pensated for by a special transformer. Finally, there are other transformers that serve to reduce the initial potential in a sufficient proportion to permit of the measurement of it by means of the apparatus in current use.

The Thorenberg installation is now supplying 3,500 Swan incandescent lamps of 10 candle power (35 watts), but, as all these are not lighted at the same time, a single machine suffices to perform the service. The light is paid for by contract, at the price of $4 per lamp per year.

The lighting has been done for nearly two years and a half, and has always given entire satisfaction.—*La Nature.*

Cedar for Paving.

The popularity of round block wood paving is steadily on the increase. A company has been formed at Mobile, Ala., with A. C. Danner, the well known lumberman, at its head, to put in machinery for making sapless blocks to pave the streets of that city, using juniper, cypress, and cedar. Cypress has been used more or less, juniper is said to be similar to the white cedar of the North, and the red cedar is thought to be better than the Northern white cedar Wood paving can be put down at Mobile for $1.50 a yard, as compared with $3.50 to $3.75 for asphaltum.

Before it was decided to go into the paving business, extensive correspondence was had with residents of cities where wood paving is in use, the replies being uniformly favorable. Fred. A. Tromley, secretary of the Board of Public Works, Grand Rapids, Mich., wrote that for ten years the city had used only yellow cedar for wood pavements, and for the past few years only the sapless cedar blocks, the duration of the paving being from seven to ten years, also that wood pavements which are sprinkled during the summer last the longest. David P. Hadden, president of the Memphis, Tenn., taxing district, reported thirteen miles of cypress pavement in use. It was green, and of the Nicholson style, lasting ten or twelve years with good care. He advised putting down nothing but round blocks of red cedar. John Torrent, mayor of Muskegon, Mich., wrote that during the past two years about eighteen miles of cedar block paving had been laid in that city, its life being from ten to twelve years. He believes it the most practical wood paving of any now in use. H. R. Wagar, president of the Wagar Lumber Company, Ionia, Mich., said that the round cedar blocks had made an elegant, durable paving, especially where the traffic was light or moderate. R. R. Blacker, of the State Lumber Company, Manistee, Mich., considered cedar the best material to use for street paving, and said that its life depended upon the amount of traffic to which a street was subjected. E. J. Senseney, merchant, East St. Louis, Ill., favored wood paving, largely because it made no noise, and was free from dust, while asphaltum was very dusty, and, being impervious to water, caused shade trees to languish. For heavy traffic, he regarded granite the best.—*Lumberman.*

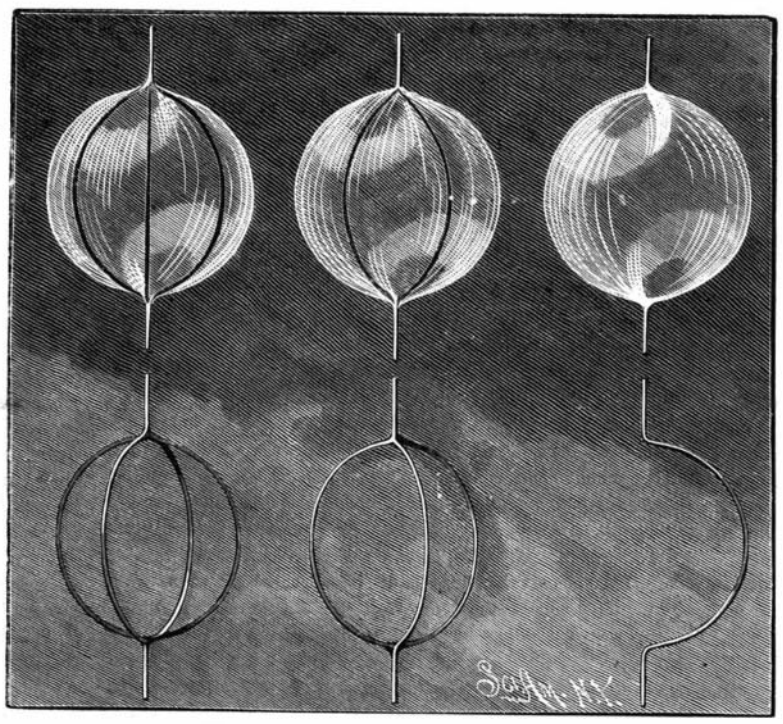
A GREAT STONE.

