SCIENTIFIC AMERICAN

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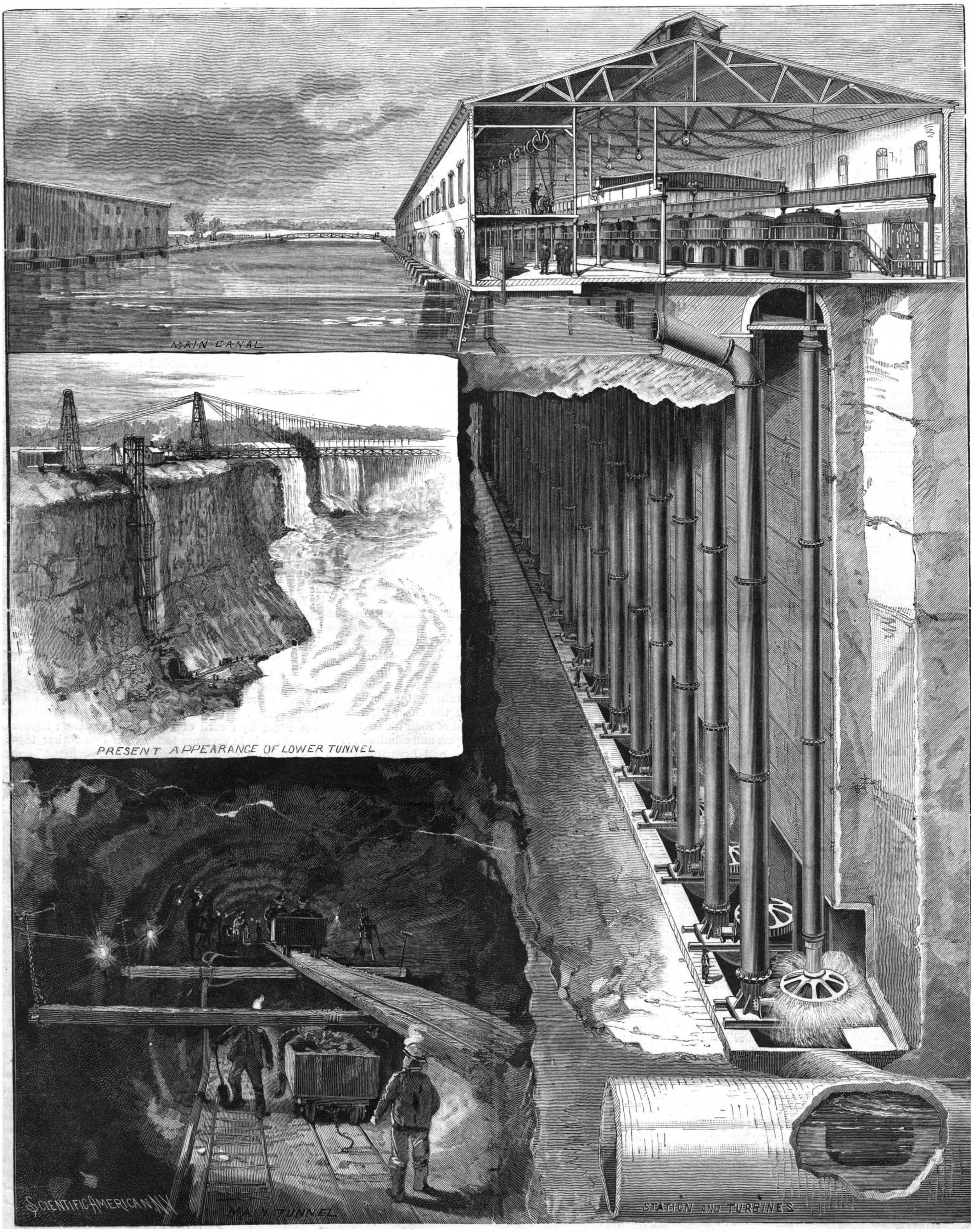

UTILIZING THE WATER POWER OF NIAGARA FALLS.—[See page 149.]

