rado granite, the balance of Colorado brick. The interior will be constructed with steel beams and fireproof tile arches. The building, together with the plot (125×200 feet), will cost $1,880,000.

Messrs. Andrews, Jaques & Rantoul, of Boston and Denver, are the architects. The erection of the building is in charge of William M. Scanlon, manager of construction, and John S. Brisbrie, superintendent.

The Work of the Cooper Union.*

The Cooper Union of Science and Art was not founded for science or for art, but for man. And it has been steadily directed with that purpose in view. While, on the one hand, there has always been a regular course, through which students might pass, obtaining what we all desire, if we are so fortunate as to have the necessary time and opportunity—a systematic preparatory training, such as the graduates of to-night have enjoyed—the facilities of special departments of the Cooper Union have been enlarged from time to time, to suit the needs of the workingmen and workingwomen of New York, not as those needs are conceived according to some profound theory of what they ought to be, but as experience has proved what they actually are.

The great mathematician and wit, Professor De Morgan, of Oxford, praised in one of his essays (reprinted after his death in that quaint and charming book "A Budget of Paradoxes") the practical common sense and individuality of a rheumatic old gentleman, who, finding no ready-made chairs that fitted him, just spread on a board a mass of shoemaker's wax, then sat upon it until it had exactly adjusted itself to his anatomy, and then took the wax mould to a cabinet maker, saying, "There! make me a seat like that!"

The illustration is a homely one; but it precisely represents the manner in which the operations of the Cooper Union, wisely adjusted to the public pressure, have been fitted to the public need. The relative usefulness of every department has been tested by its results. Everybody connected with the management knows how Peter Cooper used to welcome, year after year, the practical proof of this point—the evidence that so many men or women had gained, in the classes here, the power to earn increased wages; how this or that student in the Cooper Union had made himself more useful in the world by reason of the knowledge here obtained. These were the statistics he loved.

Another generous man, Ezra Cornell, gave to the institution he founded a motto, declaring in substance that it was to be a place where any man could learn anything." A noble charter, indeed, embracing at once all branches of human knowledge and all seekers after knowledge, without distinction of color, class, condition or sex. And Cornell University is a noble expression of this ideal—though necessarily imperfect still, because the ideal itself demands for its full realization yet vaster endowments in money, and, beyond that, the ripe results of time in the maturing of great scholars, and the appreciation of them. Money alone will not accomplish everything. If I am not mistaken, the richest university in the world to-day is the State University of Texas, the endowment of which is estimated, as I am informed, to be worth $50,000,000. That is a grand provision for the future; and the future is never far off in the United States of America.

But meanwhile, even for the sake of the future, we have to deal with the present, and the prime purpose of the Cooper Union was not to establish a superfluous rival to Columbia, or the University of New York, but to aid the working people of New York—the class which will always exist, no matter what great universities may hold above its head the culture to which only a small part of the community may aspire. Thus this institution stands to-day, a University of the People, the type and model of many others of its class; and my old friend and schoolmate, the President of Columbia, never occupied a more dignified or consistent position than when he stood upon this platform last February to praise the character of Peter Cooper, and the institution which Peter Cooper created.

The proof that the Cooper Union supplies a great want with a great relief is overwhelming. One branch of it—and one branch only—is seen in such gatherings as that which our alumni organized in February last, to celebrate the centennial of Peter Cooper's birth. How the testimony of that meeting would have rejoiced his heart. What could be more glorious and grateful to any man, either before the tribunal of history or at the higher tribunal of the judgment day, than the glad witness of thousands who have received from him the one gift that neither impoverishes the giver nor pauperizes the recipient—the gift of knowledge, which is power!

The Speed of Electricity.

It requires about three seconds to transmit an electrical signal through the Atlantic cable. The speed at which electricity travels amounts to several thousand miles per second, but the electrostatic resistance of the cable reduces this speed to about 1,000 miles per second.

* Abstract from the address of Dr. R. W. Raymond at the commencement of the Cooper Union, May 28, 1891.

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NEW YORK, SATURDAY, JULY 11, 1891.

Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 810.

For the Week Ending July 11, 1891.

Price 10 cents. For sale by all newsdealers

INTERNATIONAL CONGRESS OF GEOLOGISTS.