There was recently cut out from the Pilkington Quarry, Horwich, in one piece, without crack or flaw, a large stone, weighing upward of 35 tons. The dimensions are 14½ feet in length, 6 feet high, and 5 feet 3 inches wide. The removal of this mass from the quarry to its destination, a bleach works in Bolton, a distance of seven miles, over a rough, hilly road, was successfully accomplished, as shown above, by the Phœnix Steam Boiler Company, Bolton, under the direction of Mr. H. W. Rushton. The London *Engineer* remarks, it is said to be the largest stone ever quarried in England.

IT is a fact not well known that native sulphate of baryta is an active poison to rats, mice, and dogs. It is not easy to explain its action, considering its extreme insolubility, but mixed with lard it is readily eaten by them. This being the case, the question suggests itself, whether it might not replace the more dangerous poisons now so much used for this purpose, and do away with the risk attending them.—*Pharm. Jour.*

CURIOUS OPTICAL ILLUSION.

The engraving illustrates an interesting illusion observed by Mr. J. Rapieff, the well known electrician. The apparatus consists of semicircular and circular wire loops, provided with axles, by which they may be twirled between the thumbs and fingers. The lower row of figures shows some of the loops used in the experiment, while the upper figures represent the effects produced. The wire has a polished surface. When



CURIOUS OPTICAL ILLUSION.

the single semicircular loop is twirled, the only effect is to produce a gauzy glimmer of spherical form, as shown in the upper right hand figure. When three of the loops are joined together, each extending from the other at an angle of 120°, the figure produced is similar to that already described, but with two perfectly distinct curved black lines extending from one axle to the other, as shown in the upper central figure. When four loops are joined at right angles to each other, three jet black lines are shown, as indicated in the upper left hand figure. A circular loop shows a single black line.

This curious effect is produced by holding the apparatus so that the light is reflected as much as possible from the inner surface of the wire. The result is due to the eclipsing of the bright surface by the shaded portion of the upper loop as it passes between the eye and the lower loop. The whole of the loop is not eclipsed at the same instant, but persistence of vision causes the entire eclipse to be seen at once.

Success in this experiment depends upon holding the loops in the right position relative to the light, as well as the provision of the proper background. The loops should be held over a dark ground, with the axles parallel with the plane of vision. G. M. H.

WITHIN a radius of forty miles of Rochester there are more than 1,500 fruit evaporators, giving employment during the autumn and winter to about 30,000 hands. Last season the production of these evaporators was about 30,000,000 pounds, worth at first cost about $2,000,000. A large proportion of the product is exported.

A GREAT STONE.

Fecundity of the Eel.

Mr. Fred Mather, the well known fish culturist, has been estimating the number of eggs in a six-pound eel in November (in what is known to fishermen as "eel fat," but which are really the ovaries), and credits that eel with fully 9,000,000. Under the microscope he found that they measured 80 to the linear inch, and taking one ovary and dividing it by means of the most delicate scales known to science, he halved, quartered, and further divided the mass seventeen times, until he had a section small enough to count the eggs in it. This section represented 1-131,072 of the total number, and three sections were laboriously counted under the microscope. One of the sections contained 68 eggs, making the total 8,912,896 eggs. The second held 77 eggs, or 10,092,544 in the whole. The third section consisted of 71, from which it would appear that there were 9,306,112 eggs in the eel. Taking the last as the medium number, Mr. Mather figures, in round numbers, that that six-pound eel contained 9,000,000 eggs.