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NEW YORK, SATURDAY, MARCH 5, 1892.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 844.

For the Week Ending March 5, 1892.

Price 10 cents. For sale by all newsdealers.

AN ELECTRICAL LIFE SAVER WANTED.

The Sims-Edison electrical torpedo, designed for the destruction of life, has proved highly successful. This novel contrivance consists of a small tubular boat or float containing an electric machine, operated by a dynamo, which is located on shore or on shipboard, through the medium of a connecting wire, which is unreeled as fast as the boat advances. By touching proper switches the boat is made to run with great swiftness through the water, and is steered with the utmost precision. The distance which the boat may be thus sent out and its movement controlled from the shore or from the deck of a vessel at sea is from one to two miles.

The front end of the boat carries a torpedo powerful enough to sink the largest ship of war, and it is believed, in a naval combat, this device may be worked with most disastrous results to the vessel against which it is directed.

Hitherto the efforts of constructors seem to have been chiefly directed toward the perfection of the device for purposes of war. But it seems as if the time had now come when a portion of ingenuity might be turned with advantage in humanitarian directions; and here, perhaps, the richest rewards of inventors hereafter will be found.

It surely is feasible to provide small electric boats on the electric torpedo plan, that may be carried on ships or used on shore in sending assistance to vessels and mariners in distress. The electrical boat can be launched and propelled with impunity for long distances in the roughest seas, in which the ordinary lifeboat could not live for a moment. There is no reason why an electrical lifeboat might not be made one of the most useful and valuable appliances of all life-saving stations on our coasts and on well-appointed ships or steam vessels.

We hope some of our ingenious readers will carefully study this subject and find out the best means for accomplishing the purposes we have indicated. At the present time the only means of sending out relief lines from the shore to the wrecked vessels, if the sea is rough, is the line-throwing gun, which cannot operate usefully beyond a distance of about 1,800 feet.

A full account of the apparatus at present employed at our life-saving stations will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 840.

REFORM OF THE IMMIGRATION LAWS.

In former years it was an expensive and difficult matter for emigrants in Europe to reach the shores of the new world, and it was chiefly those of pluck and health who were able to do so. They made good citizens, and almost immediately assimilated with the general population. In those days the finest of agricultural lands were open to settlers, for homesteads, free of cost.

But great changes have taken place within the past decade. Steamers have greatly increased, passage charges have been reduced, and the facilities for transport of passengers from the remotest corners of the earth to this country have been greatly multiplied. The governments of England, France, Germany, Russia, Norway, Sweden, Italy, Turkey, to say nothing of China, have found out that the cheapest, easiest and most effective way to get rid of their diseased people, their lunatics, cripples, paupers and criminals, is to ship them to the United States, and here they come and keep coming in large numbers. Russia has expelled her poor Jews, and they are now pouring into this country. The irregular or so-called tramp steamers bring great numbers, and these boats come stuffed full with the lowest classes of immigrants.

The new arrivals embrace, it is true, many good and substantial individuals whose coming may be welcomed. But still there are thousands of the unworthy, the only result of whose presence is to spread crime and disease, and fill our prisons, hospitals and poor houses.

It is far more difficult now than formerly to dispose of immigrants. There are no longer any free homesteads to be given away. The best agricultural lands are occupied. The immigrants, now, in general, of lower grade than heretofore, crowd together into special settlements of their own, establishing as it were separate communities where their own language and often degrading customs wholly prevail, where English is not allowed to be spoken and Americans not permitted to live. These communities are as distinct and separate as is Chinatown in the heart of San Francisco. All these are dangerous nests of foreign influence which bode no good to our existing laws and institutions.

It is time that new and more closely discriminating statutes were adopted in respect to immigration, and we are glad that a movement in this direction is on foot in Congress.

The proposed new law contains, among others, the following features:

1. No paupers, diseased persons or criminals are to be received.

2. Owners of steamers must deposit with the government the sum of fifty thousand dollars as security against the landing of such persons and in payment of costs for care and return if landed.