Official notice has been given of the approaching sessions of the Fifth Geological Congress in time to enable foreign delegates to arrange for their attendance. It has been wisely planned to have several important scientific bodies meet successively in the rooms of the Columbian University, Washington, D. C. From August 19th to 22d, there will be meetings of the sections and various allied societies of the American Association for the Advancement of Science, of which the foreign delegates will be honorary members. The Geological Society of America will be convened August 24th and 25th, in whose discussions foreign guests may also participate. The International Congress will be in session from August 26th to September 2d. The daily hours will be for the council, 10 A. M., and for the congress 11 A. M. and 2.30 P. M., with lectures, receptions, etc., in the evening. Besides the consideration of reports and other routine business, the following subjects will be made special topics for consideration:

1. Time correlation of the Clastic rocks by structural data, *e. g.*, stratigraphical, lithological, and physiographical; and correlation by paleontological data, *e. g.*, by fossil plants, and animals, marine and terrestrial.

2. General geological color schemes and other graphic conventions.

3. Genetic classification of the Pleistocene rocks.

Reduced rates on the Inman, Red Star, N. German Lloyd, and Netherlands-American lines of ocean steamers have been arranged for with Thos. Cook & Son, varying with location of stateroom and number of occupants, the range being, for return tickets, from $85 to $122 and upward. Return tickets will be good for six months from date of sailing. The principal United States railroads will make a reduction of one-third on regular rates. Hotel rates at Washington will also be reduced one-third to delegates and members. A number of delightful excursions will be made after the congress adjourns, through the Appalachian coal fields, the copper and iron regions of Lake Superior, the Southern iron region, the Devonian beds of New York, etc. A grand Western excursion, covering more than 6,000 miles in length, and traversing 39 degrees of longitude, and crossing twenty States and Territories of the United States, and a portion of Canada, will be taken from September 2d to 26th, at a cost of $265, including transportation, lodging, meals, and coaches in Yellowstone Park. Branch excursions will be made to Shoshone Falls and to the Grand Cañon of the Colorado—the latter under guidance of Major J. W. Powell; while competent geologists will likewise accompany all the various excursion parties. Inquiries as to details of final arrangements should be addressed to Prof. S. F. Emmons, Secretary of the Committee of Organization, 1330 F Street, Washington, D. C.

STEAMSHIP IMPROVEMENTS.

The latest plan to improve the draught of the furnaces of ocean steamers is to increase the height of the smoke pipes. The new steamer Scot, of the Cape Mail Line, is provided with smoke stacks 120 feet high above the grates, being the loftiest pipes ever put into a steamer. A draught of ¾ inch water pressure is thus obtained, all the steam needed is easily secured, and the use of fans is dispensed with. Her speed is 19 knots.

The Scot is 502 ft. long over all, 460 ft. on the water line, 54 ft. 6 in. beam, 37 ft. 6 in. deep. Tonnage 7,000. Built of steel. Fourteen watertight compartments. Draws 23 ft. with 2,800 tons of coal on board. Twin screws, 8,000 h. p. engines, two sets of triple expansion engines, 34½ in., 57½ in., 92 in. by 60 inch. Six double ended boilers, pressure 170 lb.; 36 furnaces. The success of the tall chimneys of the Scot will probably lead to the trial of even higher pipes. The above vessel could clear the floor of our Brooklyn bridge, which is 119 ft. above high water. If our great war steamers should be piped in accordance with the latest and best engineering practice, they will be debarred from the Brooklyn navy yard, unless they approach from the Hell Gate side of the great bridge. It was an error on the part of the Secretary of War to allow so low a floor for the bridge. At present all the larger ships are obliged to dismantle and lower their topmasts in order to pass under the Brooklyn bridge.

Pleuro-Pneumonia in England.

The outbreak of this disease in the herds of the East Riding and the action taken by the Agricultural Department have caused quite a stir among the agriculturists of Yorkshire. The number of animals ordered to be slaughtered is 170. The slaughter is expected to occupy ten days in all, and the value of the beasts destroyed and to be destroyed is estimated at fully $15,000, which will be paid by the Agricultural Department of the Privy Council. The outbreak of the malady, which is on a scale unprecedented in so small an area, will probably affect the cattle show of the Royal Agricultural Society at Doncaster.