There have been many theories about the reproduction of the eel, some of them being wildly absurd, such as their being hatched by fresh water mussels, or that the lamprey was the female and the so-called silver eel the male, etc. The fact is that the lamprey, miscalled "lamper eel," is a form of life lower than that of the true fishes, to which the eel belongs, and is a vertebrate with a cartilagenous skeleton instead of a bony one, has its skull imperfectly developed, and has no lower jaw. Superficially it appears like an eel, but is not nearly related to it.—*N. Y. Sun.*

Cleaning Furs.

Now that the season has arrived for getting out fur garments, some of our readers will doubtless be glad to hear how such garments are cleaned and renovated in Russia, the country of furs.

Some rye flour is put into a pot and heated upon a stove, with constant stirring as long as the hand can bear the heat. The flour is then spread over the fur and rubbed into it. After this, the fur is brushed with a very clean brush, or, better, is gently beaten until all the flour is removed. The fur thus resumes its natural luster and appears absolutely as if new.—*La Science Illustre.*

Transmutation of Cotton Seed.

Was there ever, says *Banker's Monthly*, such a history as that of the cotton seed? For seventy years despised as a nuisance, and burned or dumped as garbage, then discovered to be the very food for which the soil was hungering, and reluctantly admitted to the rank of utilities, shortly afterward found to be nutritious food for beast as well as for soil, and thereupon treated with something like respect. Once admitted to the circle of farm industries, it was found to hold thirty-five gallons of pure oil to the ton, worth in its crude state $14 to the ton, or $40,000,000 for the whole crop of seed. But then a system was devised for refining the oil up to a value of $1 a gallon, and the frugal Italians placed a cask of it at the root of every olive tree and then defied the Borean breath of the Alps. And then experience showed that the ton of cotton seed was a better fertilizer and a better stock when robbed of its thirty-five gallons of oil than before, and that the hulls of the seed made the best of fuel for feeding the oil mill engine, and that the ashes of the hulls scooped from the engine's draught had the highest commercial value as potash, and that the "refuse" of the whole made the best and purest soap stock, to carry to the toilet the perfumes of Lubin or Colgate.

Sure Death to Buffalo Moths.

Of the vast number of remedies tried for exterminating that most troublesome pest, the buffalo moth, the following is said to accomplish the object:

Take strips of red or blue flannel (as these colors are particularly attractive to them), dip in liquid arsenic, and lay around the edges of carpets, or wherever the pests are troublesome. They will soon eat a desired amount and collapse, to the entire satisfaction of the housewife, without the least injury to her carpets.

The Re Umberto—the New Italian Warship.

The Re Umberto, recently launched at Castellamare, Italy, in the presence of the Emperor William and King Humbert, is a steel twin-screw, deck-protected, barbette ship of 13,298 tons displacement. The Re Umberto is nearly as large as the Italia, which was launched also at Castellamare in 1880, and the Lepanto, which was launched at Leghorn in 1882. As far as beam alone is concerned, she is bigger than either of those leviathans; and in this respect there is nothing afloat that can rival her. Her dimensions are: Length, 400 ft. 4 in.; breadth, 76 ft. 9 in.; and her mean draught of water with all her weights on board is expected to be 28 ft. 8 in. She has no side armor at the water line. A large amount of protection is, however, afforded to her by the construction of her bottom and sides, by the subdivision of her hull into a great number of water-tight compartments, and by a curved steel deck near the water line. The ship's bottom is composed of three skins, which form two water-tight spaces that are further subdivided transversely. Experiments to test this mode of construction were made several years ago in Spezia harbor. A caisson, built up in a similar way, was moored, and a charge of 75 lb. of guncotton was exploded in contact with it, and at a suitable depth. The two outer skins were ruptured, but the inner skin remained intact. Subsequently the inner one of the two spaces was filled with coal, and the experience was repeated. This time only the outer skin was shattered. It may therefore be taken as proved that the construction of the Re Umberto affords protection against a considerable torpedo charge. The armored deck leaves the ship's side 6 ft. below the water line, and curves upward, until, along the middle line of the ship, it is but 2 ft. below the water line. It is formed by a ⅝ in. steel plate, overlaid by a 2⅝ in. compound plate. Below this deck and between it and the ship's bottom there are over fifty water-tight compartments. Between the armored deck and the deck immediately above it there are one hundred other water-tight compartments. If, therefore, water were to enter the ship either above or below the protective deck, its volume and evil effects might, with proper precaution, be strictly limited. The chief part of the armament will be carried in two barbettes, one forward and the other aft, on the middle line of the vessel. Each of these barbettes will be plated with compound armor 19 in. in thickness, placed at an angle of 24 deg. from the vertical. The ammunition hoists between the amored deck and the barbettes will also be armored, and the bases of the funnels will have substantial protection to a height of over 3 ft. above the water-line. Beyond this the vessel will have no armor.