3. If any person landed proves, within two years, to be a pauper, diseased or criminal, he is to be taken back at the cost of the steamer.

4. Special stations for the examination of intending immigrants are to be established in foreign countries, to be conducted by American officers.

5. More stringent regulations are to be adopted in the examination of arriving immigrants.

6. Steamers must pay a head tax of one dollar on each immigrant they land. The present tax is fifty cents. The increased amount is to be used to cover the additional expenses which the new law will involve.

Improvement of the Potomac.

According to the report of Col. P. C. Hains, the Potomac River is 113 miles in length from its mouth to Georgetown, D. C., the present head of navigation for sailing vessels. The width of the river varies from 1,000 feet at Georgetown to 7 miles at the mouth.

The standard of navigation on which the survey was based was 24 feet at low tide, this depth being regarded as sufficient for the prospective needs of commerce. Any greater depth can only be had at enormous cost.

The entire cost of the improvement of the Potomac River for 24 foot navigation, 200 feet wide, from the mouth up to the city of Washington, would be as follows:

1. Kettle Bottom Shoals	$1,320
2. Maryland Point Shoal	30,195
3. Smith's Point Shoals	33,000
4. Mattawoman Shoals	93,885
5. At the city of Washington	141,504
	$299,904

The cost of a channel 400 feet wide and 24 feet deep would be about double the above.

It is believed that, if the river were improved to a depth of 24 feet, an impetus would be given to the trade of Georgetown. The reconstruction of the Chesapeake and Ohio canal has recently been completed, and if facilities were afforded for deeper draught vessels, large quantities of coal and produce from the interior would undoubtedly be shipped from this port.

Besides the commercial interests involved, the government itself has strong reasons for improving the Potomac River, in order that its vessels of war may reach the navy yard at Washington, where the new naval gun factory is situated. It is understood that at the present time the guns for our cruisers, manufactured at this yard, have to be shipped to other ports, as most of the vessels cannot come here for want of sufficient depth of water. It would therefore be a great advantage to the government if the obstructions referred to were removed.

Tivoli Falls Used for the Electric Lighting of Rome.

In a recent lecture on "The Induction Coil," at the Royal Institution, by Prof. Fleming, the employment of transformers for raising or lowering the pressure of alternating currents was illustrated by experiments in which a current of electricity, sent from the Deptford station of the London Electric Supply Corporation, and supplied to the lecture table at a pressure of 100 volts, was raised to 2,000 volts by means of a Mordey transformer. At this high pressure it was sent across the room by means of two very thin wires; then reduced again in pressure to 100 volts by another transformer, and used to illuminate a large incandescent lamp. The lecturer pointed out that a great economy was effected in the cost of transmission of the energy by thus sending the current at high pressures, and concluded with a brief description of the alternating current transformer station at Rome, which supplied, he said, 20,000 lamps by means of transformers.

Preparations were being made to utilize a part of the energy of the Falls of the Anio at Tivoli for this purpose. A turbine plant of 2,000 horse power had been put down, which would drive dynamos generating electric currents at 5,000 volts pressure. The current was then to be transmitted across the Campagna for sixteen miles, and reduced in pressure by transformers in Rome for use in the public and private buildings. Energy would thus be conveyed from the Tivoli Falls sufficient for 40,000 lights in Rome. It was expected that this plant would be in operation in the summer of this year. The lecturer pointed out finally the enormous extension of electric lighting, which was due to the employment of induction coils or transformers.

THE splendid steamer Majestic reached New York from Liverpool on the 24th ult., her average speed being 20·41 knots per hour for the voyage, or about 23½ miles per hour. What the navy of the United States needs is a fleet of twenty-five cruisers like the Majestic, which in time of peace should be employed in active service, such as transport of the mails, thus keeping them always in effective condition. At present we only have three or four vessels which, when they were light and strained to their utmost, on their trial trips of four hours, were able to reach 20 knots, but have never done as well since, and could not carry coal enough to maintain a continuous high velocity throughout an Atlantic voyage.

Occupation for Old People.

