possibilities, not only by economic ones. In the electric synthesis of calcium and carbon leading to the production of acetylene we have a discovery whose economic future may yet prove to be of world-wide importance, and whose scientific interest is of the highest. We have recently published several articles on the subject, and we warmly commend them to our readers ; and elsewhere in this issue will be found a discussion on this dis covery.

Reflections by an Old Time woodworker.
An old time carriage builder relates in the Hub how they built carriages fifty years ago and the changes machinery has wrought in the construction. They who are engaged in any part of the woodwork in a carriage factory at the present day know little of the difficulties that surrounded the workmen of the days prior to the sixties, but it will not do to make clain of better mechanics now than then; for while the change has simplified the labor, removed much of that which was extremely tiresome, it has not elevated the skill of the mechanics as a class. There are a few to-day who outrank in skill and technical knowledge those of fifty years ago, but they who do the bulk of the work are not skilled as were the former workmen. The body maker of those days had little more than an outline to work from. If the job was a new one, he made his patterns as he went along, and gave the curves and sweeps without rule, depending entirely upon the eye and then, as each particular sweep or pattern was completed, and the thickness of wood, form of mortise tenon, lap or miter was determined, each fact wa faithfully recorded on the pattern, and should the latter become broken or mislaid, all were at sea. " have used that pattern forty years," was a remark made by an old body maker in Newark, N. J., in the year 1857. Said pattern was of cherry, $7 / 8$ inch thick and so written over in ink that it reminded one of the hieroglyphics on an Egyptian obelisk. The pattern had done its work for a coach corner pillar, a shor pillar for a coachee, a family rockaway, brett, and a variety of vehicles of equally dissimilar character, and it was but one of many that had been thus utilized In those days, when there was no record, the first thing to be done was to mortise the one bottom side for the standing pillars, then mortise the top rail and tenon the pillars, after which these parts were put togethe and the outside of the bottom side swept off to suit the sweep of the top rail and the turnunder of the door pillars. This done, the corner pillars were fitted on and swept off, and so on until the body was com pleted; it was "cut and try," and yet when the body was completed it was a model of good workmanshipas good so far as mechanical execution was concerned as the best of to-day
The manner of working by the body maker was duplicated in every other line. The wheel maker had his hub turned, but he laid off, bored and made the nortises, hewed out, squared and rounded his spokes sawed and bored his fellies, did all other work by hand but who makes a better wheel to-day? When bent timber came into use, the steam box and former constituted an important part of the shop fittings, and when the bending was done, all hands turned to and assisted by advice, if not otherwise. Twenty-four pe cent perfect was a large a verage, and fifteen per cent breakage, beyond repair, was a satisfactory result The chopping block and the broad ax were as much part of the fittings as was the plane, and one to e very wo benches was a necessity. All the modern appli ances in the line of machinery were absent. In place of a tenoning machine for spokes was a plane with a cutter spur for the shoulders, and guards with a set screw to regulate the depth of the cut. Fortunate indeed, was the body maker if he had the thick plank sawed up. All their stuff had to be sawed by hand and the $1 / 2$ inch panel stuff planed down to $1 / 4$ inch by hand. Wages were not so much lower then than now. A good body maker could earn $\$ 3$ a day; wheel maker the same or a little more, and a genera workman about $\$ 9$ a week. A top buggy, covered with oil-dressed leather, made up with wood axles and up holstered with moss or rowen covered with curled hair, which, by the way, was picked from the rope by the voungest apprentice in the trimming shop, would sell for from $\$ 225$ to $\$ 250$. In view of the fact that every piece of iron was hand forged, all bolts and nut threaded by hand, paints and colors ground and mixed in the paint shop, we wonder how the carriag builders ever succeeded in business; but they did, and their vehicles were honestly built and did many years service.

## Combined Ship's Buoy.

At the yachting exhibition in London is shown a " combined ship's buoy." It is carried on deck, and when the ship sinks it floats and records at once the hour and minute of the disaster. It then automati cally fires rockets, burns blue lights, shows a lamp and rings a bell.

The Brazilian Rubber Tree Tappors.* The business of rubber gathering, after the forest has been reached, begins with the opening of a "road" -a winding pathway just wide enough to allow a man to pass from tree to tree. Usually 100 rubber trees are connected by one of these roads, the inter vals between them varying from twenty feet, or less, to hundreds. While one man's road may not be more than a quarter of a mile long, his nearest neighbor may have to walk five or six times as far to reach the same number of trees.
There is as much difference in the milk from rubber trees as in the milk from different cows. The consistency of the sap varies, some yielding a larger and some a smaller proportion of solid rubber. In the same road one tree may yield a thick, creamy sap, while the next will give a watery one, or even nothing at all, the "flow" being so slight that the sap merely puts in an appearance without reaching the cup underneath. Where several "taps" are made on the same neath. Where several "taps" are made on the same
tree, some may run freely, while others give nothing at tree, some may run freely, while others give nothing at
all. On other trees, again, all the taps may run freely. In view of these differences in quality and quantity of the sap, the yield of a road, instead of single trees, is taken as a standard in any rubber camp.
One man can easily tap 100 trees daily, placing on each five or six cups to catch the sap. These trees, on what is called a good road, will yield, at the commencement of the crop season, $\dagger$ about 22 pounds of sap for each tapping. But all the roads are not equally good. and one with the yield just mentioned may lie next to another with a yield of only 10 pounds of sap. On the lower Amazon, in a field containing several thousand rubber trees, not more than 10 or 12 pounds of sap can safely be counted on for each 100 trees per day. Supposing the trees to be tapped regularly for twelve weeks-the extent of the tapping season-the total yield per tree would be about 7 pounds of sap, or $31 / 2$ pounds of cured rubber. But a rubber gatherer can, without great exertion, work two roads during a season, making, at the a verage yield here mentioned, 700 pounds of rubber. An active, hard-working man can doublethis product, and can do even better with the help of $h$ is wife (seldom with "benefit of clergy") and children. In partially cleared forests a rubber gatherer can care for more trees.
In the state of Amazonas the average size of the rubber trees is larger, and the yield is greater. This is because rubber gathering has not been practiced there so long, and the trees have been allowed to mature fully before being tapped. In the lower districts, where the rubber industry had its origin, the yield per tree is much less now than formerly. A man who worked in the rubber fields forty years ago once told me that he had known roads of 100 trees to yield 40 to 45 pounds of sap per day, while his early employer used to complain because the yield had fallen from 60 and 65 pounds. To-day an occasional rubber tree will sometimes yield two pounds at a single tapping, but there are more on which the scanty exudation dries on the bark without reaching the cup.
The quantity of sap required for making a pound of India rubber varies more than the quantity of milk needed for a pound of butter. While two pounds may be given as the average, very much more is sometimes necessary. The yield of rubber from a given measure of sap is greater at the beginning of the season than
at its close, the consistency of the sap steadily diminishing.
The age at which rubber trees become fit for tapping depends upon their surroundings. In the dense forests they will hardly bear tapping before the age of $t$ iwenty-five or thirty years; in partially cleared forests, they can be tapped at sixteen years, while on lands from which the other growth has been removed, rub ber trees begin to yield at ten years, and, if carefully treated, appear not to suffer from the tapping. The trees in cleared spaces grow much more rapidly than
those in the dense forests. Without doubt the application of science would increase the yield of sap, and also the proportion of solid rubber contained in it, but this good result is not yet to be looked for. The rub ber gatherers will trust to "the prodigality of nature" until all the unexplored fields have been opened and all the existing trees have been exhausted. How long that will be in the future may be imagined when one reflects that trees continue to be tapped that have been yielding rubber ever since it became a marketable commodity.

The season for tapping trees may last for three months, and sometimes six, the operation being per formed daily. This is determined by the size of the trees and the richness of the yield. In some cases the trees are tapped only every other day. In others, the trees are tapped daily in the season, but only in alterthe locality where he works sometimes taps the trees
*'This article has been suggested by the receipt during the past year of no fewer than sixty-nine letters of inquiry fromTndia Rubber World readers, to
which paper we are indebted, and is written by Mr. M. F. Sesselberg (Para) with the idea that the information which has been asked for may prove of interest to other readers.
$\dagger$ The crop year is measured from the first of July.
so heavily as to kill them in a single season, but such a man will find it hard to get a road in the same field again. These roads, by the way, often exist year after year, and have a rental value.
The cups used for catching the rubber milk as it oozes from the tree are now mostly of tin, though in some places cups of burnt clay are still used, being considered superior. The making of the latter requires much time, however, and they are liable to break, so that tin cups are rapidly displacing them. The clay cups are attached to the rough bark of the tree with the aid of a dab of wet clay, while the tin cups are held in place by turning down the top and pressing it into the bark. The tins could be improved by the addition of some sharp points to the back of each, to drive into the bark. The cups are made in three sizes- 4,6 , and 8 ounces. The smallest size is used on the lower Amazon, the middie-sized ones in Amazonas, in the developed fields, and the largest size in virgin fields. In the latter case smaller cups are likely to be substituted before the crop is finished.
As in every other industry, there are careless, shift less workers in rubber gathering. Such persons, when finishing their day's labor, will throw the empty cups on the ground at the foot of the trees, with the "drippings " left within. A more practical man, when he begins the season, will drive into the ground by each tree in his road a stick in which there are as many saw cuts as he has cups for the tree, while underneath is a box in which the last drop of rubber is caught. These drippings at the end of the season represent a not small item.
A rubber gatherer who is fully conversant with his business and is desirous of protecting his trees will work as follows: He will first mentally divide the lower part of the trunk-beginning about one foot from the ground and going as high as he can reach with his hatchet-into six sections, representing the six working days of the week. On Monday, we will say, he will commence work by making taps about eight inches apart around the trunk, forming a circle as high as he can reach. Under each incision he for a cup to catch the sap: eight will be needed for
place a tree sixty-four inches in circumference. On Tuesday the same tree will be tapped on a circle about foot lower, the incisions being directly under those made on the first day. By continuing this process to
the end of the week, the circle of taps on Saturday will be about a foot from the ground, and forty-eigh incisions will have been made,-i. e., six circles of eight
taps each. The next week he will begin by tapping again in the circle of the previous Monday but tap ping between the incisions in the circle. When, after a time, no room for new incisions can be found in the original circles, new circles are started a short distance below, and thus the work of cutting into the bark is continued until the whole surface of the tree is cov ered with taps. It will then be necessary for the tree to rest for the remainder of the year-possibly for
all of the next year. If the tapping has been properly done, by which is meant if the bark has been cut into no more than is necessary, and the wood not cut into at all, the incisions will heal over so as to leave no sign.

Much skill is needed in tapping rubber trees. Deep incisions damage the trees, but if they are too shallow, the sap will not flow. If the tapper, on failing at first to go deep enough, attempts to strike again in th same place, he is likely to miss his aim, thereby mak
ing two incisions instead of one, and chipping out a ing two incisions instead of one, and chipping out a
bit of wood between them, which wounds the tree Some superstitious people try to make the cut in the form of a cross, "for luck."
Having tapped the trees in his road early in the day, nd placed the cups in position, the tapper returns home for breakfast. Later he starts out with a bucket or other receptacle to collect the sap from the cups, beginning with the first tree tapped, and going over the same route followed in the morning. The milk
does not run more than three hours. At the end of does not run more than three hours. At the end of
his road he will find himself near his hut again, where he next proceeds to smoke the sap over a fire of palm nuts.
In the case of some large trees two series of circles are described in the tapping, the upper series being reached by means of a staging built around the tree. Such treatment is likely to prove fatal to the tree, however. It is good management to avoid tapping during the flowering season of the rubber tree, which is during September. The best months for tapping are July, August, October, November, and sometimes December.
In answer to several correspondents it may be said would prove a misit to the Amazon states doubtless than any letters that can be written from here. Life is easy in these latitudes, though somewhat oppressively de rigeur in the cities, where Portuguese cus toms still prevail. In the country, especially in the rubber fields, it is quite another matter. There a man may go about dressed in a light flannel hunting shirt and cotton trousers, a coat and waistcoat being
superfluous. A big straw hat and high hunting boots
are needed for going about, besides which one's outfit generally includes a rifle, cigars, and a bottle of qui-nine-the latter as a precaution against possible fevers.

An experiment has been made recently in New York of much importance concerning the relative value of rubber-tired wheels on ambulances. Two rubber-tired ambulances have been in constant use for several weeks, one being equipped with solid and the other with pneumatic tires. The weight of each of these wagons alone, not including the weight of the driver, doctors, or patients, is 1850 pounds and it is therefore the heaviest pneumatic-tired vehicle in the world It has been found that the rubber tires offer a great many advantages over the ordinary iron tires. It has not as yet, howe ver, been determined whether the solid or the pneumatic tires are preferable. There is a great increase of comfort to the sick person who has to be carried over our rough streets by using the rubber tires and it is found also that the noise made by the vehicle is greatly lessened. Another important advantage is the saving in the weight of the ambulances. The am bulances have been made very heavy to give them greater stability to reduce the jolting. With the use of rubber tires the wagons may be made 400 pounds lighter, which of course lightens the load for the horses and reduces the cost of construction.

Several inconveniences have been experienced in the use of both forms of rubber tires. The ambulances are so heavy that the pneumatic tires collapse very often. And the solid tires are likely at any moment to be torn from the wheels, since the strain is unusually great. These difficulties, it is thought, however, can be remedied in time. It is as yet uncertain which form of rubber tires will be adopted, but it is certain the use of rubber in some form will be continued.

## Effic Between New York an

During the past year 879 passenger vessels arrived at New York from European ports, 96 fewer than in the previous year. The number of passengers, how ever, was very much less. This is especially so in re spect of steerage passengers, only one-half the numbe going westward, as compared with the four preceding years. The total number of cabin passengers wa 92,561 , and of steerage 188,164 , the decrease on the former being 29,268 , and on the latter 176,536 . The first-class passengers were less by 24 per cent, and the steerage by 48 per cent. It therefore follows that each ship on an a verage carried less. This, however, applies more forcibly to the emigrant steamers sailing out from Continental ports, for the decrease in their case is very much greater than with the British liners. is very much greater than with the British liners
When the totals are compared with those of preceding When the totals are compared with those of preceding
years, the decrease is still more marked, and there is years, the decrease is still more marked, and there is
no question that the real cause is the restrictive measures adopted by the United States to preven pauper immigration. By reason of extreme caution the steamship companies have not had to carry back many passengers, but the fact that some of the Continental steerage liners have only carried one-tenth or one-twelfth the number taken in preceding years in dicates the effect of the law.

|  | Cabin. | Steerage. |
| :---: | :---: | :---: |
| 1894. | 92,561 | 188,164 |
| 1893 | 121,829 | 364,700 |
| 1892. | 120,991 | 388,486 |
| 1891 | 105,023 | 445,290 |

## Imitation of Pearl.

When nitrocellulose, dissolved in alcohol and ether, or in soda or potash-soluble glass, is spread over a surface of wood, paper, glass, porcelain, or metal, and the solvent allowed to evaporate, the film remaining is said to have the appearance of mother-of-pearl. The proportions recommended are : 1 part of nitrocellulose 8 parts of alcohol ( 90 to 100 per cent); 21 parts of ether With soluble glass as solvent, 10 parts of this to 90 parts of water are employed.
The nitrocellulose may be pure or crude, or in different stages of nitrification, as guncotton, etc. Ethyl or methyl alcohol and sulphuric or acetic ether are recommended. The degree of concentration of the nitrocellulose may be varied within certain limits, which variations produce different results. The addition of bisulphide of carbon in the proportion of 25 parts to 100 of the above solution, or the addition of benzine, produces a difference in the brilliancy and a rrangement of the colors of the iris developed on the nother-of-pearl-like surface.