A Lake Formed in Colorado Desert.

This desert is in the eastern part of San Diego, the southern county of California, and is about two hundred miles directly south of what is known as Death Valley, on the boundary line between California and Nevada. The Southern Pacific Railroad runs through the Colorado Desert, on a northwest by southeast route, and its station at Salton, 90 miles from the Colorado River, marks the lowest level on the route, being 263 feet below the level of the sea, while for some thirty or fifty miles southeast of Salton the land is 250 feet below the sea level, the width of the portion having this great depression varying from five to twelve miles. In this tract, during the latter part of June, water began to appear, seeming at first to emanate from some unknown subterranean source, and by July 1 a lake some thirty miles long by twelve miles wide and two to three feet deep had been formed around and stretching to the southeast of Salton. It was soon discovered, however, that there was a strong current in the lake from the southeast, or the direction of the Colorado River. Several channels, ordinarily dry, lead from near the banks of this river to the desert basin, and it was soon apparent that the water came from the river, which is always at its highest stage late in June, as the result of the melting of the winter snow in the mountains of Colorado, Utah, and Nevada. This river, at Yuma, in the southeastern corner of the State, is 140 feet above sea level, and Major Powell, of the United States Geological Survey, places it as only a short time back, geologically, when the river emptied into the Gulf of California some two hundred miles north of its present mouth. The river carries an enormous amount of sand and silt, and is supposed to have built at its mouth a dam which cut off from the Gulf the large areas of country now included in the Colorado Desert and Death Valley region. The average rainfall here is only three inches a year, and, with the temperature as high as it is, evaporation proceeds very rapidly. It is thus that were left these great basins, the lowest land of the United States, and, as the evaporation here proceeds at the rate of 100 inches a year, it is not supposed that any quantity of water which may now be poured into the Colorado depression by the overflow of the river will cause more than temporary inconvenience.

Tons of Currency in Uncle Sam's Treasury.

The new treasurer of the United States has only recently finished counting out his money. It took some time, because it is no small job to reckon over 4,500 tons of coin; and this is apart from $300,000,000 or so in bank and treasury notes. For several weeks clerks were engaged in clinking the gold and silver which fill Uncle Sam's huge cash boxes, telling over the shining pieces, weighing them out and sealing them up in bags. One gets a notion of the magnitude of the task when it is considered that one of the vaults beneath the ground floor of the national treasure house, containing 85,000,000 silver dollars, is 100 feet long, 60 feet wide and 14 feet high—chock full of coined precious metal. As you walk around this huge lattice work box of iron and view its dimensions, you begin to realize the actual magnitude of so vast a sum. To empty the receptacle with a coal shovel would require many months of hard labor, if you had to do the work unaided. When the great French actress Rachel, who had always been very poor, was suddenly placed in possession of a large heap of gold coins, she put them into a basin and poured them over her bare arms delightedly, with ecstatic enjoyment of a literal wash in wealth. You might fairly swim in gold and silver in these immense coffers at the treasury. There is another which contains $25,000,000 in gold and $60,000,000 of silver also. In counting these masses of silver and gold, each bag containing $1,000 is removed from the vault and first examined to see if the seal is intact. If so, it is placed upon scales and weighed. On one side of the balance are put one thousand unused dollars, and the sack must be found an equal counterpoise. Supposing that it is light, it is opened and the money in it is reckoned piece by piece. Coin suffers more or less loss of weight by abrasion, even when not in circulation, and it might be that a bag would be less heavy on this account, though having in it the required $1,000. Also when a seal has been disturbed the contents of the sack are poured out, stacked up, counted and put back again. The sacks which are opened are resealed; but ordinarily the seals are found all right and the weight is correct, in which case the bags are computed as representing so many thousands, and no further trouble is taken with any of them before putting them back into the vaults. When the gold is gone over, a particularly rigid inspection is exercised by the overseeing officials, because the value is so much the greater. It is a very interesting sight to watch the millions in paper money—bank notes, treasury notes and gold and silver certificates—being counted by deft-fingered young women in a big room beneath the treasurer's office. Every dollar has to be numbered before the new guardian of the national cash box gives his receipt in full to the out-going incumbent. The stuff is all kept, save such small change as is needed to transact government business with, in the shape of packages, each about one foot cube, which are stored away on shelves in vaults. Cash in the shape of gold or silver takes up a great deal of room, but in bills enormous sums require very little space to hold them.