A few remarks to answer correspondent, page 117, Feb. 20, 1892, may not be amiss.

To prescribe one cure for all cases of *ennui*, even to retired mechanics alone, would be a futile task; but as human nature is nearly all the same, under like conditions of living, climate and surroundings, some general, fundamental points deserve consideration.

Where occupation dependent on remuneration is desired, the choice of such occupation is more limited; but where the object in view is simply to avoid *ennui*, the choice invariably must be the one for which inclination, interest and even love exists.

There are but few people in existence that are not possessed of a "hobby," and in such cases that hobby, provided it is compatible with the individual capacities, bodily and mental, should be selected and vigorously carried on until the "one-horse shay" collapses in the midst of its last usefulness in the roadway. It is far better to wear out than to rust out, and as a stubborn rule, rust consumes material faster than wear.

It is supposed that any retired mechanic, not dependent on continued gain, has a home of his own, and with this some family, or at least some human being dear to him, who can enjoy his joys with him and share his sorrows with him; for "joy shared is joy doubled, and sorrow shared is sorrow halved." For such it is no hard task to find useful, pleasant and healthy employment.

Let them look around in their own premises, and they will be astonished to find ever so many opportunities for employment. None is healthier, more pleasant and useful than the garden. Where large pumpkins and cabbages are of no consideration, a choice bouquet of carnations, mignonette, roses, or even heliotrope, will gladden the heart of the donor and the receiver. Where no ground permits garden culture, the ingenuity of the lover of flowers easily finds the sunny window, porch, balcony or roof, where, with willing hands, a little paradise may soon flourish. It takes work and tools to overcome difficulties, but the latter will be the best investment that the retired worker can make, as they often suggest many operations that, without them, would never be thought of.

In case no love for plants exists, where the attraction of a fine lawn, a shady arbor, or the charms of flowers in and out of the house fall on barren ground, the comfort of a more commodious house, with its numberless possibilities, the repairs of doors, sills, steps and stairs, repainting, repapering, revarnishing, changes in ventilation, light and heating apparatus, gas and water pipes, and the endless introduction of modern improvements, may offer some inducements to the man of leisure to try his own skill in this direction. The trouble with most people is the lack of tools.

No investment that I ever made (and my case is not different from that of many others) has paid me better returns than my stock of tools, and my investment is quite costly. I recommend the purchase of such tools that you cannot make yourself, and I predict that you will use them with profit to yourself.

Should your inclinations not run in this direction, it may be that music drawing, and painting strike your fancies. Be sure to take these up, but do not forget to let your body have exercise and fresh air, and keep up an even balance—"*Mens sana in corpore sano*" should be the motto of everybody, but the older the man becomes, the more careful he should be to guard himself against excesses.

Boating, rowing, fishing, hunting, may be the hobby of others, while the ten-pin alley and the billiard room find other advocates. While not specially recommending these, as they satisfy exclusively the selfish notions of the individual, I by no means would forbid them; in fact, any recreation agreeable to the person enjoying it, provided no unhealthy sequences are in sight, should be eagerly improved.

Cycling may be forbidden fruit to many, but walks, long walks through fields and forests, are possible; a closer acquaintance with things around us—the worm that creeps at our feet, the bird that attracts our ear or eye, the beautiful butterfly that is wafted by the balmy breeze from the near clover field, the impertinent beetle that flies into our face, or the shy lizzard that hides under the rail fence, any one, any number of these creatures may interest the truly wise man and may form, as well as plants, objects of collections and the creation of a new and truly interesting hobby.

Where true benevolence toward the rest of mankind, including the "benevolens," is one of the virtues of the retired seeker of employment, a vast field of operations is open for him, and without his joining the Salvation Army or the temperance fanatics, let him constitute himself a committee of one, look up, judge, decree and execute his cases and their remedies. This will exercise body, mind and heart, allow him to rest well at night and be less afraid of robbers, as his pocket book will keep pace with his light heart.