The engines have been built by Messrs. Maudslay, Sons & Field, London. They are of the compound type, and are splendid specimens of marine engines, but it must be remembered that they were designed as far back as 1884. The following are the leading particulars of the engines of the Re Umberto, viz.: Four sets of compound engines, two sets being applied to work each screw propeller, each set having one high-pressure cylinder 47 in. diameter and one low-pressure cylinder 89 in. diameter, with a stroke of 4 ft. 3 in., making about 100 revolutions per minute. Diameter of screw propellers, 20 ft. Eighteen main boilers, 14 ft. 3 in. diameter, 9 ft. 6 in. long, having altogether seventy-two furnaces, 3 ft. 2 in. diameter, 6 ft. 4 in. long, with an aggregate area of grate surface of 1,444 square feet, and a total heating surface of 40,230 square feet. The working pressure of the steam is 100 lb., and the indicated horse power, 19,500. It is expected that these engines will drive the ship at an extreme speed of 18 knots. The coal capacity of the vessel is 1,200 tons.

The armament of the Re Umberto, in addition to a ram, will comprise four 17 in. new model 104 ton Armstrong breech-loaders, two being mounted in each barbette; twelve 6·1 in. Armstrong 4½ ton breech-loaders, carried in the batteries; six 3 in. guns and ten machine and quick-firing guns, together with torpedoes. The so-called 104 ton gun—that is not its exact weight—has a total length of 40 ft. 9 in., the length of the rifled bore being 28 ft. 10⅔ in., and of the powder chamber 7 ft. 6 in. The number of grooves in the rifling is eighty, and they have a twist of 1 in 50 calibers, or, in other words, of one revolution in 70 ft. 10 in. The full firing charge for the armor-piercing projectile is 900 lb. of progressive Fossano powder; for common shell it is 600 lb. The projectiles weigh 2,000 lb. each. The bursting charge of the armor-piercing projectile is 32 lb.; of the common shell, 60 lb.; and of the shrapnel, 5 lb. The muzzle velocity of the gun, when fired with the full charge, is 1,992 ft. per second. The muzzle energy is 55,030 foot-tons—sufficient to raise the Re Umberto, guns and all, more than four feet out of the water; and the projectile, at the muzzle of the gun, is capable of perforating 33½ in. of wrought iron. These heavy guns will be carried at a height of 28 ft. above the surface of the water.