One of the vaults, which is nothing more than a big safe about as large as an extra size closet, alone contains $150,000,000. Each package holds four thousand notes, is done up in ordinary brown paper, and labeled on the outside in red figures with the amount inclosed. If it is a parcel of twenties, the bundle represents $80,000, if hundreds $400,000. Just such a package was made up a few years ago that held $40,000,000 in gold certificates of $10,000 each. You could carry one like it under your arm very comfortably. The packages of notes are brought down on little trucks by the elevator from upstairs and wheeled into the room where the counting is done. They are brought by the assistant cashier in person, and the committee in charge of the reckoning receipts for every bundle. Each parcel is opened in its turn and the contents handed over to one of the skilled young women, who is responsible for it, and signs a guarantee of its correctness before it leaves her hands. She runs over the crisp, unused bills with fingers marvelously rapid, taking note not only as to whether there are four thousand of them inclosed, but also regarding the numbers on the notes themselves, which must run in regular order. If there is a number wrong, her practiced eye detects it swiftly, or, if a bill is defective in its printing, she removes it, and it is sent back to the Bureau of Engraving and Printing, to be replaced with another.

When the bundle has thus been found correct, the notes are put under a hand press for a moment to reduce them to the least possible bulk, a new wrapper of brown paper is put around them, and a seal with red wax completes the operation, at the conclusion of which a memorandum is made of the sum the package contains, and it is ready to be sent back to the vaults with its fellows. At the close of the last count that was made of the money in the treasury the cash was found $19 short, but the amount was subsequently swept out of the corners of one of the vaults in the shape of some stray silver coins. It is said that no deficiency of this sort has ever occurred save once, when the specie turned over to a new treasurer proved to be just three cents short, and the outgoing official was obliged to make up the amount out of his own pocket.

If it should ever happen that an unexpected hole in the assets was made by an embezzlement or otherwise, the treasurer would be responsible, but Congress would undoubtedly make it up for him by a special appropriation. It is hardly likely that such a thing can occur, however, inasmuch as things at the treasury are so arranged that not even the treasurer himself can possibly steal a dollar, nor yet the secretary of the treasury, nor the register, nor the cashier, nor any one else, unless a conspiracy were organized. Furthermore, if anybody succeeded in breaking in from the outside, he could not very well get away with more than two hundred pounds of gold, which only represents about $50,000. A million dollars' worth of that metal weighs one ton. This would be discouraging.

Not long ago there were certain treasures of considerable value in the treasury, in the shape of articles made of gold and silver and precious stones, which had to be looked over and receipted for, as well as the money. Most of these things were presents which had been made to the various Presidents of the United States and to other officers of the government by foreign powers and potentates, and which they could not accept on account of the existing law forbidding reception of such favors. Among them was a bottle of attar of roses, given to President Grant by the imaum of Muscat, which held a pint of this valuable fluid, also a bottle of pearls, another bottle of diamonds, a gold sword scabbard, a diamond snuff box, ten beautiful sabers from Ali Pacha, bey of Egypt, and lots of other such trifles.

In old times the Patent Office was a sort of museum of curiosities, and these gifts and other valuables were deposited there. A large part of them were stolen twice, and on the occasion of the second robbery the thieves got away with pretty nearly all of them that were worth taking. They secured the bottle of pearls and the bottle of diamonds, as well as the diamond snuff box, the scabbard of the gold sword and a number of medals. Not even the pint bottle of attar of roses did they leave behind. This disaster occurred on the night of November 9, 1848, and on the following day a reward of $1,500 was offered for the capture of the goods and the burglars. The latter were traced to New York, where the treasures were recovered, although the precious articles of gold and silver had been melted down, after removing the gems with which they were set, for pawning separately. Later on it was thought desirable to hand over the whole business to the care of the treasury, which was done in 1883. The collection remained in its hands for some years, until a while ago it was turned over to the National Museum. There were some curiosities among these valuables which are rather difficult to account for—for example, two Rio de la Plata dollars, a shotgun with gold mountings, seven gold coins from ancient Rome, a pair of pistols, and a pearl necklace. There were ever so many medals of all sorts, in gold and silver. One box there was full of diamonds and pearls, which had been presented by the emperor of Japan to President Monroe. The gems were not of the very finest kind, being intended for the decoration of sword hilts and purposes of that sort, but nevertheless they were worth a good deal of money.