## Preserve for Binding.

The publishers of the Scientific American would advise all subscribers to preserve their numbers for binding. One year's issue ( 52 numbers) contains over 800 pages of ilhustrations and reading matter. The practical receipts and information contained in the Notes and Queries columns alone make the numbers worth preserving. Persons whose subscriptions have commenced since the beginning of this year can have the back numbers sent them on signif ying such wish. Their subscriptions will then expire with the year,

AN AUTOMATIC FEED LUBRICATOR.
The oil cup shown in the illustration may be conveniently applied to any reciprocating portion of an engine, whether the part moves horizontally, perpendicularly or through any intermediate angle, or it may be advantageously used on any part having a crank motion. It has been patented by Mr. George W. Mitchell, of Lunenburg, Nova Scotia, Can. Its base'is a disk like casting. with upturned marginal flange, and a shank with reduced and threaded lower end, to screw into a socket communicating with the part to be oiled. The base has a central channel communicating with an upwardly projecting tubular extension having


## MITCHELL'S LUBRICATOR.

apertures in its lower portion, and with its upper end threaded to receive a tubular plug centrally located in a cap plate having a downwardly turned marginal flange. The body of the oil cup consists preferably of a cylindrical glass casing held within the marginal flanges of the base and cap plate. In the central tube is a regulating rod with conical lower end adapted to be seated in the beveled wall of the entrance to the central channel of the base, the rod extending upward through a packing in the tubular plug, and its upper end being threaded to receive an angular weighted lever. The lever is fulcrumed in a bracket bearing on the cap plate, being held in place on the rod by a lock nut. The lever is so arranged that it will have the same motion or power on a back and forth or an up and down movement, or a combination of both movements. To regulate the throw of the lever, a guide screw is secured in the cap plate, the horizontal member of the lever being limited in its movement by contact with the under surface of the head of the screw, the guide screw being held in adjusted position by a lock nut. This manner of seating the conical end of the regulating rod forms a needle valve which is reciprocated when the machinery is in motion through the pendulum-like action of the weighted lever, the oil being thus passed through the base channel at reg ular intervals and in predetermined quantities. In the top plate is an opening closed by a cap for introducing the supply of oil or lubricating compound.

AN AUTOMATIC INSTANTANEOUS WATER HEATER. The illustration represents an entirely new departure in the method of heating water for the bath, the kitchen, or other domestic uses, designed to wholly supersede the familiar kitchen boilers and water backs in all houses supplied with gas. The heater is made on the principle of the latest improved water tube boilers, heating the water as it flows, and only so long as it does flow, the gas being automatically shut off from the burners with the closing of the outlet faucet, and there being no large standing body of hot water


CLARKE'S automatic water heater. temperature. the animal rotates the cage, and by the animal rotates the cage, and by
means of a tambour or levers this momeans of a tambour or levers this mo-
tion of the cage is recorded upon kymograph paper kept moving night and day. An electromagnetic circuit with a clock marks hours and minates. We thus have the manner in which an animal divides his time between rest and activity recorded by himself. Rats and mice divide their days into about 12 hours' rest and 12 hours' intermittent work during the night. During the work period, short intervals of activity, rarely exceeding an hour, are interrupted by almost equal periods of rest. The squirrel, in winter, works almost continuously for from twenty minutes to two hours early in the morning, with sometimes a short interval of activity late in the evening, and rests nearly 22 hours in the day.
Food has a most marked influence upon diurnal activity. In general the icher the diet in proteid, the greater
radiating away units of heat, making the surround ings always uncomfortable in warm weather, and necessitating double work in a range fire. The Gil bert \& Barker Manufacturing Company, of No. 82 John Street, New York, have just conmmenced the introduction of these heaters, which are a foot wide and thirty inches long, and may be placed in a cellar or on a bracket in the kitchen, or wherever it may be most convenient to make the pipe connections. The valve arrangement is similar to that of a direct acting steam pump. In one end is a cylinder containing a piston which rises on the inflow of water from the main, on the opening of any faucet in the pipes connected with the heater, no matter how dis tant may be the faucet, and the movement of the piston opens a valve by which gas is admitted to burners under the heating coil, the gas being instantly ignited by a pilot light. The valves and pistons complete are about four inches in diameter and eight inches long, and the coil is of drawn copper tubing, half inch diameter and thirty-two feet long, coiled in an iron frame or box. The movement of the piston is regulated by a counterpoise, according to the pressure of water in different cities, or on different floors of a house, the regulation of the gas supply, accord ing to its pressure and quality, being also provided for by adjustable needle valves, whereby sufficient air is likewise supplied to the bell-shaped atmospieric buruer pipe. The heater may thus be adjusted to use any quality or any pressure of gas and any pressure of water. As will be seen, the supply of hot wate which may be drawn from this heater is illimitabie, all the water drawn through it being heated, but the heating of the water stops simultaneously with the closing of the outlet valve, the supply of gas being cut off with that of the inflow of water. By checking the faucet from which water is being drawn, a smalle quantity of water will be heated to a much higher

This heater is the invention of Mr. W. C. Clarke, treasurer of the Gilbert \& Barker Company.

## Activity of Animals.

Thus far the animals experimented on have been rats, mice and squirrels. They are kept in circular easily rotated cages, so arranged that any motion of
serpuly.
the activity. Fat has the opposite effect, reducing the activity of mice from 6 to 8 hours' actual work to a few minutes a day. To test the influence of alcohol on spontaneous activity, rats kept on dry corn were given instead of water alcohol of from 5 per cent to 60 per cent. During 50 days of this treatment, no uniform effect of the alcohol could be demonstrated. All nor mal animals experimented on tended to work more min utes per day when barometric pressure was high, and this must be taken into careiul account in estimat ing the effect of any condition upon daily activity.C. C. Stewart, Physiologic al Society.-Science.

A Thousand Dollars an
Acre from Blackberries.
In recounting his experience, Mr. C. E. Chapman, of Peru, N. Y., said that he had heard that blackberries would grow anywhere, and he, there fore, bought some plant of Kittatiny, took no par ticular pains to set them and many died. He used on the ground a quantity of raw, coarse manure, and the nest year many of the
canes broke. He then con-

cluded that to grow blackberries required some study. As a result of the study he prepared a piece of chestnut loam, put it in prime condition, bought some plants of Agawam \& Snyder from good, careful growers, at prices that would warrant him in expecting good plants. He set them carefully in trenches seven feet apart and eight inches deep in the trench. He found these varieties deep-rooted and thrifty, and where mulched, pruned and not fed too much raw manure, he had little trouble from winter killing. When set ting his plantation he applied eight hundred pound of potash to the acre. He was careful to have al plants well set, and he frequently clipped the tops All weak canes were cut out. Every spring he applies a light dressing of commercial fertilizer. Immediately after fruiting he cuts out and destroys all old canes as these are the seat of nearly all the troubles of thi fruit. In the winter he mulches heavily and leaves the mulch on late in the spring to prevent early starting. Although he did not believe a thousand dollars an acre could be realized under ordinary conditions, yet this was an achievement worth striving for, and smal patches had been made to yield at that rate. It re quired the right combination of man, soil, variety and cultivation, but it could be done.

## A REVOLVING BRUSH CAR FENDER

The decidedly novel means represented by the illus ration for averting danger to pedestrians from fast unning cable and electric cars forms the subject of a patent recently issued to Messrs. Andrew Mohn and August J. Bothur, of No. 131 Bloomfield Street Hoboken, N. J. A revolving brush, of a diameter to cover the road way to the outer side of each rail, is held under each end of the car, the brush being revolved by a mechanism connected with one of the caraxles, or, in the case of trolley cars, by a separate electric motor, if desired. When revolved from the axle, as represented in the transverse sectional view, Fig. 1, the hub of the brush is journaled on a vertical shaft secured to the platform, and on the hub is a pulley connected by a belt with a loose pulley on the car axle, the latter pul ley being adapted to be locked to the axle by a simple form of clutch moved by a shifting lever. A coiled spring on the lower end of the vertical shaft, pressing upward against a washer in the hub, holds the brush

MOHN \& BOTHUR'S CAR FENDER.
normally at a little distance above the track, but the brush may be readily moved down into contact with the top surface of the track by pressure upon a pin ex tending up through the platform, and bearing upon a vertically sliding frame having a central tubular bos esting upon the upper end of the hub. When the motorman or gripman ceases to press upon the pin the brush is raised by the spring to its normal position When an electric motor is employed for driving the brush, the vertical shaft is replaced by a shaft rotated from the motor, and, as shown in Fig. 2, a change is made in the frame by which the brush is moved down ward, although the movement is similarly effected by pressure upon the pin extending up through the car platform. The improvement is also designed to be es pecially valuable for clearing tracks of snow and ice.
"Malaria a Water-borne Disease" was the title of a paper read by Dr. W. H. Daly, of Pittsburg, at the recent meeting of the Mississippi Valley Medical Association at Hot Springs, Ark. The author said, in sur ming up the evidence in a given case of so-called ma laria, it is important to remember that the water ve hicles of malaria may include contaminated land water taken into the stomach on the stalks of celery or on he leaves of lettuce, or it may find its vehicle in the rinsing of milk cans with malaria water, or in the adulteration of milk with contaminated water contain ing the Laveran germ. The cistern water stored under the earth may be easily contaminated by the earth water containing the germ, if the cistern itself is cracked or otherwise inefficient

## an ancient roman city in algeria.

Second only in antiquarian and historical interest to the discoveries at Pompeii are the ruins of the ancient Roman colony of Timegad, or Timegatte, in Algeria. The city lies among the spurs of the Atlas Mountains, about fifty miles due south of Constantine, and the same distance northeast of Biskra. It was known in Roman times as Thamutuda, Thamugas, and Tamugada, and must have been a place of some importance, for the ruins are about three-quarters of a mile in width and very nearly a mile and threequartersin length, if we include the Byzantine fortress and the tombs cut in the rocks close by. The city was formerly the center of a wide stretch of fertile country in the center of the granary of the empire, and was also a military station of great importance, by which the mountain tribes of the neigh boring Atlas were held in check. Through it ran six Roman roads, connecting it with Lambessa, Diana Veteranorum, Constantine, and other flourishing Roman colonies; and it has been conjectured that the veterans of the thirtieth legion were established here in recognition of their services in the Parthian war, A. D. 106. The country round is now utterly deserted, and there are no inhabitants near the spot, the nearest Arab settlement being some miles off. During the latter empire Time. gatte was a very flourishing city, and during the fourth century was one of the great African centers of religious agitation. Many of its bishops were celebrat ed men, and Optatus, who was head of its church at the end of the fourth century, was regarded as the chief of the Donatists, the strictest among the sects of the church in Africa.

Timegatte seems to have been ruined and deserted about 500 A. D., but the citadel was rebuilt and the city again inhabited toward the middle of the sixth century; and when the Arab invasion took place it after the restoration of the city. However, owing to the disturied state of the country, at the fall of the empire the city was again deserted.
A number of statues, inscriptions, and earthenware vessels are scattered about the ruins, and the houses which are still standing enable us to reconstruct the different quarters of the town without any very great difficulty. The monuments still left in more or less preservation are situated to the north of the watercourse which intersects the plain. They are: the Forum, which has an imposing appearance, with it pavement still intact, its tribunes, its inscriptions, and its columns, which supported a long colonnade running from north to south, and looking out over the fertile vallev at the foot of the mountains; the temple, a remarkable ruin full of curious detail, which is supposed to have been a temple to Jupiter; the theater, which still remains in a very fine state of preservation, and is situated on the slope of the hill against which the city is built; a gateway in a half ruined condition; a smaller temple; and the principal street, which is a fine broad thoroughfare flanked on either side by magnificent columns, and terminating in a triumphal arch. This arch is in an almost perfect state, and is one of the most important monuments of the Roman period existing in Algeria. It has three openings, the larger one in the center, and a smaller one on each side, with a niche for a statue above it. Four fluted columns with Corinthian capitals flank the openings, and an entablature connects the pillars and arches.. Our engraving shows what remains of this triumphal arch.-The Graphic.

Copyright in Photographs.
A decision by an English court has determined the rule as to photographic portraits. The copyright belongs to the sitters when they order the portrait and pay for its being taken. The only claim for copyright by the photograph er is when he invites sitters to havetheir likeness taken, and when they assent to sit with out payment, doing so for purposes of publicity or ad vertisement.

AN IMPROVED FLUE EXPANDER.
For quickly and conveniently expanding boiler flues in place in the flue sheet, to prevent leakage, the implement shown in the illustration has been devised and patented by Mr. David W. Patton, of No. 914 Concannon Street, Moberly, Mo. Fig. 1 represents a side sectional view of the improvement, and Fig. 2 is a face view of the outer head, the stock consisting of an outer and an inner head. In the outer head are re-


PATTON'S FLUE EXPANDER
cesses extending radially from a central opening and in the inner head are aligned slots, the slots and re etween longitudinal rods connecting the two heads. The central apertures in the two heads form a passage for a tapering mandrel, whose outer head is adapted to be taken hold of by a suitable tool to force the mandrel inward, at the same time pressing the rollers outward and rotating them. When the mandrel is withdrawn, the rollers may be readily taken out of and replaced in the stock. The outer head forms on its inner face an abutment for the projecting end of the flue or pipe to be expanded, and on this head inner a sleeve secured in place by a set screw, the inner edge of the sleeve abutting against the outer cons


THE ROMAN TRIUMPHAL ARCH AT TIMEGATTE.
face of the flue sheet, and the sleeve being adjusted in ward or outward as desired.

## Paper Trays and Battery Jars.

An inexpensive photographic tray or battery cell, which is practically water, acid, and alkali proof, may be made out of a pasteboard box by covering it with a coating made by melting together equal parts of paraf fine and guttapercha chips. The guttapercha should be melted first over a slow fire, the paraffine is then added and the whole composition thoroughly mixed and brought to a very fluid condition. It is then poured into the box or box cover, which should be dry and warm. The composition should be allowed to run along the edges, so that the entire inside of the box is waterproofed, the excess is poured off and the box is then allowed to cool. The outside should then be waterproofed in the same manner. In case any spot fails to receive the composition, some of it may be made into sticks and applied to the bare places with the aid of a hot iron, which mayalso be used to smooth up any unevenness of the surface. Some photo graphers like ridges in the tray to keep the plate off the bottom and to facilitate in lifting it out. These ridges can be easily built up with the aid of a hot iron. These pasteboard trays are light and are not liable to be broken by a fall. Old dry plate boxes mey be utilized for this purpose. Wooden trays may be waterproofed in the same manner and can be used for batteries i desired.

## Modern War Ships.

Old-fashioned naval officers have a habit of compar ing the new ships with the old, to the disadvantage of the former.
The deck of the modern man-of-war is no longer a broad, open space up and down which the eye may roam, seeing all that goes on. It is cut up by all sort of contrivances having relation to the business of the craft, so that one really sees at any one ime only a little corner of the deck. As for the officer of the deck, he in many ships now walks aloft on the bridge out of communication with his fellows, a solitary figure, able indeed, at a touch of the electric bell, to set in motion the most powerful machinery of modern warfare, bu no longer able to exchange a friendly word with his ellows.
There is one serious drawback to the modern stee hip that is not the result of any mere sentimenta consideration, and that is the deathlike coldness of the interior. It is possible, indeed to warm the ship with steam, but nothing can warm the sides in cold weather, and the man that sleeps near the un sympathetic steel is liable to contract rheumatism in an unconscious effort to warm it by the sacrifice of his own vital heat. The closed air port drips icicles and the sea ward wall of the state room is as cold as an ice box.