The Re Umberto is to be completed for sea in 1892. Her design, which is also that of her sister ships, the Sicilia and the Sardegna, and of her kindred, the Italia and the Lepanto, has excited much criticism; and many competent judges have not hesitated to express an opinion that in the line of battle a vessel of this description would be dangerously out of place. Yet, if the Re Umberto is not useful as a battle ship, it is hard to see what she can be useful for. The *Times* says that, writing in the August number of the *Jahrbucher fur die deutsche Armee und Marine*, Herr Spiridion Gopcevic denies her utility altogether. She is, he declares, neither a battle ship nor a cruiser. She is not a battle ship for the reason that her sides are entirely unarmored. She is not a cruiser for the reason that she does not carry sufficient coal. She is, moreover, too costly to be risked on cruiser's work. For the cost of a single Italia or Re Umberto, four iron-clads, each of about 3,500 tons, might, he thinks, be built. Their united strength in artillery might equal that of the big ship; and if that were so, they would, he maintains, be together much more than a match for the monster. There would be four vessels—that is, four rams against one; and it is hard to believe that, even if she were successful in one or two cases, the large vessel would put out of action or sink all her opponents before being herself sunk. Nay, more, the single ship, in this comparison, labors under the considerable disadvantages of being unable to divide herself and to be in four places at once. She is the less able, therefore, to enforce a blockade. Her draught of water debars her from many ports and waters, her size from many docks. She takes four times as long as a small vessel to build. Whenever she is under repair, a fourfold strength is doomed to lie idle. Herr Gopcevic urges all this, and much more, against huge unarmored ships; and doubtless Italy has run some risk in investing so much money in them as she has invested during the last twelve years. Her navy is not, and never can be, strong enough to theoretically justify her in putting more than comparatively few eggs into one basket. Nevertheless, the Re Umberto, for offensive purposes at least, deserves to be called a most formidable ship, if only because she will, when completed, throw a heavier weight of shot than any ship that has yet been built. Including all guns of 6 in. caliber and over, the gun-strength of the most heavily armed battle ships of the naval powers is as follows:

	Weight of Discharge.	Muzzle energy of Discharge.
Re Umberto (Italian)	8,960 lb.	236,896 foot-tons.
Amiral Baudin (French)	5,950 "	124,770 "
Victoria (British)	5,176 "	132,632 "
Deutschland (German)	3,864 "	66,630 "
Tchesme (Russian)	4,988 "	123,772 "
Krp. Rudolf (Austrian)	3,000 "	57,000 "

This comparison, even if no other elements be taken, is sufficient to show that, whatever may be the weaknesses and demerits of the Re Umberto, she is a very dangerous adversary and a very remarkable ship.—*The Engineer.*

Puget Sound Lumber.

Lumber is the oldest, most profitable, and the most actively prosecuted industry of the sound, employing as it does a capital of over $60,000,000 and thousands of men. Six or eight combined and wealthy sawmill companies virtually control it, owning their own timber lands, ships, stores, and the town sites upon which their mills are located, the dwellings of which are simply rented to their employes. They govern not only the price of the manufactured article, but the amount that shall be manufactured and the price that shall be paid loggers for logs. These are mainly of red fir, the trees often attaining a height of over two hundred and a diameter of eight to ten feet, single logs frequently yielding over 16,000 feet of manufactured lumber.

Logs are usually cut in the spring and summer, as convenient to streams as possible, to which they are hauled by long strings of oxen over well-greased round timbers, laid every eight feet, called skids, floated to the sound, made up into rafts and towed to one end of a long sawmill, usually located on some convenient harbor. Here they are scaled and bought by the mill company at from four to six dollars per thousand feet, according to quality. At the opposite end of the mill, anchored stern on, are vessels from Californian, Australian, and other ports, awaiting their cargoes. So complete are the modern sawmill devices for the manipulation of these enormous logs, that the hand is seldom touched to them till the manufactured article is pushed into the stern portholes of the vessels for stowage. One must be on the alert in order to follow the log when jerked from the water up an incline to the mill platform, squared by circular saws, its slabs cut into lath pickets and other small stuff, and the remainder quickly reduced by gang, band, circular, and other saws to timber, joist, plank, and boards, and delivered to the awaiting ships.

Some of the large mills have a daily output of 200,000 feet, and outward bound cargoes of from 800,000 to 1,200,000 are not unusual. The refuse pieces are carried on an endless belt of iron links, running in a trough to a safe distance from the mill, and to a pile that is constantly burning, to which pile is also blown, through a long capacious iron pipe, the sawdust. In this way scraps that, at the East, would be worth hundreds of dollars annually, but that here would soon prove a serious and costly obstruction, are removed and destroyed automatically.