For years that box of jewels gave great annoyance to the officials at the treasury. Every time there was a count of the assets of that institution, President Monroe's casket would turn up, and eager Washington correspondents, with noses preternaturally alert for news, would send out all over the country reports of the discovery in an odd corner of an unswept vault of a box full of precious stones belonging to the family of Mr. Monroe. Whereupon, editorials would appear in papers opposed to the administration, condemning this neglect and demanding that the treasure be turned over to the indigent descendants of the author of the famous doctrine. Between whiles charges would be printed to the effect that the pearls and diamonds in question, having been unheard of for some time, had presumably been distributed among the heelers of the wicked party in power.

Congress never passed an act permitting Mr. Monroe to accept the gift in question, and so it was transferred to the National Museum, together with the rest. There were other valuables also given into the hands of the treasury which were captured and confiscated during the war. Among them were 240 watches, eighty-five chains, eleven rings, six lockets, one bracelet and one pair of compasses. Most of these were secured at one haul from the person of a Southern banker, with whom they had been deposited for safe keeping. He fled with them on his person, and was so unfortunate as to be caught. For a long time there were large stories current of the wealth in the possession of the government got during the rebellion.

It was told how the ladies of Richmond, inspired by noble and patriotic motives, turned their jewels, watches and money into the Confederate treasury, piling up a vast amount of value there, and how the "swag," as vulgar burglars phrase it, was gobbled by the Union forces. But the fact was that the latter found no treasures of any sort to gobble in Richmond, and the heaps of riches in cash and collateral referred to were all imaginary.

Antiquity of the Electric Light.

Those who suppose the electric light to be a production of the present decade will be able to correct their apprehension of the subject after reading the following item:

[From the SCIENTIFIC AMERICAN, December 9, 1848.]

"NEW ELECTRICAL LIGHT.

"The inventors of a new electrical light, exhibited at the Western Literary Institution, Leicester Square, London, on its recent reopening under the new auspices, expect, it is said, to apply it generally to shop and street illumination, and they state that while the conveying will cost no more than gas, the expense of illumination will be one-twelfth the price of the latter light. The current of electricity in passing through the two pieces of charcoal which form the poles of the circuit, and are excluded from all access of air, gives, in this case, it is said, an intense and beautiful white light, with the effect of daylight to a much greater extent than the lime does, and having this advantage, that it is sustained and continuous. If Messrs. Staite & Petrie can thus produce a steady and sustained light they have accomplished what has hitherto been the sole preventive to the substitution of galvanism for gas. The *Mechanics' Magazine* states that this one light completely eclipsed ten gas lights and an oxyhydrogen. The gas companies had better look out. The dissatisfaction of the public with their mismanagement may have begotten a rival destined to eclipse many more than merely ten of their gas lights."

Dr. John I. Northrop.

By the explosion of alcohol in the storeroom of the Columbia College School of Mines, on the afternoon of June 25, Dr. John I. Northrop was burned from head to foot, his death following at the Presbyterian Hospital on the following morning. Dr. Northrop, who was an instructor in the college, had gone to the storeroom to fill a demijohn for use in his zoological laboratory. The room is a small, close, unventilated apartment, in which there was one barrel full and another partly full of alcohol, and it is said that the doctor struck a match in the room, causing the explosion which cost him his life.

Dr. Northrop was born in New York City, October 12, 1861, and was graduated from the School of Mines in 1884. He had recently received a year's leave of absence from his duties as an instructor in zoology, and was to start for Europe in a few days to study in the German universities.

* *American Analyst.*

Immense Pecuniary Losses Occasioned by Insects.