## The Largest steamer

company.
The North German Lloyd -Norddeutscher Lloyd- has from a small beginning work ed its way to the very front, being now the largest steame company in the world. The company enjoys a subvention rom the German empire for five lines, on the condition that the steamers call at cer tain ports, that the mail-car rying boats shall be built in German shipyards, and tha the speed be at least twelve knots. The company cap ital is now $83,000,000$ marks or about $\$ 20,750,000$, and its fleet consists of 83 steamers of an aggregate tonnage of 242 , 367 tons, besides tugboats The company's traffic com prises 22 lines, viz., 8 Europe an, 6 North American (twice weekly from Bremen to th United States), 2 South Ame rican, 5 to Eastern Asia, and 1 Australian. The staff of the company consists of 8,000 men, and in the year 1873 there was formed a seamen's and pension fund, by donations and an annual charge of $21 / 2$ per cent of the pay. The captains have to pass through the various degrees, and if there is an accident, they have to resign,

Gas of 240 Candle Power-Acetylene
The time was Wednesday, January 16; the place, the well known lecture theater of the Society of Arts, London; the man, Professor Vivian B. Lewes; and the matter, commercial acetylene. From this combination resulted, then and there, a sensation which, unless appearances are utterly illusory, will echo and re-echo through the industrial world for a very long time to come. When the announcement was made that Professor Lewes would read a paper on "The Commercial Synthesis of Illuminating Hydrocarbons, ${ }^{2}$ no indication was given of the particular turn which the communication would take: but that a high degree of interest and importance would be found to attach to Professor Lewes' matter was foreshadowed by the steps taken, with the co-operation of Sir H. Trueman Wood, the secretary of the society, to secure a fit audience for the occasion. In consequence of this effort, a goodly contingent of gas engineers and othersinterested in the gas industry put in an appearance at the society's house last Wednesday evening; but it is not to be supposed that a single individual among this critical portion of the audience had the faintest expectation of what was coming, or entertained the slightest idea that he was about to assist at what will, in all probability, come to be regarded throughout the gas and the allied interests as an epoch-making demonstration. Professor Lewes' and the society's secret was perfectly kept: and its disclosure at the proper time was, therefore, all the more astounding. For his design was no other than the first exhibition to the world of one of the most striking of the fruits of modern scientific discovery in the new territory of physico-chemistry, the product of that remarkable research of Mr. T. L Willson-carbide of calcium-the nature and properties of which were by a pure coincidence, described in our last week's "Technical Record.' The absorbing interest of this programme, and the brilliant manner in which it was carried out, are not likely to fade from the minds of those who had the good fortune to attend on this historic occasion.
What Professor Lewes said will be found reported in full in another column. Our present purpose is to draw attention to the text of the paper, and to supplement it with independent testimony as to the demonstrations by which the lecturer groved his statements. He commenced by laying out the ground for the structure he was about to raise, inviting the attention of his audience to the twin methods of chemical research, analysis and synthesis, to make it quite plain that he was not going to ask them to take from him anything arrived at by occult means, or needing to be hedged about by the devices of charlatanry. Only too often, in the history of so-called new discoveries in chemical industry, there is something kept back. The result, whatever it is, is stated to be attained by the employment of some "chemical," the nature of which is not disclosed. Of course, a man of reputation in science does not mix himself up in such schemes; but things of this kind occur often enough to point the observation we now offer regarding the transparency of Professor Lewes' exposition. And when the lecture had, by easily followed steps, arrived at the top of the first stage of his structure-the announcement that it was the synthesis of acetylene in bulk which it was his purpose to deal with-he was careful to show that there is nothing absolutely new about carbide of cal cium, or the phenomenon of its giving off acetylens when wetted with water. He carefully told the story of the early experiments with this compound; and only "let himselt go," in the capacity of the exhibitor of a new thing, when he came to deal with the production and uses of it on a commercial scale by the method of Mr. Willson.
And a very startling exhibition it was-as utterly fresh and convincing as good matter in the hands of a master in the art of science exposition could make it. Car bide of calcium, as known to science, was a chemical
curiosity until Mr. Willson happened upon a way of preparing it in bulk in the course of his experiments upon the manufacture of calcium alloys by the agency of his electrical furnace. But this discovery put a new face upon the compound. When an article that has only existed in grains comes to be turned out by the ton, it is, to all intents and purposes, a new article. In this sense, carbide of calcium is very new indeed; and its industrial possibilities are newer still, inasmuch as only the most direct and obvions of these development have as yet been so much as hinted at

Take it that the material can be produced by the ton and it is impossible to surmise what chemical industry will be able in the fullness of time to make of it. The product of fusing together, in an electrical furnace, such common materials as lime and carbon in any suit able form was exhibited by Professor Lewes as a greenish-gray stone-like substance greatly resembling the commonest description of serpentine rock. Whe kept in the air, a light coating of lime soon forms on suggestive of garlic, and also not altogether unlike the familiar reek that emanates from the ironwork of an old gas purifier, manifests itself. To all appearance it is a dull, inert stone, devoid of any other properties
than those of common road metal, and not more likely to be credited by the casual observer with gas
yielding capabilities. Upon a piece of this material Professor Lewes sprinkled a few drops of water from a wash bottle, and put a lighted taper to $i t$. The nascent gas-acetylene- immediately ignited with more than the brilliancy of the pitchy flame of highly bituminous coal in an open fire, and continued to burn fitfully over the wetted surface until all the water was gone. Then came the display of the same gas evolved in a jar (standing upon the lecture table) which contained pieces of the carbide in water, and stored in makeshift glass holders. It was a dramatic denoue ment of Professor Lewes' little plot when he applied a light first to a single open flat-flame burner, and then to a group of five similar burners, and people saw for the first time, in a public place, the intensely brilliant white, and solid looking flame of burning pure acety lene.

It is indeed a flame to wonder at. Nothing like it ever before came within the ken of a gas manager or dazzled the vision of a photometrist. There is some thing startling in the suggestion that gas of 240 candle power-calculated, in accordance with photometrica practice, upon the basis of a consumption of 5 cubic feet per hour-can be burnt by means of an open flat flame burner. When the carbide of calcium first came into Professor Lewes' possession this had not, in fact, been done, and, in order to get a flame of acetyiene at all, the American handlers of the gas had fallen back upon the brutal device of diluting it with a certain proportion of air. This was to repeat the crude Ameri can way of rendering naphtha gas usable. But the dilution of acetylene with air is even more objectionable than is the same treatment in regard to naphtha gas, inasmuch is it is more easily converted into a vio
lent explosive mixture. Professor Lewes, in succeeding in burning acetylene in the pure state in which it comes from the mixture of calcium carbide and water, has saved its prospects as an illuminant. He showed on Wednesday those wonderful acetylene gas flame already mentioned, each produced by burning the gas as made in the simple way described, without any ad ventitious mechanical or chemical aid, after the rate f half a cubic foot per hour, and stated to yield a neasured illuminating power of 25 candles. This could easily be credited. But what it is more difficult to con vey in mere words is the impression of steadfastness whiteness, and, so to speak, solidity which the flames in question made on the observer. At a little distance no non-luminous zone could be perceived; but, on a close inspection, a tiny speck of blue over the top of the burner was visible. No smoke or smell escaped from these flames, which, although exhibiting in their color the evidence of intensely active combustion, were found to be much cooler than oil gas or albo-carbon gas flames of the same size. This is a most striking feature of free-burning acetylene. The incandescent electric lamps, of normal brilliancy, by which the lec ture theater was lit were made to look as dull as "redhot hair pins" by the aggressive acetylene, which itself, by virtue of the irradiation produced by its daz zling white flame, appeared to form balls of almos blinding light when viewed directly in face or sideway of the flame. The mantle of the incandescent ga light is no whiter than, if it is so white as, the naked acet ylene tlame, which does not flicker or change color; but, in the absence of means of making a direct com parison between the two lights, it is rash to say which would bear the palm for purity of tint.
It is not for us to say what may be done with this new servant of a community that ever clamors for more light; and gets it more easily and cheaply every day Considerations of the cost at which the carbide of cal cium will be producible, and of the prospects of its utilization as a means of generating portable gaslight or as an enricher of common coal gas, suggest them lves to every one who sees or hears of the substanc and its qualities. But it is premature to discuss such questions at present; all that need be said upon thes points for the time being was said on Wednesday by Professor Lewes, and by those who took part in the extremely cogent little discussion that followed his brilliant discourse. When the time is ripe for more, it will doubtless be forthcoming. Meanwhile, it is only doing justice to all the parties concerned in last Wednesday's memorable proceedings in the Adelphi to acknowledge the high interest of the whole subject and the adequate manner in which it was presented to the general and technical public. The discoverer of the system is to be congratulated upon the promise of
the new industrial development; Professor Lewes may be complimented upon the deft and convincing way in which he performed the part of introducer of the nov elty; and-if last, not least-the Society of Arts deserve to be credited with having proved once more the practical value of the agency wielded by the council and the secretary of this useful institution, for giving publicity readily and promptly to warrantable novel ties in science and the industrial arts.-Journal of Ga Lighting.
「Professor Lewes' lecture in full is given in Scien-

## A St. Louis Fast Line.

An extract from the Detroit (Mich.) Advertiser of November 7, 1839, gives an account of a fast through passenger service which was then established between New York and St. Louis in the following terms:

It is no longer to be doubted that the lake route from St. Louis to Buffalo and New York is equally the cheapest and most expeditious. This fact begins to be very generally conceded, and the large number who already prefer it to all others is an argument conclusive that very soon no other route will be thought of, either by men of business or pleasure. For the infor mation of those who may hereafter wish to make the trip, we have procured and herewith publish the time
necessary to make the trip from New York to St. nocess :
From New York you, of course, take the steamboat to Albany, say 12 hours Railroad to Auburn
Swiftsure line to Rochester
Steamboat to Chicago..
Stage to Peru..

## eamboat to St. Louis, good wate

8 days 5 hours
Thus, in eight days and five hours the entire dis the way of Now to St. Louis can be traveled by ore them, who will hesitake. With bese facts be rent routes open to St. Louis? Looking at this rout just as it is, we cannot conceive it possible that any other route can be long thought of. But it is, never theless, susceptible of improvement, and this improve ment will be effected when the railroad is completed from this city to St. Joseph. That road will sav nearly two days' time, and the entire journey may then be made in a trifle over six days.
"Thus is Yankee enterprise annihilating space and bringing the two extremes of the new world into close approximation.'

Ship Building Wages Here and Abroad
In an interestinc paper recently made public by Mr. C. H. Cramp on the above subject, he gives the folowing comparative table of wages now current in this country and in Great Britain, in occupations pertain ing to ship building.

|  | American rate per week. | British rate per week. |
| :---: | :---: | :---: |
| Patternmakers | . \$18.00 | \$9.00 |
| Machinists. | 15.00 | 8.50 |
| Boilermakers. | 15.00 | 8.50 to 9.00 |
| Chippers and calkers. | 15.00 | 7.80 |
| Riveters. | 12.00 to 14.00 | 7.50 to 8.00 |
| Beam and angle smiths.. | 15.00 | 8.40 |
| Fitters up... | 15.00 | 7.80 |
| Ship carpenters........ | . 18.00 | 9.60 |
| Joiners............... | . 16.50 | 9.00 |
| Painters. | 18.00 | 9.60 |
| Coppersmiths. | 18.00 | 8.60 to 9.00 |
| Shipshed machinemen | . 15.00 | 7.20 |
| Furnacemen | 11.00 | 6.00 |
| Holders on. | . 9.00 | 4.20 to 4.80 |
| Riggers........ | . 11.00 | 7.00 to 7.20 |
| Plumbers. | . 18.00 to 19.00 | 9.00 to 9.60 |
| Drillers | 11.00 | 6.40 |
| Sheet iron workers. | 15.00 | 8.50 |
| Moulders, iron.. | . 14.50 | 9.00 |
| Moulders, brass | . 15.00 | 9.00 |
| Laborers, as helpers.. | 9.00 | 5.20 |
| Laborers, as handlers | 8.00 | 4.20 |

In 1873, when preparations were being made for the Ashantee war, Dr. Crookes was requested by the Army Medical Department to suggest a mode of protecting our troops against the use of the highly impure water of the Gold Coast.
After some experiments on polluted waters, he recommended as an addition to the impure water the following mixture :


Fine clay..
This mixture, in the proportion of $1 \mathrm{c} . \mathrm{c}$. to 10.000 parts even of London sewage, effects a rapid purifica tion.

The addition of the other ingredients along with the permanganate has the object of expediting the process and of precipitating other impurities and living organ isms upon which permanganate alone has no immediat action. It was found that moving organisms survived for more than a day in an intensely red solution of permanganate. This latter fact, however, though it hows that permanganate is of little use for soldiers on the march, does not disqualify $i^{i}$ as an addition to the reservoirs and clarifying beds of a municipal water supply.

## Femedy for Insect Stings.

A paint for the stings of insects, in which ammonia is kept in close and prolonged contact with the affected part, is prescribed as follows :


## Effects of strong Electrical Currents.

 M. Bernhardt, in the Centralblatt fur die Medicinischen Wissenschaften, has collected several instances of death by electricity. In one recorded by Dr. J. Kratter a man aged twenty-six was traversed by a current of high tension- 1,600 to 2,000 volts-and was found breathing stertorously a few steps from the point where he made contact. Death soon took place. The post mortem examination, after the lapse of twenty-one hours from the time of death, disclosed two small wounds-one on the left index finger and the other on the back-and there were large extravasations of blood in their vicinity. All the organs of the body showed hypervenous blood, acute œdema of the lungs was present, and there were extravasations into the sheath common to the carotid and vagus, along all the vertebræ, into the intercostal spaces, around the œsophagus, beneath the peritoneum and elsewhere. The muscles of the body were in an extreme condition of rigor mortis; the heart was partially relaxed. No macroscopic changes could be seen in any part of the nervous system.Kratter thinks that the electrical shock suddenly paralyzed the heart, which was the immediate cause of death, accompanied by odema of the lungs causing hypervenosity of the blood. There was a marked contusion on the left side of the diaphragm at the point of contact of the heart. Experiments made on animals showed that in them the respiration was usually primarily arrested, which caused asphyxia and secondary stoppage of the heart's action, though sometimes the heart was first affected.
In a second case, reported by M. D'Arsonval, a man was struck with a current of 4,500 volts (the ampere meter indicated 750 milliamperes). The current entered at his hand and issued at his back. Half an hour or more elapsed before any attempts at resuscitation were made, but on artificial respiration being practiced on Silvester's method, recovery took place.
Lastly, Dr. Donnellan reports a case of the passage of a current of 1,000 volts through a man, which instantly caused coma, dilated pupils, pallor of the face, and sweating; delirium, and tonic alternating with clonic spasms followed. The pulse was 80. The respiration, at first stertorous, passed into the Cheyne-Stokes type. After the injection, first of morphia and then of strychnia, the patient fell into a deep sleep, from which he awoke convalescent.-Lancet.

## Eye Mistakes.*

Conversation with other physicians convinces me that there is more real misunderstanding regarding the import of eye symptoms than concerning those of any other portion of the human body. Why this is so I can hardly apprehend, unless it comes from the fact that so many eye troubles are purely mechanical. and so are outside the sphere of ordinary medical thought and study. To many the eye seems also to be a mystery into whose sacred precincts they fear to enter, and the mechanical and optical principles which to the oculist seem so plain and easy are entirely overlooked or but dimly grasped by the gen eral practitioner. This fact will be illustrated by the following common mistakes that are made regarding eye troubles.
One very common mistake is that of belittling the importance of ophthalmia neonatorum. Many are the children who have either been entirely blinded or have had their eyesight impaired for life by reason of carelessness or neglect. It is important that proper measures be taken to prevent its occurrence, for it is to a large measure a preventable disease. The physician should always know by inspection the exact state of the cornea in these cases, so that proper measures
may be taken to prevent any impairment of its transmay be taken to prevent any impairment of its trans-
parency. Unless a physician feels that he has the knowledge and is competent to treat such cases, he should call to his aid one who does know how.
Regarding the selection of glasses, the gravest mis takes are made. I frequently meet physicians of good general ability and large practice who not only encourage their patients but they themselves set the example of selecting such glasses as they seem to see best in, from any vendor that happens along, or they
whose shop they chance to stray. In this respect they whose shop they chance to stray. In this respect they
treat the eye with less consideration than they do their treat the eye with less consideration than they do their
backs, since every one knows that to secure a comfortabacks, since every one knows that to secure a comforta-
ble and well fitting coat it is necessary that first there shall be definite measures made with the eye. They will put on glasses thus without any definite measurements whatsoever.
Now the simple truth is that proper measurements of the eye cannot be made by simple tests of the sight. The eye is an optical instrument set for seeing things far away, but provided with a focusing apparatus (the accommodation) by which it automatically can adjust itself to near objects. This power is a muscu-
lar one and is entirely involuntary. The eye always lar one and is entirely involuntary. The eye always
adjusts itself for the best seeing of any object at its distance.
*By E. M. Howard, M.D, Camden. N. J. Read before the New Jersey State Homeopa
nian Monthly.