As the sawmill companies own their own vessels, pay about five dollars per thousand feet for logs, and receive from $18 to $25 per thousand feet for the manufactured lumber at San Francisco, hauling back on their return trips, at little or no cost for freight, merchandise of all kinds to be retailed out to their men at large profits, the business necessarily proves a bonanza of the richest kind.

The Heroult Aluminum Process.

The Swiss Metallurgical Company, established close to the Rhine Fall at Neuhausen, has adopted the process of M. Heroult for the production of alloys of aluminum. The process resembles in some ways that of the Cowles Brothers, which is so successfully employed at Lockport in the United States, and which has been recently introduced in England and the Continent. In both the Cowles and Heroult processes an electric current is employed. In the former it is used simply to produce a very high temperature in a limited zone, the reduction of the ore being due to the temperature alone, and not to any effect of electrolysis, so that an alternating could be used as well as a continuous current. In the Heroult process, according to the views of the inventor, the reduction of the ore is partly electrolytic and partly due to the heat of the arc. The furnace has a carbon pole at the top, and the current passes in by it through the melted aluminum oxide to the reduced metal at the bottom, the ore is decomposed, the oxygen passing upward and attacking the carbon, while the molecules of the metal travel downward and are merged in the metal bath.

The furnace used in the process is a large carbon block hollowed out in the proper shape and inclosed by a frame of iron. In the smaller furnaces a single block of carbon is used, and the iron is cast around it; for larger sizes slabs of carbon are used, and are held together by wrought iron bands. There is an opening in the bottom of the furnace for drawing off the reduced metal. The current enters the crucible through a carbon electrode which enters the top, and which consists of a bundle of carbon slabs ten feet long, seventeen inches wide, and nine and a half inches deep. The distance of this electrode from the surface of the molten metal is regulated by an attendant. This distance is very small, preferably not over a quarter of an inch. One of the electrodes is consumed in producing about half a ton of aluminum. The crucible is covered by carbon slabs insulated from the body of the crucible. In the top holes are provided for the introduction of ore and scrap metal. The ore generally used is alumina, free from silicon and other impurities, and the scrap metal is either iron or copper, according to the alloy which is desired. The process of smelting is a continuous one, the ore being introduced and the crucible tapped at regular intervals. The production of aluminum per horse power hour varies somewhat with the percentage of the metal contained in the alloy, the average being thirty grammes of aluminum and the maximum being forty grammes. That is, to produce one pound of aluminum requires fifteen horse power hours on the average, and eleven horse power hours under favorable conditions. The present capacity of the crucible is four hundredweight of aluminum in twenty-four hours.

At the works at Neuhausen the current is produced by two dynamos driven by a turbine of three hundred horse power. These dynamos are of the multipolar type, designed by Mr. C. E. L. Brown, and built at the Oerlikon Engineering Works. They are designed to give six thousand amperes each, at an electromotive force of twenty volts, and they can be worked up to thirty-five volts. The speed of the turbine is controlled by an automatic regulator acting upon a throttle in the inlet pipe of the turbine. While the working current is normally twelve thousand amperes, it sometimes increases to twenty thousand amperes, because of a short circuit in the furnace, caused usually by one of the slabs of which the carbon electrode is made burning more slowly than the others and touching the surface of the molten metal. This increase of current does not injuriously affect the dynamos. There is no sparking at the brushes of the dynamos. The process promises to be a successful one. From the figures given it compares favorably with the Cowles process in the amount of aluminum reduced per horse power.—*Science.*

An Antiseptic Gargle.

The *Union Medicale* credits Muller with the following formula:

Thymol	3½ grains.
Benzoic acid	45 "
Tincture of eucalyptus	180 "
Water	11,250 "

At bedtime the teeth are to be cleaned with powdered soap and a brush, and then the mouth can be rapidly sterilized by gargling for half a minute or a minute with the solution.—*New York Medical Journal.*