A recent number of *Insect Life* says:

No very recent estimates of the loss arising from insect ravages have been made, but some of the older estimates are here given. Twenty-five years ago B. D. Walsh, the entomologist of Illinois, estimated the loss from this source at from $200,000,000 to $300,000,000 per annum. The great increase in acreage of crops and orchards since that date has been attended, of course, with a corresponding increase in destructiveness; but methods of prevention and remedies have so multiplied and improved that the ratio of loss has greatly decreased. Fitch, then New York State entomologist, estimated the damage to the wheat crop of that State in the year 1854 by the wheat midge at $15,000,000. The loss to wheat and corn on account of the ravages of the chinch bug in the State of Illinois alone in 1867 was estimated at $73,000,000. The loss occasioned in 1874 to corn, vegetables, and other crops by the Rocky Mountain locust in the States of Kansas, Nebraska, Iowa, and Missouri was estimated by Riley, from carefully collected data, at $100,000,000, to say nothing of the indirect loss by stoppage of business and other enterprises, which would probably increase the total loss to the neighborhood of about $200,000,000. The ravages in the principal cotton States of the cotton worm have amounted to a loss of about $30,000,000 in years of great abundance, while for many years the average annual loss was not less than 15 millions. A more recent estimate than those given may be mentioned.

The damage occasioned by the chinch bug in the year 1887 was estimated in the annual report of the Agricultural Department for that year at not less than $60,000,000. Dr. Riley has in fact repeatedly published the general estimate that the average annual loss to the United States from injurious insects exceeds $300,000,000.

The investigations of the United States Entomological Commission and of the Division of Entomology, Department of Agriculture, and also of State Experiment Station entomologists and private workers, have led to the discovery of remedies and preventives which, properly and thoroughly applied, result in saving a large percentage of the loss occasioned by insects, and the statement that these investigations have paid for themselves many thousandfold is indubitably true.

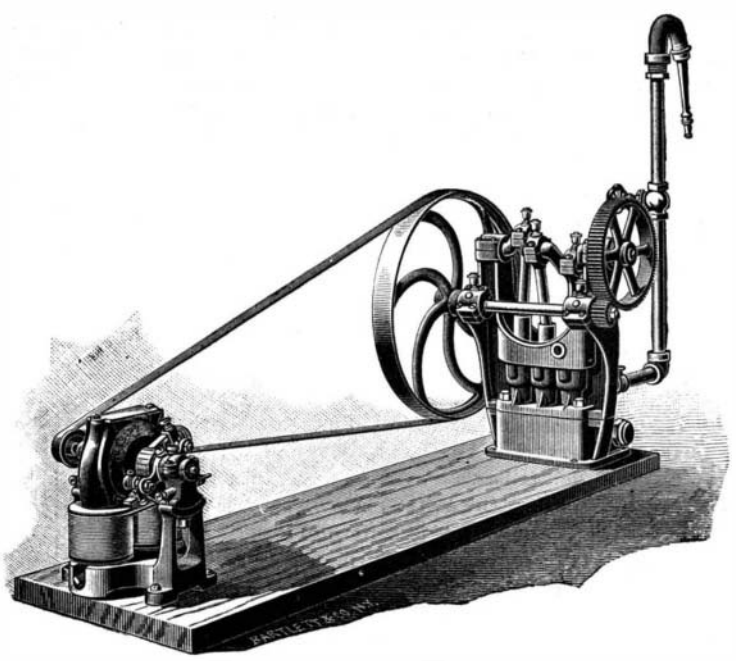
We may add that if the general government and the State goverments were to spend fifty times more money than is now granted for investigations respecting the habits of insects and the modes of destroying those that are noxious, it would, doubtless, be of great advantage to the country.

ELECTRICAL PUMP.

Naturally, along with the general adoption of electric lighting, there comes the use of a current for motive power for all kinds of industries, and for use outside of what are properly called industries in which manual power is displaced by electric motors. Prominent among these is the pumping of water in dwellings and other buildings in cities and villages where this work has usually been performed by hand. Electricity lends itself to this use in a peculiarly efficient manner, as it is perfectly automatic in its action, setting about its work when the tank becomes empty and stopping as soon as it is filled.