It is just this fact that vitiates all atiempts to measure its defects. It is like trying to measure the length of a rubber band that is constantly stretching and contracting. Hence it is that it is simply impossible to measure the refractive errors of the eye by any of the ordinary tests at the disposal of the opticians and spectacle venders. Every eye that needs a glass at all needs first of all to have its optical status accurately measured by an oculist who alone is able to determine what methods and means and drugs (mydriatics) are necessary and safe.
I suppose one reason why this truth is not really believed is because when the oculist utters it, it looks as though it was a scheme on his part to increase his business. This again is an error, for if every person were thus examined for glasses upon the first evidence of eye strain, a great mass of eye troubles would be prevented and the oculist's business would be immensely lessened. I will only mention in illustration that in this way those banes and specters of advanc ing age, senile cataract and glaucoma, would become almost unknown, since they are most probably always more or less directly the result of eye strain.
Another phase of eye mistakes is illustrated by the remark of a very able practitioner. He was speaking of a school wherein, through the vigilance of its teachers, a large proportion of the scholars were wearing glasses His remark I cannot repeat, but it was made with a
covert sneer, and the caustic hint that probably many of the children did not need them at all. Now I don't believe there are any oculists who are prescribing glasses when not needed. I have never found such a person nor such a patient so treated. The truth is that the error is all the other way, and that many eye
defects of low degree are not corrected as they should defects of low degree are not corrected as they should
be. The oculists have erred on the side of too few be. The oculists have erred on the side of too few
rather than too many spectacles. It seems difficult for the laity and even the practitioner of medicine to realize the enormous strain that modern civilization is placing upon the eye. It follows as certainly as is placing upon the eye. It follows as certainly as ing amount of attention paid to the preservation of the sight, and congenitally defective eyes can and must be corrected by glasses to a much larger extent.
But please remember all such work must be done upon But please remember all such work must be done upon
a basis of accurate measurements. All other attempted corrections are worse than useless, and it is the duty of physicians to so warn and instruct their patients.
Grave mistakes are commonly made regarding the fitting of the frames for glasses. All frames ought to be so accurately centered and adjusted that the line of vision should be through the optical center of the lens, excepting, of course, those few cases in which the oculist purposely decenters in order to obtain prismatic effects. In other words, the center of the pupil of the eye should be behind the center of the lens. All cyl indrical glasses must also be held at definite angles and any deviation therefrom is disastrous. Unfortu nately, well fitting frames are the exception and not the rule, with the result that the best selected glasses fail to relieve, and may, indeed, increase eye strain To this may be added the deplorable fact that the cos metic effects of ill-fitting frames are such as to enhance the natural aversion to the wearing of spectacles. Ob servation of the frequent manifest disfigurement of the features of such persons deters many ladies espe cially from thus wearing these much-needed helps As a matter of fact, I think well-fitting glasses really add to, rather than detract from, the beauty of the eatures.
Quite a frequent mistake is made by practitioner egarding the import and cause of the various inflamations of the margins of the lids, such as blepharitis and herdeolum or sties, etc. Physicians go on precribing for recurring attacks of these troubles, forget ful of the fact that their development is, in the great majority of cases, due to eye strain, and that it is glasses, and not medicines, that are needed.
Grave mistakes are very commonly made in the treatment of phlyctenular conjunctivitis. The first thing to be done is to remember that dietetic error are always present, and that no good results will be obtained without a strict and carefully regulated diet taken at regular intervals. It must not be forgotten also, that in addition to well selected constitutiona emedies, atropine instillations will be required when It is easy is excessive
It is easy to make serious mistakes in the diagnosis s well as the treatment of iritis and glaucoma.
Let me enumerate the classical symptoms which ought to lead to a certain diagnosis of iritis: Ciliary neuralgia, ciliary and subjunctival injections, showing fine, deep vessels radiating outward from cornea in straight lines, a discolored and sluggish iris-these point unmistakably to the trouble. And now comes the greatest and very common mistake of general practitioners in its treatment. Atropine is either ne glected or given hesitatingly and in too weak solu tions. It must be used early in sufficient strength to produce complete dilatation, or the eye will be more or less permanently ruined by adhesions of the iris to the lens. The only exception to this rule is the evi-
be used cautiously, if at all. The differential diagno
sis of iritis from glaucoma is not always so easily made.
The following are the chief diagnostic points of glancoma in the order they will be likely to ke observed We will first notice that the pupil of the affected ey is dilated larger than the other eye, and that it is fixed, inactive, will not respond to light. The patient will complain of seeing a halo of rainhow colors, the outer ring being red and the inner bluish. It will be found that the cornea is lacking in sensibility, and this will lead to a test as to the tension of the eyeball, which will be found increased. An examination of the fundus will then be made for the characteristic cupping of the disk. To these symptoms may be added enlarged ciliary veins. A shallow anterior chamber, which can be easily made out by a side view of the front of the eyeball, and impairment of the right pons, are usually present, and are sometimes the most marked symptoms leading to the erroneous diagnosis and treatment for a simple neuralgia. But pons is not always a prominent symptom, as is commonly supposed, at least in the earlier stages, when a diagnosis is most valuable.
It is a grave mistake to overlook and neglect these cases and no physician should attempt to treat theim limits of an iridectomy, which alone, in many cases, can save the sight.

## saturated waste for oiling Cars.

Mr. B. Haskell, superintendent of motive power on the Chicago \& West Michigan and the Detroit, Lansing \& Northern Railway, is using burlap for packing tender and engine truck boxes. The material is the burlap or sacking that the baled waste is wrapped in. burlap or sacking that the baled waste is wrapped in.
The material is springy and will not mat. Its elasticity keeps it up in contact with the journal and its texture permits the oil to pass through it freely. The material is cut up quite fine preparatory to use. Mr Haskell writes the Railway Engineering and Mechanics that he finds it to be equally as good as woolen waste and it has the advantage of costing nothing. He furnishes his trainmen with saturated waste instead of oil for oiling cars. To prepare this waste he has built a special tank. It is circular and will hold about six barrels of oil. A coil of steam pipe is run around the inside of the tank, and a shelf of stack netting is seinside of the tank, and a shelf of stack netting is se-
cured on one side. About two barrels of oil is put in cured on one side. About two barrels of oil is put in
the tank and waste enough to absorb that quantity of the tank and waste enough to absorb that quantity of
oil. Steam is then turned on and the oil heated slightly, making it thin enough to be absorbed readily by the waste. It is then allowed to soak for at leas twenty-four hours, and after being again heated, the waste is put on the shelf to drip. The second heating is to make the waste drip more quickly than it otherwise would. A little experience in heating the oil will enable the operator to prepare it so that the oil will drain from the waste without any handling or pressing. It has been found so convenient that since the plan has been adopted the trainmen are not given oil, but saturated waste instead, and the cost of oiling cars has been greatly reduced thereby.
ncient System of Manufacturing Salt in Mexico. Mr. James Mactear describes, in a recent number of the Journal of the Society of Arts, a very ancient method of manufacturing solar salt. which is still carried on in Mexico, near a village called Ixtapa de la Sal, in the State of Michoacan. The village lies at an elevation of 4,200 feet above the sea in a volcanic disrict, and brine is found at various points oozing from the rocks and in pits which are dug for the purpose of collecting it.
The method of evaporation is very curious and interesting: the small hills are terraced, and on the broad teps thus formed flat-topped stones or bowlders, hiefly of a black close-grained volcanic rock, are care ully arranged and leveled. On the flat surface of each of these stones a small ring of clay is built up about an inch high, and in the small vessel thus formed the brine is evaporated. There are many thousands of these to be seen close to the road. The evaporation takes about four days, the little vessels being filled from time to time by men who carry the brine up from pits in the valley in large earthenware jars. The salt is of ver arge grain and, as might be expected, rather dirty in ppearance but the production of the district is ver considerable, and the method dates back to time immemorial.

## Home Made Powder.

The Naval Ordnance Bureau is greatly gratified with the excellent results it is obtaining from the 6 inch samples of smokeless powder, manufactured at he government manufactory, Newport. This powde was fired in a 6 inch gun, 40 calibers in length, with the ordinary charges and ordinary weight of projec tiles. It gave a velocity of $2,344 \mathrm{ft}$-sec., with 12 tons pressure in one round; 2,407, with 13.8 tons pres sure, in a second ; and 2,495, with 15.1 tons pressure in the third. Altogether this is very gratifying, and the experts are proud of it.

## the advertising tricycle.

The machine represented herewith opens up a new horizon in the vast domain of advertising, in which it seemedimpossible to realize still another innovation. As may be seen, it consists of a tricycle whose hind wheels, $\mathbf{P}$ and $\mathbf{P}^{\prime}$, with very wide rims, are covered with a'rubber tire that carries in relief the advertisement that it is desired to make known.
It will be at once seen that such advertisement must be quite short (formed of two or three words, for example), so that the letters may be given as large dimensions as is compatible with the width of the wheels.
Above the wheels there are placed two inking roll ers, $A$ and $B$, that communicate with the reservoirs, $\mathbf{R}$ and $\mathbf{R}^{\prime}$, through tubes, $\mathbf{C}$ and $\mathbf{C}^{\prime}$, provided with cocks, $r$ and $r^{\prime}$.
Through the intermedium of a s all pulley, L, and a cord, $b$, the axle of the pedals actuates a small blower, V, fixed upon a small shaft supported by the frame of the reservoirs. This blower sends air into the tubes, $T$ and $T^{\prime}$, which drives away the dust from in front of the motive wheels. The system of tubes, $\mathbf{K}$ and $\mathrm{K}^{\prime}$, supporting the inking rollers is controlled by a cord, a, attached to the extremity of the lever, $E$, which the cyclist can cause to tilt in such a way as to establish a contact between the roller and the tires The reservoirs, $R$ and $R^{\prime}$, are The reservoirs. $R$ and $R$, are supported by the rear axle. The other parts of the machine do not differ from those that exist in the ordinary tricycle. Revue Universelle.

## California Scale.

In the last bulletin from the New Jersey Experiment Station, Professor Smith gives an ac count of the spread of this scale in New Jersey, where it was in troduced upon Kelsey plum trees imported from California, and probably from Idaho pear stock received from Western nurseries, and it has spread until it is known to have infested at least a hundred places in that State, and it is not safe to assume that it is absent from any orchard which has not been examined. This scale belongs to the group of armored scale insects, and a complete account of its life history and of its methods of spreading are give in this bulletin. Naturally if moves very slowly, but as will crawl upon winged insect and the feet of birds, as well as upon ants, which are great travelers, it is sometimes car ried great distances. It is probable that all rosaceous plants will support the species, al though it prefers some varietie to others The recommenda tions in the bulletin are that every orchard set out during the last six years should be tho roughly examined, and if the scale is found to be present and confined to a few trees, thes trees should be taken out and destroyed, unless the infestadestroyed, unless is slight, so that they can tion is slight, so that they can
be gone over with a stiff brush be gone over with a stiff brush
and all these scales actually and all these scales actually brushed off. In young orchards where the trees are not too large to handle it will pay to go over all the trees with a brush. Where the trees are too numerous or large they should be pruned back, removing as much wood as the tree can spare; the cuttings should be carted off and burned, and the tree should be washed with a potash solution. In California the in sect is treated with gas which is formed by the action of diluted sulphuric acid on fused cyanide of potassium. This is not recommended for Eastern orchards, as the necessary outfit is too expensive, but wherever stock is infested in nurseries, or even suspected of infestation, all trees sent out should be made up in bundles with the roots wrapped to retain the moisture, covered with oiled canvas or other gas-tight material and fumigated for an hour, an ounce of cyanide to every one hundred and fifty cubic feet of space being used. This bulletin is worth careful study by all fruit growers, since the San Jose scale is one of the most dangerous insects introduced into the Eastern States within recent years, and no fruit grower ought to consider the matter so unimportant that he can afford to neglect it.-Garden and Forest.


## ADVERTISING TRICYCLE

that most to be dreaded, is oxalic acid, which repre sents 10 per cent of the dry matter of beet leaves. But as the dry matter is 10 per cent of the beet leaves, it follows that when feeding 20 lb . leaves there is intro duced 1-5 lb. oxalic acid. All organic salts are, as it were, harmless as compared with the action of an oxalate; and recent investigations in Germany point to the effort of the animal's bony frame to neutralize the poisonous effects of oxalic acid, by furnishing the re quisite lime carbonate for a combination with the acid hat would be a harmless oxalate, not assimilated dur ing the physiological digestive process.
We have here an important bint as to the advantage of adding lime to beet leaves when fed to cattle. The question yet to be investigated is, whether it is better to add the lime to leaves before they are siloed, or during feeding. A fact not to be forgoten is, that the percentage of oxalic acid in beet leaves diminishes during their keeping. In this question of beet leaf utilization we have a series of problems to which our experiment stations should give their attention. and whatever conclusion is reached shall not be passed un noticed in these pages.-The Sugar Beet.

At Wurtsboro, N. Y., on January 10, after a fall of now the surface was covered with small black insects. On microscopical examination they proved to be Thy sanura, of the Poduradæ Burmeister family. They ar found in gardens or hotbeds, on manure heaps and on the snow. There are many different species, and all have different habits. On the glaciers of the Alps the snow species is to be found. They take up their abode under stones, and hide beneath mushrooms and in damp, grassy spots. Often they leap together in the air, looking like a shower of sand. In the Wurtsbor case, they had probably come from some nearby staole or damp place.

## Beet Leaves ill Cattle Feeding.

We have on many previous occasions discussed the advantages and disadvantages of beet leaf utilization in cattle feeding. It has been pointed that there is danger in excessive feeding thereof, that colic, etc., were sure to follow, but that those pernicious effects

## might be overcome by certain precautionary measures. <br> The principal element contained in beet leaves, and

Gratifying Results of the New Diphtheria cure
Consul General Mason, writing to the State Depart ment from Frank fort, Germany, says :
In Paris, as has been stated on the authority of Dr Roux, its use has reduced the diphtheritic death rat rom 50 per cent of cases attacked to 14 per cent The deaths from diphtheria in Paris during October, 1890, numbered 125; in the same month of 1892 they numbered 134, while in October, 1894, during which month antitoxine was extensively employed, the deaths from that disease numbered only 23. In Ger many, diphtheria has been hitherto regarded as one of the most deadly and irresistible of diseases, the fatal cases ranging in some years as high as 60 per cent Not less than fifty thousand lives have been annually sacrificed to this scourge in this country, and it is now elieved, from the experience already gained, that his frightful tribute can be reduced to less than one ourth of its present proportions when the use of anti toxine shall become general throughout the empire and physicians in rural districts as well as those in ities are skilled in its application
The discovery of antitoxine as a new agent for the prevention and cure of diph theria was announced by Prof Dr. Emil Behring, of Halle, abou four years ago. Although re ceived at first with more or less incredulity, the new remedy has borne successfally the test of actual use, and it is now recog nized by high authorities as one of the most beneficent and in teresting discoveries in modern pathology.
Horses are now exclusively employed to furnish the blood serum in which the antitoxine is developed and contained.
Dr. Behring found that when an animal which is by nature susceptible to diphtheria isinocu lated repeatedly with gradually increased doses of diphtheria poison, or living bacilli, it becomes finaliy "immune" to (proof against) the poison of that disease, and there is devel oped in the tissues of the anima so treated an antitoxic principle which has the power to neutral ize and render innocuous the poison which is secreted by the true diphtheria bacillus, as dem onstrated in 1884 by Loeffler which poisonous secretion, as is well known, forms the source of danger in diphtheria.

The neutralizing agent thu created was named "antitox ine," and is the specific which forms the basis of the new treat ment of diphtheritic disease, both as a preventive and as a remedy in cases that have become actu ally developed. Precisely what this antitoxic agent is, has not been demonstrated. Chemistr has not separated and defined its constituent elements, but it action is perfectly understood and is analogous to that of hy drated oxide of iron when used as an antidote for arsenical poisoning. In the presence of arsenic, the oxide unites with the poison and forms a combina tion which is not poisonous. In a similar manner, the antitoxine attacks and neutralizes the poi son secreted by the bacillus of diphtheria, and this, so far as experience has shown, without immediate or subsequent injury to the tissues or prejudice to any of the functions of human life
The finished antitoxine is a clear, amber-colored fluid, soluble in water, and is put up for use in strong carefully closed, sealed and labeled vials, having a uniform capacity of 10 cubic centimeters, or one-third of a fluid ounce. The exact bulk of serum in each vial is regulated according to its number and strength.

Foreign Honors for an American Scientist.
A recent number of the Comptes Rendus announces the award of the Janssen prize of the French Academy of Sciences to Prof. George E. Hale, of Chicago. Prof Hale, who is the director of the new Yerkes Observa tory, has been especially interested in astrophysics and has followed out very successfully some suggestion made in 1869 by Prof. Janssen. He has thereby suc ceeded in photographing many of the details of th sun's disk, such as faculæ and protuberances, and ha endeavored to catch the corona witnout an eclipse.