To those of selfish natures, but still possessing pride and self-esteem, who find themselves for the first time enabled to look into themselves, and find their knowledge of common things even lacking—they had to work too hard to get where they are—I tell study, study, study! It is no shame to be ignorant, but to neglect a chance to learn, is shameful.

Humboldt said: It is never too late to learn.

Through our knowledge we have risen above the brute. By our ignorance we approach it again.

To the second class of retired workers, whose object is to secure a money remuneration, aside of pleasant and healthful employment of their time, I say select such that combines both, but bear in mind that your reduced vitality and bodily powers require special considerations and that well regulated activity means prolongation of an enjoyable life.

Toledo, O. E. W. E. KOCH.

Convention of the National Electric Light Association.

The fifteenth convention of the National Electric Light Association closed on the 26th ult., having been in session, at Buffalo, four days. Mayor Bishop, of Buffalo, made the opening address, being followed by President Huntley, of the association.

The committee on underground conduits and conductors made an exhaustive report, summing up with the following:

The expense of conduits and underground cables is so heavy that they can only be adopted in a few of the larger cities, thickly settled, and then the electric lighting companies adopting them must be paid a higher price for service, or eventually their company will be bankrupted by the expense and loss entailed. Therefore the taxpayers in any city who demand that wires shall be placed underground need to realize the fact that this move means increased cost for lights and larger taxes to pay for same. From data obtained it is evident that nearly all the cities could be served with aerial lines for high tension current in a more acceptable manner and at less expense than with underground conduits, and they could be so arranged as to be perfectly secured and not in any way endanger the public or mar the general appearance of the streets.

The Committee on Safe Wire, by M. D. Law, chairman, then reported the following proposed amendments to the rules on that subject: Inside conductors must not be laid in plaster, cement, or similar finish, without an exterior metallic protection. In rooms where inflammable gases exist, the incandescent lamp and socket must be inclosed in a vapor-tight globe. This is not understood to include rooms where illuminating gases are used in the ordinary manner. The words "water proof" change to "moisture proof," so that the article will read: Provided with a durable moisture proof covering. Interior conduits must not be of such material or construction that will be injured by plaster or cement or other surrounding material, or that the insulation of the conductor will be ultimately injured or destroyed by the elements of its position. The amendments were adopted.

Mr. Lane, of Cleveland, O., spoke on the subject of Lubricating Oils. He said that after extended experiments it had been found that a light oil, light in gravity and low in viscosity, was the oil that would give the best satisfaction in the lubrication of both high speed and heavy machinery. In the case of machinery running at very high speed, an increase of oil will increase the temperature; and unless you use oil enough to absorb the heat, so that the oil will run away, taking the heat with it, you cannot reduce the heat by a large amount of oil; that is, if you use more than is really necessary for lubrication, but fall below the point necessary to carry the heat off with the oil. The oil recommended by Mr. Lane was an oil of about 32 gravity and 140 viscosity. He instanced the Calumet and Hecla mines, where lard oil was used up to two years ago, but they now use a mineral oil. Objection was sometimes raised to oils because they produced a gummy substance; but this is usually a scale-making material, which comes from the walls of the cylinder. As a rule, any oil that will produce a gummy substance is a good oil.

E. F. Peck read a paper upon Overhead Construction; D. Ashworth one upon The Allied Powers (steam and electricity); C. A. Schieren one with the title: From the Tannery to the Dynamo. He said that leather being by nature an absorber of moisture, belts must be guarded against exposure to oil. In electric light and power plants much mineral oil is used, and the great velocity at which the belts are run seems almost imperceptibly to suck or draw the oil from the journals of the engines and dynamos, and allow it to be absorbed by the belts, which get completely saturated with oil, and in a short time rot and destroy the fiber of the leather. Various methods have been used to overcome this difficulty. One of the most successful is a certain composition or belt dressing, which is rubbed over the surface of the belt, and closes the pores of the leather. No foreign substance can penetrate a belt treated with this compound, and the belts last much longer and give better service. With perforated belts this compound does not seem to be so effectual, because the perforations naturally expose the inner part or the heart of the leather, which is very porous; however, the surface of the belt being covered, it shields that part of the leather which comes in contact with the pulleys, and the current of air passing through the perforations protects the belt to a certain extent, and that class of belt runs smoother, with less friction, and is more reliable.