The motor shown in the annexed engraving is the smallest made for the purpose of pumping, by the Thomson-Houston Motor Company, of 620 Atlantic Avenue, Boston, Mass. It is a ⅛ h. p. electric motor, connected by a belt with a 1¼ × 2 inch Gould triplex pump. Connected with this outfit is an automatic slow-acting switch, for stopping the motor as the water in the tank reaches its full height, and starting it again just before the tank is emptied. This pumping outfit has a capacity of 100 gallons an hour raised to a height of 30 feet. The next size, a ¼ h. p., with a 1¾ × 2½ inch Gould triplex pump, has a capacity of 250 gallons an hour raised to the same height. The number of gallons delivered varies inversely as the height to which the water is raised.

This company furnishes pumping outfits of any desired capacity and for any pressure. In the larger sizes, beginning with the 4 × 4 pump run by a 1½ power Thomson-Houston motor, the pump and motor are placed upon the same base and connected directly by gearing.

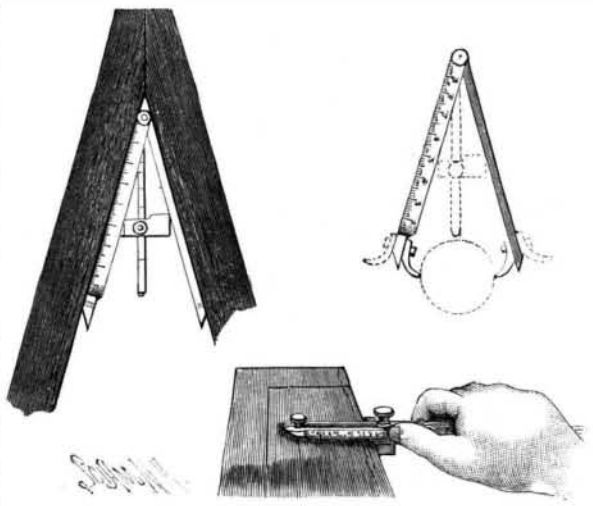


THOMSON-HOUSTON ELECTRIC PUMP.

ACCORDING to the authors, rape oil consists of the glycerides of three distinct fatty acids, one of which, melting at 75°, occurs only in very small quantities. The other two, erucic acid and a liquid acid which the authors name rapinic acid, are present in equal quantities. Lead erucate is readily soluble in hot ether. The zinc salts of the fatty acids can be separated by means of ether.—*Reimer and Will, Deutsch. Chem. Gesell.*

A MEASURING AND DRAWING IMPLEMENT.

The illustration represents an implement which can be readily manipulated to measure inside or outside angles and obtain their miters, or used for calipering, or as a depth and end marking gauge, dividers, compasses, etc. One view shows the implement as applied to take an inside angle and its miter, while in another it is arranged as a pair of calipers, the third view showing its application as a marking gauge. Three arms are jointed at a common pivot, the middle arm carrying an adjustable block adapted to engage the other two arms. The pivot has in its center an annular flange separating the middle arm from one of the



JAMES' MEASURING AND DRAWING TOOL.

side arms, the other arm being forked, and the outer ends of the forks hung on the pivot, which is threaded near its ends and engaged by nuts, by the adjusting of which the jointed ends of the arms are pressed upon to lock the arms in position. On the middle arm is fitted to slide a block, held in place by a set screw, the block indicating on a graduation representing degrees and subdivisions of angles measured by the outer edges of the other arms. The side arms have points at their lower ends, so that by removing the block from the middle arm and folding the latter into the forked arm the device can be used as a pair of dividers, in one leg of which a pencil may be fastened when it is to be used as a compass. In the outer ends of the main arms, also, at or near the points, are threaded apertures in which may be fastened curved finger pieces, fitting the device for use for inside or outside calipers. In adapting the device for a marking gauge, the forked arm only is used in connection with the block and set screw, a pointed screw then screwing in the threaded aperture near the end of the arm.

This improvement has been patented by Mr. Charles W. James, of No. 4140 Parrish Street, West Philadelphia, Pa.

Progress in Military Ballooning.