## A MECHANICAL COLOR TEST

 by marcus benjamin, ph.d.Early in 1894, the question of the possibility of analyzing various colors and shades in terms of certain standards having been referred to the present writer, he sought the advice of Professor Thomas C. Mendenhall and Professor John K. Rees, of the American Metrological Society, concerning the feasibility of appointing a committee to fix such standards. This ac tion resulted in the naming of a committee, and, what has since proved of much importance, the taking up of the entire matter as a special investigation by the Physical Department of Columbia College, under the immediate supervision of Professor William Hallock and Mr. Reginald Gordon.
At the outset it must be stated that the important, the vital, element in any color system is the employ ment of proper standards. Physicists here and elsewhere have from time to time studied this subject and have determined standards, but it has remained for Professor Hallock to introduce practical standards that are, easily procurable and readily determined. For this purpose he carefully sought out five typical colors from among the many pigments on sale in the open market. His selection was as follows: Best English vermilion, mineral orange, light chrome yellow, emerald green, and artificial ultramarine blue Having chosen the fundamental standards, it be came necessary to identify them exactly in the spec trum by means of the in strument known as a spec-
troscope and in terms of troscope and in terms wave lengths of light.
As soon as the selection of the typical pigments was made, it became necessary to say exactly what they were in terms referable to the solar spectrum and for this purpose the use of the spectroscope was essential. Prof. Hallock found his colors to have the following values expressed in microns: Red, 0.644 ; orange, 0.614 ; yellow, 0.585 ; green, 0.521 ; blue, $0 \cdot 425$. Thus the green 0.521 corresponds to the $b$ line and the orange 0.585 is very close to the D line, which is the characteristic element in the spectrum of sodium.
The important elements of luminosity and saturation require some consideration. We find that a color changes in value according to the degree of its illumination. That is under certain conditions of light the color is stronger or more intense than under certain other conditions. This effect may be artificially produced by the addition of black. Solikewise color reflects to the eye a greater or less proportion of the white light that it contains. Hence by the use of black and white in addition to the standard colors selected, the further consideration of these elements may be eliminated.
With the five colors, and black and white, it is now possible to determine exactly in terms of the standards the composition of any shade or hue in existence. But how? This constitutes the second portion of the investigation. We have made our tools, and now to use them.

Sir Isaac Newton was the first to point out that white was decomposed into the so-called spectrum colors, and his name has also attached itself to an apparatus in circular form, on which are arranged disks of colored paper representing the spectrum colors. When this disk is rapidly rotated, the colors, so to speak, decompose themselves, forming a more or less white or gray. J. Clark Maxwell, an English physicist of recent date, perfected a similar instrument known as a color wheel. For the purpose of the investigation this instrument was used and seven disks were employed. They were about five inches in diameter, with a small hole at the center for the axis and a radial cut from the center to the periphery.

The white disk was of the purest white cardboard the others were cut from light cardboard or heavy drawing paper, and painted each with its proper pigment, first mixed with a thick solution of gum Arabic in water to the consistency of oil paint, and then applied with a bristle brush. The color must be
even and the paper completely covered. For the black
disk a mixture of the best lamp black in an alcoholic solution of shellac was used and similarly applied with a bristle brush. A disk slightly larger than the foregoing, with a circular scale made by dividing it into exactly one hundred parts is also necessary. In use the colored disks are combined by overlapping each other until approximately the desired shade or tint is made, and then rapidly rotated until the different disks produce on the eye the effect of a single mass of color. The scale recurds the exact proportion of each used. Thus, for instance, the color known as cadmium orange is produced by using 65 parts of orange and 35 parts of yellow. Most colors, however, require the addition of either white or black. Hence we find the color fuchsia consists of 27 parts of red, 12 parts of blue, and 61 parts black. While, on the other hand, pearl blue consists of 22 parts green, 29 parts of blue, and 49 parts of white. Some shades require both black and white; thus mouse color consists of 5 parts
blue, 14 parts white and 81 parts black. By means, therefore, of the wheel and standard disks it is possible to determine the composition of any color.
The investigation thus begun was to be developed into a system. It was decided to attempt the determination within reasonable limits of the composition of the many colors, shades and hues on the market.


1. Order card and formula. 2. Wheel and color diske. 3. The complete apparatus. 4. Experimental tup. 5. Coler disk.

## A MECHANICAL COLOR TEST

Thus, for instance, what is the composition of the once popular color known as crushed strawberry? For this purpose over 6,000 named samples of colored articles were collected from various sources all over the United States. These included about 3,500 silk threads, ribbons, plushes and other silk fabrics; 1,300 printed specimens of colored inks used in print ing; 300 samples of colored woolens and cottons and some 400 paints, stains, pigments, etc. From these all the different specimens named "crushed strawberry" by their respective manufacturers or dealers were col ected together and an analysis of each was made From the results a formula for a color approximating to that which agreed to the average was deduced. To be specific, it consisted of 32 parts black, 24 parts red, 26 parts orange and 18 parts blue. Out of this collection of samples there has been prepared a table giving he exact composition of more than 500 colors, beginning with absinthe and ending with zulu.
In the actual manipulation Professor Hallock and Mr . Gordon were soon able to form an approximate idea of the composition of the color to be analyzed, so that the disks of its component colors could at least be immediately placed on the wheel, and then it was only necessary to adjust them in order to secure the result. The wheel was connected with a small dynamo, so that rapid rotation was made easy. In comparing colors,
they held a sort of a mask in front of their eyes, so as to hide everything except the sample to be analyzed
hem are easily within practicallimits, that is to say, i the proportions given by them are recomposed on the wheel, the result will match the sample so closely that the ordinary person cannot detect a difference.
This investigation is of the utmost practical value to the community. For the first time it fixes with exact ness the composition of most known colors. For a ong time the nomenclature has been very confusing. Amber, Hayana brown, mazarine blue, and sea green give some suggestion of what they are like by their names, but such colors as Admiral, Charles X, luciole, and Pullman car, are not readily appreciable. If, however, the composition of Admiral is given as 13 parts of green, 37 parts of blue and 50 parts of black, we can see at a glance that the color is of a dark greensh blue. So likewise when the composition of Pull man car is said to be 86 parts of black, 4 of yellow, 5 f orange, and 5 of green, it is apparent that it is dark greenish yellow.
Turning to another phase of its utility, let us assume that we desire to match a piece of wall paper of the shade known as Pompeian red, of which we have a sample on hand. In order that the match shall be exact, we analyze the sample, and find it to consist of 89 parts black, 5 parts red, and 6 parts orange. Accordingly our order should demand a paper that will ayre with the foregoing composition. Besides wall papers various fabrics can be easily duplicated by this process. Samples of cloth used in bookbinding can be matched with an exact ness far beyond the usual commercial practice.
Other applications de monstrating the great practical value of this in vestigation will readily suggest themselves to the reader. The whole system is clearly represented in the accompanying engrav. ing. In the apparatus shown the disk may be rotated by hand, and the same results are obtained as if it were rotated by an electric motor, as a variation in the rate of rotation does not produce a differ ence in the shade, but the colors blend in the same manner and degree irre spective of the speed. At the left is shown the grad uated wheel and the super imposed colored disks. A voucher or order card is also given showing the manner of writing out the formula. The colored disk should be slit, so that the degree of color to be exposed to view may be varied according to the exigencies of the case.
An ordinary top may be used for purposes of expe riment, and the various colored disks may be readily adjusted and clamped in position by means of a thumbscrew. Should such a system be brought into general use, it would result in the greatest advantage in the arts and would avoid the present confusion and uncertainty. Not only so, but with a constant and generally recognized standard, a color record could be preserved which would be of standard value for al countries and all ages, and colors could be read in the same value by succeeding generations as by those of the present day.

## Dur Lighthouses.

The lighthouses of the world number more than 7,000. The United States has over 1,300 houses and as many posts. The latter are simpler in construction and not very expensive, since they are maintained on shore. Our government has been proceeding with the theory that the coast should be so sprinkled with lights that the rays meet and pass; that a vessel will meet the one in advance before the one in the rear is out of sight. The anuual appropriation for their keepng is now nearly $\$ 4,000,000$.
Kerosene oil is that which has been adopted by the lighthouse board as the luminant, though gas and, to a limited extent, electricity have been given a trial. Gas is being used only at Alexandria, Va., and Newburyport, Mass. Kerosene is considered the best and the cheapest. It is ever reliable. Electricity will no doubt be adopted when Congress can be prevailed upon to appropriate money.

## What is Electricity?

In view of the number of theories advanced in answer to this question, the question might perhaps appear somewhat superfluous when so many satisfactory solutions-all more or less different-are at hand. In his concluding lecture at the Royal Institution, however, Professor Fleming answered it once more as follows:
What (said Professor Fleming) is this mysterious agent which we call electricity, and which seems so ready to adapt itself to our needs? It was the first question people asked; it was the last to be answered. Our knowledge of electricity was comparable to our knowledge of biology, or any other of the sciences. We could see the life processes at work, but were no nearer understanding what life was. We could see electricity at work, but failed to perceive what the thing itself was. However, science was beginning to recognize one thing as the result of its researches, and that was that electricity was probably a wave disturbance of the ether analogous to the wave distur bances which we called light. With light we had waves of the imponderable, ethereal medium which filled all space (equally that filling up space between thestars as that bet ween the smallest atoms of matter vibrating at the astounding speed of forty-five millions of millions per second, with an amplitude of oscillation as minute as the 37,030 th of an inch. The researches of Faraday, Clerk-Maxwell, and Hertz had led to the demonstration by actual experiment that electricity was also a. wave motion of the ether of great rapidity but with waves yards in length instead of mere frac tions, like those of light. It was in this direction that the great discoveries of the future would be made.

## The Pratt Institute Plumbing Class.

The benefit of trade schools is well illustrated by the observation of a correspondent of the Sanitary Plumber: A few evenings since I called at the Pratt Institute, Brooklyn, and was very kindly shown through the plumbing class departments. The instructors, Messrs. George Heath and John Todd, are thoroughly conversant with both the theory and practice of plumbing and ventilation, and the classes under their charge are making unusually good progress this season. As I glanced down the line of boys, each with his complement of tools, pot, gas furnace, etc., working away under the bright light, I could hardly suppress a wish that I was a boy again simply for the privilege of learning the trade under such favorable conditions. Memories flitted through my mind of the times when, with a few odd wiping tools, a scrap of pipe and a broken-eared pot, I relegated myself to the basement or wood shed to practice wiping joints, so that no one would see my failures or smile at the antic I went through when I burned myself.
As the instructor stooped to direct and encourage one of the students whose solder was dripping from the bottom of the joint he was trying to make, I reflected upon the cold indifference of some journey men I was obliged to work with when an apprentice. They seemed to take no notice of a boy until he suc ceeded in making a passable joint, and then, instead of taking the cloth and ladle and showing him how to improve or indicate where he had failed in that particular style of joint, they would invariably wipe another kind, in some difficult position, and while putting the finishing touches on, remark, "When you can do that, you will be a plumber."
During one hour of the session of Wednesday evening of each week Mr. Todd lectures to the boys on the elementary principles of the trade. The entire class attends this lecture, but it is especially intended for the junior class, while on Friday evening the senior class alone listen to an explanation of the more complex questions, which their better knowledge of the business aids them in appreciating. Both lectures are illustrated by diagrams. After a student has become proficient in a certain branch of work he is allowed to finish an example of it and fasten it to the wall above his bench, as evidence of the progress he is making. This serves to stimulate the boys to greater effort, because none of them is satisfied to see their fellow students get ahead if it can be prevented.

## collection of Brains.

Dr. Luys has offered to the Paris faculty of medicine, for the Dupuytren Museum, a collection of 220 brains, carefully prepared and catalogued by him during his long service at the Salpetriere and Charite Hospitals. In a letter to M. Brouardel, in which he calls his collection unparalleled in Europe, he describes in detail its scientific interest. "It presents," he says, "manifold samples of lesions of human brains, from the commonest ordinary hemiplegy, the aphasia, up to the most characteristic lesions of madness, and, as a foundation for the studies, hitherto so ill-based, of mental pathology, a series of types of persons suffering
from halia iration or monomania, and of those who are chronicisly delirious with or without consciousness; and it presents also anatomical expressions in harmony with the symptoms observed. Types, of which there
are four examples, relate to periodic madness. These
are the first examples of the sort ever collected and offered to the examination of the medical public, and they show similar lesions which justly place them in a special nosologic category. Next come brains of general paralytics, with granulated lesions in certain regions and characteristic concomitant atrophy. have collected also a number of brains relating to idiocy, some relating also to deafness and deaf-mutes Others have been taken from persons blind of one eye from the wholly blind, and from the amputated, and they all show special atrophic lesions. There are
chosen specimens, to which I intend later on to add chosen specimens, to which I intend later on to add
others (in particular the brain of a hypnotized subject others (in particular the brain of a hypnotized subject
the only one at present in existence), and they allow us from the point of view of the morphology of human brains to gain a rapid and accurate idea of the rarity or the frequency of such anatomic dispositions, since it is thus possible to consult immediately from th point of view of verification the cerebral lobes rihich are present under the eyes." The collection is the re
sult of twenty years' investigation, and Dr. Luys look upon it as his scientific heritage, "a stone" in th edifice of neurologic studies, which are assuredly in our day a glory of French science.-Paris Correspond ence London Times.

telegraph pole BORED BY TH WOODPECKER.

THE BORING WOODPECKER
The drawing shows part of a cedar telegraph pole from near Phœnix, Oregon which $h$ as been bored full of holes by woodpeckers for the purpose of storing away acorns for their winter's supply. The birds generally use large pine trees for this purpose, but they have diselegrat occasionaly purpose admirably as the purpose admirably, as the pecker first digs a hole in pecker first digs a hole in
the pole about large enough the pole about large enough
for an acorn to fit in, then he flies off and soon returns with an acorn which he jam into the hole. He hammers away at it with his bill until only the head of the acorn is visible. So tightly are these acorns driven in, that hey are with the greates ifficulty $\epsilon$ xtracted. In such numbers do they store them
that the bark of a large pine orty or fifty feet high will pre sent the appearance of being studded with brass nails. The birds also store acorns in the hollow stalks of dead plants, notably the century plant the flowering stalk of which is often found completely filled with the acorns. Some times the oak trees are thirty niles away from the birds place of storage, so that the storing and collecting of each acorn requires a flight of sisty miles.
In times of famine all this good work shows to advan tage, for not only birds bu many kinds of beasts feed pon the acorns which the fully hoarded. If it were not for the industry of the wood peckers, they would have to die of starvation.

## What Pcople win Lat a century Hence

解 rench chemist, the time may be approaching when and milk, or their equivalents, will be produced artificially in the laboratory of the chemist. It is true that we have not yet got beyond the first steps in the process, but, according to Professor Berthelot, who is
entitled to speak with authority, these first steps are a guarantee of extended triumphs in the same field.
The professor, as reported by Henry J. W. Dam, in McClure's Magazine, said that "new sources of mechanical energy would largely replace the present use of coal, and that a great proportion of our staple foods which we now obtain by natural growth would be manufactured direct, through the advance of syn thetic chemistry, from their constituent elements, car bon, hydroge; $9 x y g e n$, and nitrogen." He continued "I not only believe this, but I am unable to doubt it The tendency of our present progress is along an easily discerned line, and can lead to only one end. I do not say that we shall give you artificial beefsteaks at once,
nor do I say that we shall ever give you the beefsteak nor do I say that we shall ever give you the beefsteak
as we now obtain and cook it. We shall give you the
same identical food, however, chemically, digestively and nutritively speaking. Its form will differ, because it will probably be a tablet. But it will be a tablet of any color and shape that is desired, and will, I think, entirely satisfy the epicurean senses of the future; for you must remember that the beefsteak of to-day is not the most perfect of pictures either in color or composition. There is a distinction which I would like to make at this point between the laboratory stage and the commercial stage of any given discovery in food making. From the scientific point of view, the labora tory result is the important one. As you and all the world know, the commercial result follows inevitably in time. Once science has declared that a desired end is attainable, the genius of invention fastens upon the problem, and the commercial production of the result slowly attains perfection by gradually improved pro cesses at less and less cost. Take aluminum for in tance. Once a very expensive metal, its steadily de creased cost in production is bringing it within the each of all. The use of sugar is universal. Sugar have recently been made in the laboratory. Com merce has now taken up the question, and I see that an invention has recently been patented by which sugar is to be made upon a commercial scale from two gases, at something like one cent per pound. As to whether or not the gentlemen who own the proces can do what the inventor claims, it is neither my rovince nor my desire to express an opinion."
The professor here cited as an instance of laboratory products, the dye stuff alizarin, the coloring rinciple of madder, which was formerly a great agri cultural industry, but which is now almost wholly supplanted by the artificial product from coal tar The chemists, he said, have succeeded also in making ndigo direct from its elements, and artificial indigo will soon be a commercial product. "Tea and coffee could now be made artificially, if the necessity should arise, or if the commercial opportunity, through the necessary supplementary mechanical inventions, had been reached. The essential principle of both te and coffee is the same. The difference of name beween thein and caffein has arisen from the source rom which they were obtained. They are chemically identical in constitution, and their essence has often been made synthetically. The penultimate stage in the synthesis is theo-bromine, the essential principle of cocoa. Thus, you see, synthetic chemistry is geting ready to furnish from its laboratories the three great non-alcoholic beverages in general use. And what is true of food substances is equally applicable all other organic substances."
As regards tobacco the professor said: "The essen ial principle of tobacco is nicotine. We have obtain ed pure nicotine, whose chemical constitution is per ectly understood, by treating salomin, a natural glucosid, with hydrogen. Synthetic chemistry ha not made nicotine directly as yet, but it has very nearly reached it, and the laboratory manufacture of nicotine may be expected at any moment.
The tobacco leaf is simply so much dried vegetable matter in which nicotine is naturally stored.
Perhaps the greatest importance, and certainly the profoundest charm, in the study of synthetic chemis try is the certain evidence which it offers of the dis overy and manufacture of many compounds now en tirely unknown, whose effect upon human health human life, and human happiness no one can pos sibly conjecture.
As regards the future supply of heat, which is no ess important than that of food supply, Professor Berthelot speaks confidently of improved appliances nabling man to make use of the illimitable supply of the earth's central heat. In conclusion, the professor ays: "If one chooses to base dreams, prophetic fan cies, upon the facts of the present, one may dream of alterations in the present conditions of human life so great as to be beyond our contemporary conception One can foresee the disappearance of the beasts from our fields, because horses will no longer be used for raction or cattle for food. The countless acres now given over to growing grain and producing vines will be agricultural antiquities, which will have passed out o the memory of men. The equal distribution of natural food materials will have done away with protectionism, with custom houses, with national frontiers kept wet with human blood. Men will have grown too wise for war, and war's necessity will have ceased t be. The air will be filled with aerial motors flying by forces borrowed from chemistry. Distances will di minish, and the distinction between fertile and non ertile regions, from the causes named, will largely have passed away. It may even transpire that deserts now uninhabited may be made to blossom, and be sought after as great seats of population in preferenc to the alluvial plains and rich valleys.