Underground Construction of the Buffalo Railway Co. was the subject of a paper by J. B. Craven. E. A. Leslie read one upon The Operation of High Tension Currents Underground, from a physical and financial standpoint.

How to Fire a Boiler was the subject treated by R. Hammond. He said among other things:

In my experience for steam plant boilers carrying 80 to 160 pounds of steam, I find that at least 20 pounds of bituminous coal should be burned per square foot of grate per hour, and the air spaces of the grates should not be less than 50 per cent of the grate area; if the grate surface is so large that only 10 pounds of coal is consumed, it would be more economical to reduce the grate surface and burn not less than 20 pounds with good draught, thus securing a good combustion. The same weight of coal burned on a large grate would not be as economical, on account of the low temperature; the temperature of the furnaces should not be less than 3,500 degrees, and the ratio of the draught area through the tubes or flues should not be less than one-sixth nor more than one-fourth of the grate surface, and the proportion of the grate surface should be at least as 35 to 1.

The steam users should see to it that all parts of their boilers and settings should be of equally as good proportions for strength and economy as their engines; employ good, intelligent firemen as well as engineers, and see that both produce good indicator cards.

H. W. Leonard read a paper on The Transmission of Electric Energy by alternating currents and its utilization by continuous currents, and W. Stanley, Jr., one on Alternate Current Motors. Erastus Wiman read a paper upon Profit and Loss of Electricity.

The African Tsetse Fly.

The *tsetse* fly is gray, about the size of an ordinary horse fly, with crossed wings. Our donkeys, poor things, got many bites, and we felt grieved at their prospective deaths. We provided them with the only remedy of which we could hear, namely, a handful of salt every night; but how this is supposed to act in counteracting the bite of the fly I cannot imagine.

Ample evidence of the deadliness of this venomous insect is seen on the roadside. Dozens of wagons lie rotting in the *veldt*, bearing melancholy testimony to the failure of Messrs. Heany and Johnson's pioneer scheme. Everywhere lie the bleaching bones of the oxen which dragged the wagons; and at Mandigo's is a deserted hut filled to overflowing with the skins of these animals, awaiting the further development of the Pungwe traffic, to be converted into ropes, or *reims*, as they are usually termed in South Africa. Fully £2,000 worth of wagons, we calculated, we passed along during one day's march, lying on the *veldt*, ghost-like, as after a battle. Then there are Scotch carts of more or less value, and a handsome Cape cart, which Mr. Rhodes had to abandon on his way up to Mashonaland, and which contains in the box seat an unused bottle, calling itself "anti-fly mixture," an ironical comment on the situation; and at Sarmento itself, a Portuguese settlement on the banks of the Pungwe, two handsome coaches, made expressly in New Hampshire, America, for the occasion, lie deserted near the Portuguese huts. They are richly painted with arabesques and pictures on the panels; "Pungwe route to Mashoonaland" is written thereon in letters of gold. The comfortable cushions inside are being moth-eaten, and the approaching rains will complete the ruin of these handsome but ill-fated vehicles. Meanwhile the Portuguese stand by and laugh at the discomfiture of their British rivals in the thirst for gold. Even the signboard, with "To Mashoonaland" inscribed on it, is in its place; and all this elaborate preparation for the pioneer route has been rendered abortive by that venomous little insect, the *tsetse* fly.—*Mr. Bent, in the Fortnightly Review.*