There can be no doubt that balloons are destined to play an important part in the great European war which every one assigns to a more or less indefinite future. As a means of observing the movements of the enemy, and at times of enabling messengers or others to escape, they must have high value. The question is receiving at least as much attention on the Continent as in this country, and it is claimed that important advances have been made in the portability and simplicity of balloon equipments. There are large works near the Champ de Mars, Paris, which are entirely occupied in the construction of balloons and aerostatic machinery and material. Plants have been supplied to almost every foreign government, and complete schools of military aerostation have been fitted up in Italy, and more recently in Russia. The system employed in this balloon may be called the portable captive, and its adaptability to the conditions of actual warfare has recently been tested by the Italians in their campaign around Massowah. The total weight of all the plant necessary for the transport and inflation of the latest type of portable captive balloon does not exceed six or seven tons, so that it can easily be forwarded over long distances by rail. It is carried upon three wagons of special construction adapted to rapid conveyance over rough ground.

The entire equipment, besides the balloon itself, consists of an apparatus for the generation of the gas and a winding drum for the cable by which the balloon is secured. The generator produces hydrogen gas by the decomposition of water, and is of rapid and continuous action, supplying from 8,750 to 10,500 cubic feet of gas per hour. It can be set to work anywhere where there is a supply of water, such as is afforded by the proximity of a river or pond. The winding drum is worked by steam, and it unrolls not only the cable, which is over a quarter of a mile long, but also a telephonic wire, through which constant communication can be maintained with the occupants of the car. The capacity of the balloon varies from 17,500 to 21,000 cubic feet, and by an automatic arrangement the car is always maintained in a perfectly vertical line, notwithstanding the inclination of the cable. The makers of these equipments have at present under construction the largest balloon that has ever been constructed. The enormous captive balloon which made continuous ascents at the Paris Exhibition two years ago was of 105,000 cubic feet capacity, and carried twelve persons. The one now being made will be over 2,000,000 cubic feet, will be able to accommodate no fewer than 180 passengers, will have a car 35 feet in diameter, and will be held by a cable nearly 1,200 yards long.

But the most extraordinary product of the works referred to is a mysterious invention known as an "aerial torpedo boat," which has been ordered by the Russian government. All that is known about it is that it is an elongated balloon, 170 feet long, furnished with a steam engine of 50 horse power, and impelled at a speed of 25 miles an hour by a screw 36 feet in diameter. This is evidently the latest development of the familiar "flying machine" notion. The trials are to be conducted in secret at St. Petersburg. It is to be hoped that the Russian government will not have reason to regret its expenditure; but it is of ominous augury that nothing further has been heard of the trials that the French government commenced last year at Havre with another vessel of a similar design.—*The Engineer.*

The Pike's Peak Railroad.

Our Colorado correspondent writes from Manitou, Col., at the foot of Pike's Peak, June 28, 1891, that the date of the opening of the new road to passenger transportation to the summit of Pike's Peak, heretofore so frequently and erroneously stated, seems at last truly at hand.

A small army of Italians are to-day shoveling snow at or near the top, at an elevation of over fourteen thousand feet above sea level, and a large force of mechanics are at work adjusting the track, hurriedly laid last summer and somewhat disarranged by last winter's frosts.

The rack rails were found quite uneven, failing to accurately fit the cogs on the engines, causing unnecessary friction, necessitating an excessive consumption of steam and fuel, and making travel rough, noisy, unpleasant and expensive.

All the old cog wheels on the engines have been removed and new and heavier ones substituted, made of a tough and elastic steel, that will spring about sixteen per cent without breaking, obviating all danger should a tooth accidentally fail.

These cogs have now been gauged to within a sixtieth of an inch for the correct distance, so that a ton of coal, formerly consumed in a distance of three miles, now lasts the entire trip.

Cement for Parchment Paper.

The best cement for pasting parchment paper, according to a lithographic authority, is casein glue. It is much better than so-called chrome glue, because the latter produces yellow or brownish spots where it has been employed. Casein glue is a solution of casein, which appears as whey or drop when milk is allowed to curdle. The glue is dissolved in a saturated solution of borax. When dried in the form of transparent gelatin it appears as grayish white and somewhat brittle matter, which can be easily dissolved in water, and possesses great adhesiveness. When employed for pasting parchment paper a thin paste is prepared, used in the customary manner, and the jointed places afterward exposed for a little while to a jet of steam.

THE largest bay in the world is Hudson Bay, measuring 850 miles north and south by 600 miles wide.