The present 1,500 foot tunnel and turbine wheel it of the Niagara Falls Power Company wil', when it shall work at its full capacity of 100,000 hors power, divert 3.64 per cent of the total volume of ater and reduce the depth of the crest along the en tire falls to the extent of $1 \frac{4}{8}$ inches.

The Lion from a Medical Point of View. The president of the Bristol Medico-chirurgical Society, A. J. Harrison, M.B., delivered before that society, on October 10, a very interesting address founded on his experience in the gardens of the Clifton Zoological Society, with which he has been connected for many years, It appears in full in the current number of the Bristol Medico-chirurgical Journal. Theexperiences and observations mentioned in the address are not arranged in any formal anatomical, physiological, or pathological order, as the author states, but, fragmentary and disjointed as they are, they are exceedingly interesting. The first case mentioned is that of a lion, considered to be the finest lion in Europe at the time, and one that had always seemed in excellent health until a few months before his death. One morning he was found dead in his cage, and at the post mortem examination it was ascertained that an enormous hemorrhage had taken place into the abdominal cavity, proceeding from the spleen, which organ, it was inferred, had been ruptured by the exertion of coitus. The splenic enlargement, says Dr. Harrison, seemed to have been caused by hyperæmia and increase in the lymphatic and vascular elements, but as to the ætiology, he can only speculate. "Are lions," he asks, "subject to malarious attacks? and had Hannibal been a victim in the days of his youth, in his native wilds-for he was forest bred-before the civilization of captivity had fallen upon him? He had been ill a couple of months or so before his death, when his breathing was affected. Did he have pneumonia then, with carnification of the base of the rightlung-or perhaps more probably a hæmorrhage from an embolismor are lions subject to splenic fever?
Another lion, a fine creature, had become lame by reason of an ingrowing claw. The trouble went on from bad to worse, until something had to be done, and it was decided to extract the claw. The use of chloroform, says Dr. Harrison, was out of the question, for attempts to give these animals anæsthetics have been worse than failures; so it was decided to resort to the "cramp cage." With some difficulty the animal was got into this cage. "He didn't like his quarters," the account goes on to say, "and showed that even within the comparatively small dimensions he could turn round and so evade any efforts to get hold of his claw. Planks of deal, one foot broad by one and a half inches thick, were then put into the cage to limit the space. The animal was fairly furious before; but now came such a display of rage that no one who did not see it could imagine it. He fought for dear life, as he thought. Plank after plank was seized and ripped up like so much match wood, and it seemed as if the iron bars and plates, strong as they were, would not contain the infuriated beast. His mouth bled, and he broke a tooth. Several of the keepers stood on the top of the cage to prevent it from being overturned, and some of the spectators took re fuge by quietly withdrawing from the scene. At length, by putting in plank after plank, above and behind, the poor brute was brought to bay, and, to save himself from his very constrained position, pushed out his paws through the bars of the cage. 'Now's your time,' I said. Blunsden immediately seized the offending claw with a pair of strong carpenter's pincers; the grip was good. The animal helped in the operation by trying his best to get his paw free, and the claw came away. It had grown into the flesh at least half an inch, most likely more ; and here I can show you the very thing. In half an hour afterward the creature had quite calmed down; he seemed then to have com prehended the rationale of the operation, and he gav me the conviction that if he had had to undergo a repe tition, he would have been a mild consenting party. The operation was permanently successful."
The case of another lion is mentioned, one only four months and a half old, that was found dead in its cage. It had been ailing for three or four days; its breathing was very quick and it took no food, but simply lapped a little water. At the post mortem ex amination the pericardium was found distended with a semi-purulent fluid, of the consistence of gruel, tinged somewhat with blood. Notwithstanding the tradition that in old times, when lions used to be kept in the Tower of London, the lion named Pompey is said to have lived there for seventy years, Dr. Harrison says he cannot believe the story. He looks upon the lion, at least in captivity, as comparatively a short lived animal, and gives various facts on which he founds this opinion. So decided is he that in the case of a lion that died at the age of sixteen years his conclusion was that the beast's death had been owing to senile decay. The death of a lioness, described as "rather rickety," is recorded as having taken place during parturition, from rupture of the right cornu of the uterus. The animal had been in labor for five days, and one cub had been born and the other wa partly extruded into the vagina.
Dr. Harrison's address deals with pathological and physiological observations on various other animals, but the space at our disposal has allowed only of our Med. Jour.

## THE MYSTERIOUS CLEPSYDRA.

The destiny of old clock work movements, when they are curious, is to figure in museums. Their rusty springs, broken-toothed wheels and out-of-center axes permit them to be no longer anything but the witnesses of a vanished art. This is an irresistible law. So it cannot be denied that a piece running in spite of this law three hundred and fifty years after its construction, without having undergone the least repair, is a remarkable object. Such is the case with a clock that is in operation at Mr. Pottin's, at Ivry-Port, and the age of which has been estimated by Mr. Morie Davy, the lamented superintendent of the Montsouris Observałory. Let us say at once that if it has escaped the sad fate of aged mechanisms, it is because it has no mechanism, since it is, in fact, a sort of clepsydra (Fig. 1).
Externally, we see merely a cylinder about six inches


Fig. 1.-THE MYSTERIOUS CLEPSYDRA.
in diameter, suspended by two strings winding round the extremities of a small rod that passes through its axis. If, after having finished the winding of the strings by revolving the cylinder upward, we leave the apparatus to itself, the cylinder, after oscillating for a couple of seconds to find its perpendicular, will begin slowly to descend, and take eighteen hours to travel, with precision, the entire length of the scales to the right and left, whose divisions are of copper set into the walnut of the case. This curious result is obtained as follows: The cylinder (see diagram, Fig. 2) is di-


Fig. 2.-EXPLANATORY DIAGRAM.
vided into eight compartments, which are exactly equal and symmetrical with respect to the axis, $O$. These compartments, $G, G_{1}$, etc., communicate with each other through three small apertures, $I, I_{1}$, etc. Central channels, $R$, put them in connection also in pairs. Thus $G_{7}$ communicates with $G_{3}, G$ with $G_{4}, G_{1}$ with $G_{5}$, and $G_{2}$ with $G_{6}$. The cylinder is filled with liquid up to the level, M N. Let us suppose it suspended by the string, $F$, wound around $O$, to the right of the vertical, which passes through the center of gravity of the system, C 1 ; evidently, gravity will cause the apparatus to revolve in the direction shown by the arrow, V. But in this motion there is produced
a change of level of the liquid to the left and right of CD , in the system of communicating vessels formed by the compartments, G, and the small apertures, I. The liquid rises to the right and descends to the left
until the center of gravity passes through the vertical including $F$. The descent of the cylinder then ceases, and is again resumed in measure as the two levels tend to become equal by the slow communica
tion through the orifices, I. As such equalization can take place only so long as the cylinder is suspended, the slow motion of descent continues indefinitely. It takes place in a perfectly regular way, because all the parts of the cylinder are symmetrical with respect to the central axis. An examination of Fig. 2 will readily show that it is possible for the compartments to com municate during the descent only through the smal apertures, I. It will be seen also that the winding up of the apparatus is exceedingly simple. It suffices to revolve the cylinder in the direction shown by the arrow, $\mathrm{V}^{\prime}$. The string winds around the central axis, and, in measure as the apparatus ascends, the compartments become emptied, through the central channels, $R$, into their mates, whence it results that, no matter what the height be, the system left to itself will find its perfect equilibrium at the end of two or three oscillations.
Mr. Morie Davy attributes the construction of this clepsydra to an artist of the time of Henry II. It is probable that workmen of less skill have attempted imitations of it, since in the region of Brie, where Mr. Pottin obtained it, at least twenty more have been found, but all incapable of operating. At the Exposition of Retrospective Arts, in 1889, there was to be seen a copper cylinder having much analogy with the one just described and bearing the inscription: Clepsydra of the Time of Charlemagne." Were not a few centuries too many give: to this product of ancient art? We cannot say. We have simply desired to make known a very simple and very accurate instrument which certainly very few clockmakers even know of. From this standpoint it merits particular mention.-La Nature.

## The Invention of the Bicycle.

A monument has been recently erected at Bar-le. Duc to the two Michaux, father and son, who are credited with the invention of the modern bicycle. The Petit Lyonnais tells the story of the invention as follows:
" The Michaux had a small locksmith shop in Pairs. One day a bizarre machine was given to them to repair -a small saddle resting upon a snake-like frame and holding together two light wheels. The machine was put in motion by the 'rider' striking the ground with the tips of his toes. The queer thing was painted yel low, and called a draisine, from its mentor, the German forester, K. V. Drais. A 'ride' on this was very tiring, impossible uphill, and, above all, very ungrace ful. But the young bloods in the time of the Second Empire managed very well with it, and got lots of fun out of the machine. Young Ernest Michaux conceived the idea of adding pedals to the front wheel, and be came thus the inventor of the modern velocipede. His idea found little favor at first; more attention was given to the tricycle. As early as 1863 a Paris hatter named Brunnel visited his customers on a tricycle.
"The International Exhibition of 1867, however, gave an impulse to bicycle riding by drawing the attention of the public to several new improvements added by the Michaux. The Prince Imperial learned to ride, and the aristocracy, with the Prince of Sagan at their head, followed his example. The latter had two high-wheeled machines built to order. One was of aluminum bronze, with wheels of rosewood; the other was built entirely of steel, beautifully engraved with hunting scenes. The bicycle school of the Michaux was now always full. They could no longer fill all orders, and formed a company for the manufacture of their machines. They also built a velodrome, with an asphalted track, on which also a kind of hurdle race could be run. Here was a ditch, which had to be crossed on a narrow plank, and a kind of Irish bank. Lawsuits among the partners broke up the concern, the war of 1870 came, and people had other thing to speak about. In the meantime the English and Americans improved the invention, and it was reintroduced into France from across the sea."-Public Opinion.

## A Novel Logging Device

There is a wood pile in Lead City, S. D., widely known throughout the Black Hills mining region. It belongs to the Homestake Gold Mining Company, and is composed of timbers about the size of railroad ties, which are used in supporting the walls and roofs of the drifts and tunnels of the mines. A narrow gauge rail road brings the logs, which have been sawed flat on two sides, to a point on the mountain slope about 60 feet above the valley, and they are then thrown into a wooden chute about 4 feet wide and 2 feet deep. The inside surface is kept smooth and slippery by a small stream of water. If the logs were allowed to run directy to the ground, they would speedily excavate an enor mous hole besides damacing themselves, so the lowe and of the chute is curved upward, and the logs leave it at an angle of about 60 degrees with the horizonta and rise from 150 to 200 feet in the air, turning ove and over, and finally landing on the enormous pile already there. A useful fact in connection with this method is that the logs sort themselves in the pile according to their size: the heavier ones, having a
 away from the chute.
recently patented inventions.

## Engineering.

Builer Feeder.-Moses Gregson Philomath, Oregon. To feed at regular intervals a mea.
sured quartity of water to a boiler, this inventor has de sured quar.tity of water to a boiler, this inventor has de-
vised an apparatus comprising incaed rotary valves having crank arms, the upper valve having a two-way
passage and a steam pipe extending from the lower end passage and a steam pipe extending from the lower end
of the casing below the lower valve and communicating with the upper part of the casing through the two-way valve, while an oppositely cranked shaft and pitmen
connect the cranks with the valve cranks to alternately connect the cranks with the valve cranks to alternately may be used with this device without interfering with its working.

## Rallway Appliances.

Car Brake.- Robert C. Suowden, Mckeesport, Pa. This improvement is more especially
applicable to street cars. The brake shoe is first applied applicable to street cars. The brake shoe is first appied
to the wheels by means of a hand wheel, and the friction of this brake shoe and the momentum of the car applies a brake shoe to the track rails. A set of toggle arms is
arranged immediately above and connected to the rail arranged immediately above and connected to the rail
brake, there being also connected thrust barss and both brake, there being also connected thrust bars, and bot
being operated simultaneously to apply the brake to being operated sinuultaneoosly to apply the
the rails by both a vertical and lateral thrust.
Car Fender. - John H. Faulstich, New York City. This fender has a vertical fixed section
adapted to be supported In front of the dashboard, and a lower horizuntal sliding section adapted to pass beneath the car, this section yielding sufficiently to break th
force of the fall upon it of any one in the track of a mov ing car. The sliding frame may be quickly carried from
the inner to the outer working position. and in conjunction with the fender ard is provided for the whels of the car
Poultri Car.-Joseph B. Mockridge, New York City. This is a completely ventiated car for
the shipping of live poutry to great distances, providing for the convenient feeding, watering, and continued
cleanliness of the birds Au open framework with compartment for each bird forms a permanent fixture of the car, and is arranged in an inclined position, with
the single compartments in vertical rows, so that the the single compartments in vertical rows, so that the
droppings are discharged through an opening in the floor of the car. The side doors of the car are so arranged
that the attendants can move one door past the other that the attendants can move one door past the othe
to load the car in sections until the entire car is loaded.

## Mechanical.

Clip for Brake Staffs, Shafts, Erc.-Albert W. McCasin, Pittsburg, Pa. This improvement consists of a bolt, preferably in the form of
carriage bolt, on which is held a clip band engaging part carriage bolt, on which is held a clip band engaging part
of the brake staft or shaft, to form a brace for the bolt, the device being applicable for fastening a chain to car brake staff, or to a roller bar, a winding bar, or e.sily applied, and not liable to break on a heavy or sud den strain.
Paper Coating and Drying Ma chins.-Louis Dejonge, Jr.. Stapleton, N. Y. In this cally clamped to a carrier, conveeed to a color-applynn mechanism and held from buckling while being coated automatically released at a a given point and elevated for
removal. The wet sheets may also be automatically removed from the coloring or coating section and made to pendent position, until the drying operation is completed The carriages or conveyers for the sheets are arranged carriages being automatically returned to the colorin section of the machine when the sheets are removed, an the dip does not injure the sheets in gripping them, the coating and the drying being effected without marrin
Drying Coated Paper.-This is a farther invention of the same inventor, improving upon ployed to maintain the coated paper for a certain time it the drier in a substantially horizontal position, whereb heavily coated thin paper will not buckle or turn at the corners. An improvement is also effected in the manne in which the sheets are carried from the receiving poin in the machine to the discharging point.
Lath and Chain Paper Drier.wiliam H. Greenwooa, New Brunswick, N.J. This
nvention provides an ausiliary lath box adapted to feed lath on the chains of a lathing or sticking machine whe the main lath box fails to deliver a lath, or when 2
broken lath may have been delivered, whereby the paper will always be taken up at the proper time to form fold for drying, without danger of spoiling the paper.

## Agricultural.

Combined Planter, Harvester, HAy Rake, AND CuLTVVATor-Joseph Ehrbard, Diller,
Neb. With this machine stalks may be cut and the ground plowed and cultivated, corn may bedrilled and culleing also utilized for brvesting grass or train of any description. It has vertical standards which may be util ized to carry plow blades, cultivator blades, harro teeth, or similar implements, and each standard has wheel traveling overt the path of each disk cutter at the rear. There is a driving connection between the seed the axle and the sickle, the devices when not in use being carried out of action. The rake may be used in connec tion with the sickle or each employed independently, or both may be removed or elevated when the machine is used for cultivating or planting.
Transplanter.-Henry P. Meetze, Chapin, S. C. This device consists of a funnel-shaped body constructed in pivoted sections adapted to open at
their lower ends, packing arms operating at each side of their ower ends, packing arms operating at each side o
nection between the packing arms and the handles of Che body. Plants may be conveniently placed in the de vice, and the later may be readily introuaced into the
ground in the desired position, the earth being packed round in the desired position, the earth being packe
sufficiently around, the ${ }^{2}$ pants without interfering,with the withdrawal of the device.

## Miscellaneous.

Variable Driving Gear for Biprings, Co of sprocket wheel and chain, and the gear permits of
being readily changed to yield three different rates of being readily changed to yield three different rates of
speed, high, medium, and low, the shifting parts being speed, high, medium, and low, the shifting parts being
arranged in a simple and easily working way. The drlving shaft, geared to the rear wheel, is provided with a on the pedal shaft, the shipping mechanism for sliding oth gears being actuated through a lever extending up within convenient reach of the rider.
Pneumatic Tire.-John J. Koetzner, Washington, D. C. In this tire an annular under-cu tube, and in this groove in packed a iflling of emery or
other good resistant, over which is cemented a covering other good resistant, over which is cemented a covering
fubber, leather, or similar material, the outer surface being finished to the proper external circular form of he tire. The improvement is designed to protect the

Circle Cycle.-Edward I. Brannan, CIRCLE CrCLE.-Edward I. Brannan
Richmond, Va. This is an improvement in merry-go ounds, and provides an apparatus by which riders ma ents. The any beycle rianed of detachably con sections which may be readily tailen apart for storage o ransportation, and comprises a turn post and circula rackway having a yielding bearing face, with radiating apporting sections, trames whereby thee are normally yielang bearing on trames whereby
held from contact with the track ways.
Pyrotechnic Signaling. - Nicholas .Halpine, United States Navy. For long distance signa tised a system which cossisists in projecting above the sender a single star, which, by its successive changes of color, will represent a numeral or letter, the system
being thus adapted for use in connection with the ordibeing thus adapted for use in connection with the ordi-
nary international and miltary codes. The changes in nary international and miltary codes. The changes in
the coloring of each star take the place of the numerous the coloring of each star take the place of the numeroun
tars heretofore required to represent a sirgle letter or stars here
number.
Manufacturing Artificial Bone.Robert Reiman, Egg Harbor City, N.J. This is an im provement on a former patented invention of the sam
nuventor for a process of making white artificial bone he process covered by this invention relating more es
pecially to making black artificial bone, but the two proesses, though differing in some respects, being actually unit. The process embraces the macerating of the nat.
ral bone, separating the liquid from the organic solids separating the gelatine from the residue of the oorgad matter, and then converting the gelatine into artificia one without the residue by adding a chromate, a dryin oil and a material to give body to the composition. The
or
roduct is uninflammable, is impervious to the influene of weather and forms a perfect plastic mass for nume of weather and form
Drawing Instrument.-Herrman a Kleist, Philadelphia, Pa. This is an instrument of the compass type, dispensing win set screws, while the slip n obstruction on the outer face of the device forming has a pivot point in which the wear of the pivot pin automatically taken up, and it has a bail hande by which the legs may be held in any position in which they may have been placed, preventing their wabbling in making
ciccle or an arc, and enabling the instrument to be Paraleiel Ruler.-Augustus S Cooper, Santa Barbara, Cal. In this ruler a head is ifted
to slide on a straight edge, while a drawing blade has a lead fitted to slide in one open side of the sliding hea ar abuts against one edge of the straightedge, obliquel drawing blade and there being set screw in the hea or regulating the distance apart the lines are to be drawn. The springs consist preferably of rubber bands extending over both sides of the straight edge and passing through apertures in the head portion of the drawing blade and the connecting arm of
Indexing Cutter.-John T. Car nody, Cedar Rapids, Ta. This is a simple hand tool for cutting semicircular nicks in the edges of indexed book
to facilitate reference to the required letter. It is a powerful tool, designed to cut through many thicknesses of tough paper with a clean, sharp cut. It has jointed and fixed to the inner faces of the jaws, one blade work ing within the other and the tool effecting a double shear
cut starting simultaneously at the two ends and termi cut starting simultane
Recording Device.-Adrian C. Kint er, Bedford, Pa. For recording the variations of timepiece to facilitate setting and regulating it, this in ing and two fixed segmental graduations at opposite Thes, pivoted pointers indicating on the graduation
whilc a ring turning on the pointer pivot has indication adapted to appear in the opening of the dial.
Purse frame.-Louis B. Prahar, Brooklyn, N. Y. The jaws of this frame are pivotally
connected and spring controlled, and have a sliding movement in opposite directions on their pivots, suct sliding movement being effected by pressing upon studs
which pass loosely through the outer end of the which pass loosely through the outer ends of the jaws
and thus releasing the jaws from a latch or lock engas ment with each other. The jaws or members of the trame lock automatically on being closed.
Workivg Butron Holes.-Cornelius
hand-worked button holes this inventor provides a simple
evice to clamp the cloth near the button hole and to inee the the in sting. We device comprises two nged plates with pointed noses and opposite curved rooved flange, there being means for clamping the plate

Ornamental Sheet Metal Hollow Ware.-Albert Wanner, Jr., Hoboken, N. J. This inconsiderably varied. for an inexpensive and highly orna mental article, such as a vase for flowers, receptacles tor jewelry and toilet materials, articles for cabinet adorn-
ment, etc. The metallic structure, coated wih gold, sil ment, etc. The metallic structure, coated with gold, sil-
ver or bronze dips, presents a rich and chaste appearnce.
Boot or Shoe Jack. - John I. E. Nel on, Cedar Home, Washington. This is a light and easily and useful in studding the soles of boots for loging mining and mountain climbing, while specially adapte or repairing and reinforcing the bottoms of rubbe boots. The main stock section has a socket in which fit tenon of the instep section, while the last has an opposite tread section reversible upon the instep section,

OAr.-Charlie O. Hodges and Georg H. Gardner, Batavia, N. Y. An oar which may be use ith the oarsman acing the beow has been devised by
these inventors, the oar being one which may be feathered or moved in any direction as an ordinary oa he oar has a body sivilly connected with a rockin frame attached to the gunwale of the boat, rods attached to the two sections of the oar passing loosely through the tubular arms, while a connecting block unites the op-
posing ends of the rods. The improvement may b uickly and easily applied to a boat
Rope Clamp.-Henry Vachon, Golden anada. This invention comprises a two-limbed clam ng plate adapted to be pivoted on a transversely slotte pulley block opposite the transverse slot, forming an eff shackled pulley block, a stationary rope cleat or a rotata ble snubbing post, to facilitate mooring a vessel or hold

Hose Coupling.-William L. Walker nd William A. Nelson, Fitchburg, Mass. The head of ne hose section, according to this improvement, has lasp oppening in which is a gasket and a hook-shaped lasp opposite which are parallel ears, there being be
ween the ears a spring latch and a pivoted cam leve while the head of the opposing hose section is provide with an annular flange to be engaged by the cam lever cam lever makes the connection tight and holds the tions securely in water tight engagement, a disengege ever.
Cutter Guide for Barbers.-James H. Howard and Woodford A. Scoggan, Oregon City Oregon. To facilitate the even cutting. of the hair with ne ordinary clippers or any other suitable cutter, these having a downward extension or bearing at its forwar end, while a comb plate within the frame has its back ounted adjustably in bearings above the extensio cut the hair at any desired length.
Bed Pan.-Moses S. Diamond, New York City. This is an improved article of manufacture esigned to be lighter and less expensive than such ar cles heretofore, and so
conveniently cleaned.

## Designs.

Jug.-Frederick H. Weeks, Akron, O as at one closed at the ordinary opening at the top, and side, there being ears at right angles to the spout.
Bracket.-Edward S. Field, Metcho in, Canada. This is a simple bracket adapted to hol ther, the opening between the arms flaring outward he top.
Note.-Copies of any of the above patents will be frnished by Munn \& Co., for 25 cents each. Pleas send name of
of this paper.

## NEW BOOKS AND PUBLICATIONS.

Model Evgine Construction, with PRACTICAL INSTRUCTIONS TO ARTI ander. London and New York:Whit taker \& Company. 1894. Pp. viii, 324 Price $\$ 3$.
The author, in his preface, speaks of model engine making being a hobby. He makes for it, however, the plea that it is of invaluabe ase to young mechanical enit. In and adocates that all such devote themselves it. In addition to its over three hundred pages of text,
the book contans a very exhaustive series of large scale drawings to illustrate the subject and make it practical It cannot but be believed that a young man can spend his time more profitably in building model engines than in many other occupations, provided, of course, that hit
future work is to lie in practical or scientific lines.
Laboratory Exercises in Botany DESIGNED FOR THE USE OF COL
LEGES AND OTHER SCHOOLS IN which Botany is Taught by LaboBastin. Illustrated with 7 figures in the text and 87 full page plates from original drawings, comprising up-
ward of 250 figures. Philadelphia: W. B. Saunders. 1895. Pp. 540. Price $\$ 2.50$
Modern botanical work, in this octavo, seems to be ad-
equately treated ; with numerous illustrations, very full
ext and an index of nearly 20 pages, everything seems to present which could be desired for the school. It can ot be reviewed within the space at our disposa, bu what we have seen of it is enough to make us resommen different exercises, each exercise forming practically ifferent exercises, each exercise forming practicaly
chapter and being fully described in the table of con tents, when such description is required. We notice, moreover, a very full treatise on the microscope and ac-
cessory apparatus, special reagents, staining fluids and cessory apparatus,
Perennial Irrigation and Flood Protection For Egypt. Plans ment of Egypt. 1894. Elephant folio 29 plates.
accompanies the setof plans it will neering works contemplated by the government are great importance and are of the first magnitude. Th plans of the Nile on a scale of one to one hundred tho and are admirably executed. The other plans includ designs for various dams, sluces, weirs, gates, inlet an utlet canals, discharge sites, etc., as well as plans of the
Assuan cataract. pressure and discharge diagrams. question of flood protection and irrigation in Egypt ha occupied the attention of engineers from the earlie mes, and it is to be hoped that the problem will last be solved successfully.
SCIENTIFIC AMERICAN
BUILDING EDITION
FEBRUARY, 1895.-(No. 112 .
table of contents.
Elegant plate in colors, showing an artist's home a Bronxwood Park, N. Y. Perspective elevation leicht, architect, New York City. A unique de sign.
leted for East Orange, N. J., recently comelevations and floor plans. A pleasing design. Mr. Jas. H. Lindsley architect, Newark, cottage at Glen Summit, Pa., erected for H. H. Harvey, Esq. Two perspective elevations and ome novel architectural features, Messrs. Neuer Darcy, architects, Wilkesbarre, Pa. residence at Forest Park, Springfield, Mass. Two ith French chate eatures. Mr. Louis F. Newman, architect, Springfield, Mass.
Esq., at Flatbush, residence of Robt. S. Walker, Esq., at Flatbush, L. I. Three perspective eleva-
tions and floor plans. An exquisite design. Mr. tions and floor plans. An exquisite design,
Frank Freeman, architect, New York City. A picturesque and well appointed residence erected or the late E. E. Denniston, Esq., at School Lane, Cost complete $\$ 22,000$. Perspective eleva
tion and floor plans. Mr. Geo. T. Pearson, arch tect, Philadelphia, Pa
A residence at Nutley, N. J, recently erected at cost of $\$ 5,800$. Perspective elevation and floo
plans. Mr. E. R. Tilton, architect and designer plans. Mr. E. .
New York City.
cottage in the Colonial style at Southampto H. Skidmore, architect.
. Hall and Library at Glen Ridge, N. J., erected at cost of about $\$ 12,000$. Mr. Wilbur S. Knowles,
architect, New York City. Perspective view and floor plans.
dwelling in the Colonial style at South Orange . J. Cost complete $\$ 6,500$. Mr. P. C. Van Nuys, architect, Newark,
elevations and floor plans.
wo views showing a most successful alteration in he Colonial style of the Blinn homestead at Cam bridge, N. Y. One view showing the original
structure as built over one hundred years ago and he other showing the additions and changes re cently made. Mr. H. Inman Furlong, architec 2. A cottage in the Colonial style at Cushing's Island Me., erected for Francis Cushing, Esq. Two per
spective elevations and floor plans. Cost com spective elevations and floor plans. Cost com
plete $\$ 2,000$. Mr. John C. Stevens, architect, Portland, Me. A unique and picturesque design for a model summer home.
Colonial house at Weatogue, Conn., being erected for the summer residence of Arthur M. Dodge,
New York City. Perspective view and floor plans. Measrs. Child \& De Goll, architects, New
York. method of man acturing hydraulic cement.-A complete Pompeian house.- Inventions reduce the cost of buila
ing.-Those dreaded draughts. How they are caused and avoided in window-tight rooms.-Fire proof buildings.-The great staircase in the Capitol Building at Albany, N. Y.--Porous glass for
windows.-Mexican onyx.-The Manhattan Life winiows,- Mexican onyx.-The Manhattan Life
Building, New York.-View showing the waterprooting of the walls by the Caffall process.-A traveling lawn sprinkler, illustrated.- Egyptian cement plaster.-Ornamenting glass.-A bridge of con-
crete.-A new model parlor door hanger, illus trated.
The Scientific American Building Edition is issued onthly. $\$ 2.50$ a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary
book pages; forming, practically, a large and splendid Magazine of Architectire. richly adorned witio legant plates in colors and with fine engravings, illus ral Construction and allied subjects.
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for eaci insertion: aiour eignt worris to a iine. AarerThursian morning to appear in the foilowing weei's's issuc. "C. S." metal polish. Indianapolis. Samples free. Presses \& Dies. Ferracute Mach. Co., Bridgeton. N. Handle \& Spoke Mchy. Ober Lathe Co.,Chagrin Falls, O port, N. Y.
We buy mailable novelties. Warren \& Co., 10 E. 14t Practical A mmonia Refrigeration. Redwood. Cloth Screw machines, milling macnines, and drill presses Centrifugal Pumps for paper and pulp mills. Irrigating nd sand pumping plants. Irvin Van Wie, Syracuse, N. Y. The best book for electricians and beginuers in elec-
tricity is " Experimental Science," by Geo. M. Hopkins. By mail. 84; : siunn \& Co., publishers, 36: Brosd way, N. Woven wire brushes.-The Belknap Motor Co., of
Portland. Me.are the patentees and manufacturers Portland. Me.are the patentees and manufacturers on
the best woven wire commutator brush on the marke
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HINTS TO CORRESPONDENTS.






 | $\begin{array}{l}\text { price. } \\ \text { incras sent for examination should be distinctly } \\ \text { marked or labeled. }\end{array}$ |
| :--- |

(6402) W. C. McC. writes: 1. I am about to wind an unduction coil for a medical battery. In
what way would you wind the wire, so that it will give three current-porimary, secondary, and primary and
secondary combined: I am going to have three binding screws hov will the connections be made? Also which way would you advise to regulate the current? With a
tube sliding over the core or over the whole coil? How does the tube in either way affect the current as to weakening and strengthening it? A. For medical induc-
tion coil we refer yout to our SUPPLEMENT, No. 569 . For hon coil we refer y you to our Stuplewent, No. 569. .
primary connections connect wires from handes to each side of the make and break contact mechanism. F combined place erimary and secondary in series. A
range regmlating tule as shown in Surpuesment abo referred ${ }^{\text {t. . When tube is pushed in so as to cover }}$
the core, it weakens the effect of the coil. 2 . How many volts are there in two Mesco dry batteries?
(6403) S. M. M. asks: Will you please let me kuow by letter what the resistance of ordmary
fresh water is, hot and coll, and through what resistance will an ordinary gravity battery, say a bluestone, ring scept when the potential is high enough to electrolyz it, and then it needs some salt, acid or other compound to give it electrolytic conduction. A single gravity bat tery will not electrolyze it, and hence cannot maintain a
current through it. By using large iron electrodes in he caustic soda solution, two or three cells would ring
(6404) O. J. asks: 1. Which is the best for the core of an induction coil-a solid core or one
built up of wires? A. A wire core. 2 . Which isthe best -between the primary and secondary coil or between core nt primary coil? A. It matters very little; place a
most conveniant. ${ }^{\text {3 }}$. Should there be any special ratio between the amount of wire on primary and sec-
ondary coil! A. No. 4. Which is the best solutionfor a bichromate of potash battery-solution of bichromate of potash or or chromic acid? A. Chromic acid or
sodium bictromate. 5 I can only get chemically pure hatin a battery, and if so, will you please give me formula? A. Use the bichromate. 6. In calculating the
length of wire in a certain weight of wire, about how much or what per cent should I deduct for weight of insulation? A. It depends on the kind
For cotton-covered wires it is very trifing.
(6405) H. E. asks : 1. Can electricity be there is a pressure of three or four atmospheres of air, a well as in open or one atmosphere of air? A. Yes.
What propelling power or part of horse power has and of 15 miles rapidity per hour on a sail of twenty-five square feet ? A. The pressure of wind at 15 miles per
hour is $1 \cdot 125$ pounds per square foot on a stationary plane or sail, and on 25 square feet would be be pounds.
If the eailshould be moving before the wind, the presIf the sail should be moving before the wind, the pres-
sure would be somewhat less, or equal to the loss due to sure would be somewhat less, or equal to the loss due to
the progress of the sail. So that if the sail were moving the progress of the sail. So that if the sail were moving
at the rate of 5 miles per hour, the pressure would be 1
$\left\lvert\, \begin{aligned} & \text { pound per square foot, or 22 pounds for the sail as abore } \\ & \text { stated. } \\ & \text { The speed per minute in feet multipilied bo the }\end{aligned}\right.$ pressure will equal foot pounds of power, 4010 feet $\times 25=$ $1,000=1 / 3$ of a horse power.
(6406) R. K. B. writes : I have in my ofice an electric b.ll communicating by wire and knot with my private room. The bell has been in operation
oir six monthe and for the first fonn months worked properly. For the past two months I have been unable to make the bell work by pushing the button (after aas remained unused for a few hours) without five o
six enceessive pushes. I have had a new knob attached ind an extra battery, but this does not help the matter A. Clean your binding posts and connections and the
contact points of the bell.
(6407) T. R. says: In a cylinder ooiler 33 inches in diameter lying horizontal, filled with water, it was found necessary to take out one-fourth the
water. What would be the perpendiculard distance fro water. What would be the perpenacular disance from
cop of boiler to the level of the water? Take an equilateral triangle and suspend weights of 5 , in, and 15 ral point on center of gravity in this triangle. Please give formulas for the above questions, avoiding alge-
bra, if possible. Please give your opinion of cylinora, if posible. Please give your opinion of cylin-
der boilers, 30 feet long and 45 feet long, 34 inches liameler, both working ander simiar conationsin ever espect, which wh me more economical ? A. The distance
ime and which is the more from water to top of boiler will be 10.72 inches. RuleDivide area of circle by the square of its diameter, and
with the quotient find in the table of "areas of seg ments of a circle," in Haswell's "Enginer's Pocket
Book,") the proportional versed sine of the diameter, and Book," the proportional versed sine of the diameter, and
with this multiply the diameter for the required distance. with this multiply the diameter for the
As in your case area 36 inches $=-101787$
of segment=25449 square inches and $\stackrel{.25449}{2}-=0 \cdot 1963$, and opposite $0 \cdot 1963$ in the segment tabbe will be found of an equilateral triangle bisect each side inversely in the atio of the weights respectively and draw a line from each angle to it opposite point of bisection; the point
of crossing of these lines will be the center of gravity of crosing of these lines will be the center of gravity
of the triangle as loaded; the triangle itself not considered. The boiler having the largest fire surface will pro duce the most steam
the most economical.
(6408) R. L. E. writes : I would like to submit the following. With water pressure 100 pounds to he square inch, how large a nozzle must I have to drive
Pelton water wheel directly attached to a 200 light dynam Also which is the best type of incandescent dynamo, 11 volts, for such a purpose? Also how large a diameter of You will require about 22 horse power for 21012 -candle
年 power lamps. At 100 pounds pressure, a 114 inch nozzle
on a 24 inch Pelton wheel will give the required power on a 24 inch Pelton wheel will give the required powe
at 580 revolutions per minute, using 56 cubic feet of water per minute. As the dynamo must run at a spee
f 1,200 to 1,400 per minute, pulleys and belt must be usee oo bring up the speed. For a direct connected dynamo pair of 12 inch wheels may be used with $27 / 3$ inch no 2 zles, using the same amount of water with a speed of
1,160 revolutions per minute. Affour-phase dynamo re duires less speed than the two-phase, and is the best form ${ }^{(6409)} \mathrm{H} . \mathrm{K}$. asks : 1. What size wire hall I require to make a helix like the one illustrated in
Experimental Science," on page 577 , Fig. 6 , if the dyamo on page 488 is employed to work it? A. Th elix will answer for the dynamo in question. 2. When sary to retemper it before remagnetizing it? A.
No. 3. In what manner are teethp painessly extracted by means of electricity? Is the operation really painless ? A. The induction coil discharge has been applied to deaden or conceal the pain. 4. Please give scientific explanation why it is that the brass tube which slides
ver the iron core of a medical induction coil affects the over the iron core of a medical induction coil affects the orce which otherwise would go to excite the secondar 5. Can you give me a receipt of a depilatory which when
once or twice nce or twice applied would permanently destroy the oots of the hair, and thus do away with shaving? A No. 6. In experimenting with a Jablochkoff cancle (on
in arc circuit of 2,500 volts, 10 amperes and carbons ficed that when the current was türned off after the lam had burned about 20 minutes that the points of the ca Jons emitted a peculiar odor. Something like the un-
consumed gases that sometimes issue from a locomotive using hard coal) wien it is fired up with fresh coal What is the odor due to, and do all forms of arc lamps ive the same peculiar smell? A. It is hard to say jus
what the odor is due to. Possibly it was ozone, which is liable to be produced in all electric discharges. Your (6410) C. M. A. writes : Some few day one of the rubbers in one of the ball gauge try cock on Erie City boiler water column blew out, causing mall jet of steam to escape from it, and while replacin with new rubber I received rather a heavy shock, and apon investigation found that one of our boilers semed
to be charged with electricity. Holding a knife or any me to be charged with electricity. Holding a knife or any me
tallic tool near it cuased a bright ppark at point of contalict tool near it caused a bright spark at point or con-
tact. During such times $I$ was standing on a ladder believe that the electricity was generated by the friction of the escaping steam? If so. why can it not be found in any boiler at any time under steam pressure, and never occurring before nor since? A. Very powerful electric
excitation is produced by escaping steam. A number of conditions are essential. Sometimes quite severe shocks ting of your boiler contributes to the result in effecting a complete insulation from the earth.
(6411) W. W. F. writes : 1. What effect hast tension on the molecular vibrations in metal? If a
hot wire were made to sustain a heavy weight, would
this shorten the swing of its atoms or lessen their ra-
pidity, or, in other words, would the tension cuase the pidity, or, in other words, would the tension cause the
metal to cool and contract more rapidy than it otherwise would $\%$ A. Simple tension has no effect as such. But as the wire is lengthened by the tension, its temperature
is increased. 2 . If a heated wire, sustaining a weight vere inclosed in a tube of cold water, would the hea siven off by the cooling wire elevate the temperature
on water to the same extent that He water to the same extent that it would if there wer
no weight attached? A. Yes; there would be no difer-
(6412) L. R. C. asks : 1. Would it b practical to run a dynamo with a water motor? The is 10 horse power, with an unlimited sapply . ff practical, how. many 16 candle power lamps could be used. also what size dynamo should be used? A.
About 80 with an 80 light dynamo.
3. If power is not he curent tedy? A. Yes; but it is preferable to ue the current steady?
the power directly.
(6413) F. P. C. writes: Is differentia or integral calculus used in the work of electrical engi
neering? cf so, to what extent, i . e in the calculation ecessary in above mentioned profession? A. Very little xxept in deducing laws and working
original work the calculus is most useful.
(6414) M. S. P. writes: Is asbesto apera good material to use between the plates of better to omit all such material if possible. The troubl (6415) F W W A.
(6415) E. W. A. asks how to make an nexpensive paste that will do to stick apaper label on
in. I have tried several different kinds of paste and stue, but after becoming dry the label peels off every
time. A. 1. 4 parts shellac, 2 patts borax; water, 30 parts; boil until the shellac is dissolved. 2. Add lage. 3. Balsam of fir, 1 part ; turpentine, 3 parts ; use only for varnished labels. 4. Butter of antimony is good to prepare the tin for the label. 5. Venice turpentine
dded to good starch paste makes an excellent mounting
(6416) M. C. C. says: Will you kindly inform me through your columns if there is anything to
put on windows to keep them from frosting and what it composition is? A. A thin coat of pure glycerine ap plied to both sides of the glass will prevent any moisture orming thereon, and will stay until it collects so mnct ust that it cannot be seen through. Surveyors can use
to advantage on their instruments in foggy weather In fact, it can be uus: anywhere to prevent moisture from forming on anything, and locomotive engineers will
find it particularly useful I I preventing the accumulation find it particularly useful in preventing the accumulation
of steam as well as frost on their windows during the weather
(6417) E A. G. writes : Please give rule for iiguring the power derived from balance wheels. A.
There is no power derived or generated by the motion of balance wheels. They only transmit power that usual office is to equalize speed by their momentum, through which they transfer the force received at the maximum to the minimum sections of the crank revolution. When a balance wheel is running free, it gives out power while in motion. Its weight in pounds multiplie by its rim velocity in feet per minate is ths momentum
in foot pounds, and this product divided by 33,000 in foot pound, and this prod
horse power for any moment.
(6418) W. H. Van A. writes: 1. Does it ever snow when the thermometer is a zero or below
A. There is no place on our earth where it is too cold to now. Blizzard snow storms have been experienced by ners within the Arctic circle. 2. Is rnle, the snows during very cold weather are light, for he reason that the quantity of watery vapor that the atmosphere can hold at low temperatur. 8 is very small in
proportion to the volume just above the freezing point, which accounts for our heaviest falls of snow occurrin . Some persons entertain the idea that it is sometim to cold to snow. Is that not a popular delusion? not, please explain why it snows in cimates where it it
intensely cold? A. The popular saying that it is cold to snow is only comparative, and not strictly true for any zone, and may be derived from the comparative rryeess or ready for snow fall, contains but one-half urated, aztr at zero as it does under like conditions $20^{\circ}$, and but one-third as much as at $32^{\circ}$, and this is about the average volume of snow storms at these tempera
tures althourh special conditions sometimes produce ex. reme snow falls.
(6419) G. T. asks : 1. One part of dias lase can convert 2,000 parts of starch into dextrine and nuch longer would $\mathrm{t} t$ take if the temperature were $100^{\circ}$ Fah.? A. It will not operateat a low temperature. 2. Ha diastase any converting power over cellulose or gum of
starchy nature? A. Not over cellulose. 3 . Does atme spheric oxygen take an active part in the conversion? A It takes no part. 4. Does diastase convert starch int fixation of water. 5 . How is cellulose converted in glucose? A. By treating it with perfectly cold oil of
vitriol, and after standingrubbing it up with water, and boiling the mixture thus diluted for three or four hour with repriall) be procured? A. Address Queen \& C , Philadelphia, Pa.
(6420) G. A. writes: 1. How many yravity cells $6 \times 8$ will it take to maintain a chloride accu-
nulator, giving a current of 6 volts, 250 ampere hours used from two to four hours per week, runnng $1 / 4$ horse power motor? A. 32 cells-eight in series, four in
parallel. 2. How long (about) will it take to charge said accumulator for same amount of work, with a dynamo having a current of 25 volts and about 8 amperes ? A
Five hours 3. What power (about) will I Five hours. .3 . What power (about) will I get out out 10
500 500 pound weight hung in a chain on a
inches diameter, geared from 1 to 1,000 , having 3 gearrs, 1
o 10 each, the small gear being brass, with an escapement arge loss by friction, and as you do not give the rate of descent of the weight, the query cannot be answerea.
(6421) L. W. C. asks how to figure the ines of force in a magnet, that is, how many ampere
uurns should $I$ wind a magnet in order to get 10,000 line to the square centimeter. A. For magnetic circuit calce lations, see Sloane's "Arithmetic of Electricity," \$1 hy
mail. The rules are not accurate except for full iron or
(6422) C. B. V. asks : 1. What size and ow many turns and layers of wire to use in the primary of No. 30 , wound in 68 layers? A. Use 4 or 5 layers No 20 wire. 2. Woulddouble cotton covered wire do in the seconary: A. Yes. 3. Can you tell me where I ca with them? A. See our Supplement, Nos. 160, 166. 4. About what length of spark would this coil give with 8
cells of Bunsen battery? A. One-ightb to one-quarter ells of Bunsen battery? A. One-eightb to one-quarter (6423) A. L. C. asks : 1. Is it considered safe e have the disks of a dynamo armature in electrical
connection with the shaft? A. Yes. 2. Is the black oxide of iron on the disks sufficient to insulate them rom one another? A. Hardly; it is better to use thi paper. 3. Can you give me some practical rule by whitere
can determine, approximately, the number of amper turns necessary to produce a certain intensity of mag netic foree per square inch of area. A. See Sloan's
"Arithetic of Electricity", or Thompson's works on "Arithmetic of Electricity," or Thompson's works on
the electro-magnet. The rules are not accurate, owing to agnetic leakage.
(6424) T. H. M. asks what size wire to ise in the circuit of the sixty light dynamo described in Scinntric Americas sumcencn, No. 85, the cir wire; ss branches are taken off, proportion tle size to
he amf erage.
(6425) W. B. P. asks: How many and What ize cells of Edison-Lalande type will run the motor
described in SUPPLEMENT, No. 641 ?
A. Ten cells type
(6426) E. A. T. asks: 1. Will a simple atomizing burner be suitable for a smain forge? A.
Yes, if properly constructed. 2 . How many volts and mperes are necessary to run motor described in SuPpLEmENT, No. 767, ten inch fan? A. Twelve volts, twi
amperes.
3. Is the motor efficient?
A. Its efficiency is amperes. 3. Is the motor eficicient? A. Its efificiency is
not very high. 4. What is the average expense per not very hergh. 4. What is the average expense per
hour to operate with plunge battery : A. This has not been determined. 5. In calculating the capacity of plate (positive)? do allow 5 to 6 amperes per square foot of immersed positive plate. 6. Are sal ammoniac
batteries with carbon negative equal to the Leclanche with carbon and manganese ? A. They have had extenive use, but the Leclanche is probaby preerable.
Do dry batteries generally have more or less interne resistance than liquid batteries? A. More reeistance than chromic acid batteries
(6427) G. J. W. writes: How can I ix the skins of some small animals so they may be used
or furs? A. Skins, to Preserve (as a Mole Skin)-Sup. posing the skins are dry, they should be softened throughout by soaking in pure water; ; soft water is
best, but any ordinarily pure water may be used, and best, but any ordinarily pure water may be used, and
care must be taken that the skins are thus soaked only a sufficient time to soften them. Then clean off any bits of flesh that may remain on the flesh side, rinse all well, tack on a bes feater, and then sprinkle with a mixture of powdered alum and salt, about two-thirds alum and one-third salt, enough to just'cover every part. As the skin dries, it takes up the mixture, but if any be left on he surface the second day, sprimke on a little more water, otherwise put on more alum and salf, and
sprinkle. Two to three days should be sufficient for such mall skins, the idea being to give the skin all of the alum and salt it will take up whlle in a moist condition. This tawing process makes the hair frm, a gentle rubbing and beating softens the flesh side, and it is preserved from decay, although tawed skins are never cal-
culated to stand much wetting. This process is well dapted for all small skins, although those which are times folded together and the skins rolled up. When the skins are freshly taken off no soaking is needed, but more care is then called for in thoroughly washing off and cleaning them, and the first application of salt
and alum should be in proportions of one-half each. It and alum should be in proportions of one-half each. It requires the judgment of a tanner to deal with skins in a fore drying, and it requires special knowledge also to fore drying, and it requires special kn
tell whether a dry skin is so damaged.

TO INVENTORS



INDEX OF INVENTIONS

## Which Letters Patent of thes States were Granted United

Febriaary 12, 1895,
and EACH BEARING THAT DATE.
[See note at end of list about copies of these patents.]




 boot, C. H. So Southall
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Nut tappins mar, hine, W. J. Siefit
Oit burner, H. H. Hornish. $\ldots .$.
Optometer, H. A. Huntington...

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