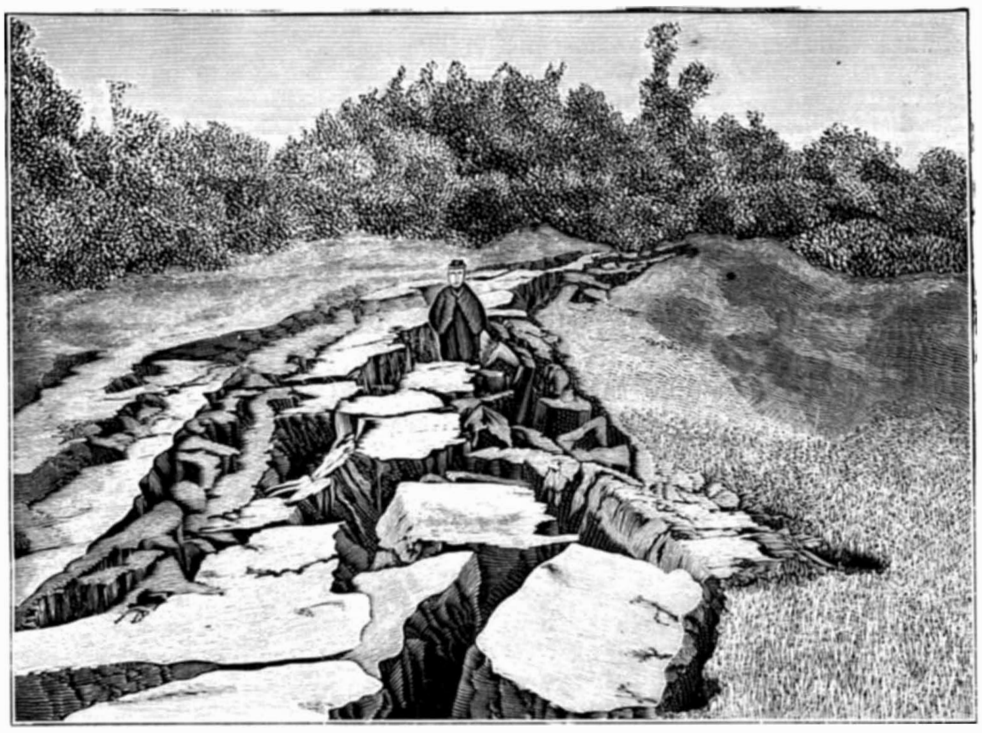
New High-Speed Cruiser for Japanese Navy.

Messrs. Armstrong & Mitchell, of Elswick-on-Tyne, have been successful in securing the contract to build for the Japanese government a cruiser of large size, which is to attain a speed of 24 knots, or 27·6 land miles, so the *Practical Engineer* says. The Piemonte, which the firm constructed for the Italian government, made 22·3 knots, while the Argentine cruiser Demayo attained 22½ knots. These boats, however, were all smaller than the new Japanese cruiser. There are torpedo boats which make speeds of about 24 knots, but no large cruiser has yet been capable of steaming this velocity, and the trial trips will no doubt be watched with considerable curiosity. This new vessel is to have engines of 15,000 horse power, or nearly as much as a 20 knot Atlantic liner with four times the displacement. The Japanese navy, at its present rate of increase, will soon become a substantial factor in naval calculations. It possesses at present two cruisers of 18 knots, one of 19 knots, and three of 16 knots, and a torpedo gun vessel of 22 knots.

THE RECENT EARTHQUAKE IN JAPAN.

The recent earthquake in Japan was one of the most disastrous ever recorded. We here give an illustration from a photograph showing the fissures produced on a section of roadway between Nagoya and Gifu. In all directions the country was broken up, buildings destroyed, railroad bridges knocked down, tracks twisted into serpentine forms, and travel everywhere stopped. As seen from a railway train the following description is given in the *Japan Mail*:

"It was accompanied by a loud rumbling and the movement was so violent that the passengers slipped from their seats and were thrown into a state of the greatest alarm, conceiving that a collision had taken place. On looking out of the windows, however, they perceived that the station was in ruins and that the water in a neighboring pond was dashing from side to side—indications which showed pretty plainly what had happened. The movement continued for some time with such severity that it was impossible to leave the carriages. Meanwhile large cracks, from two feet to three feet wide, were observed opening and closing in all directions, volcanic mud and ashes being thrown from some of them. So numerous were they that every step threatened destruction."



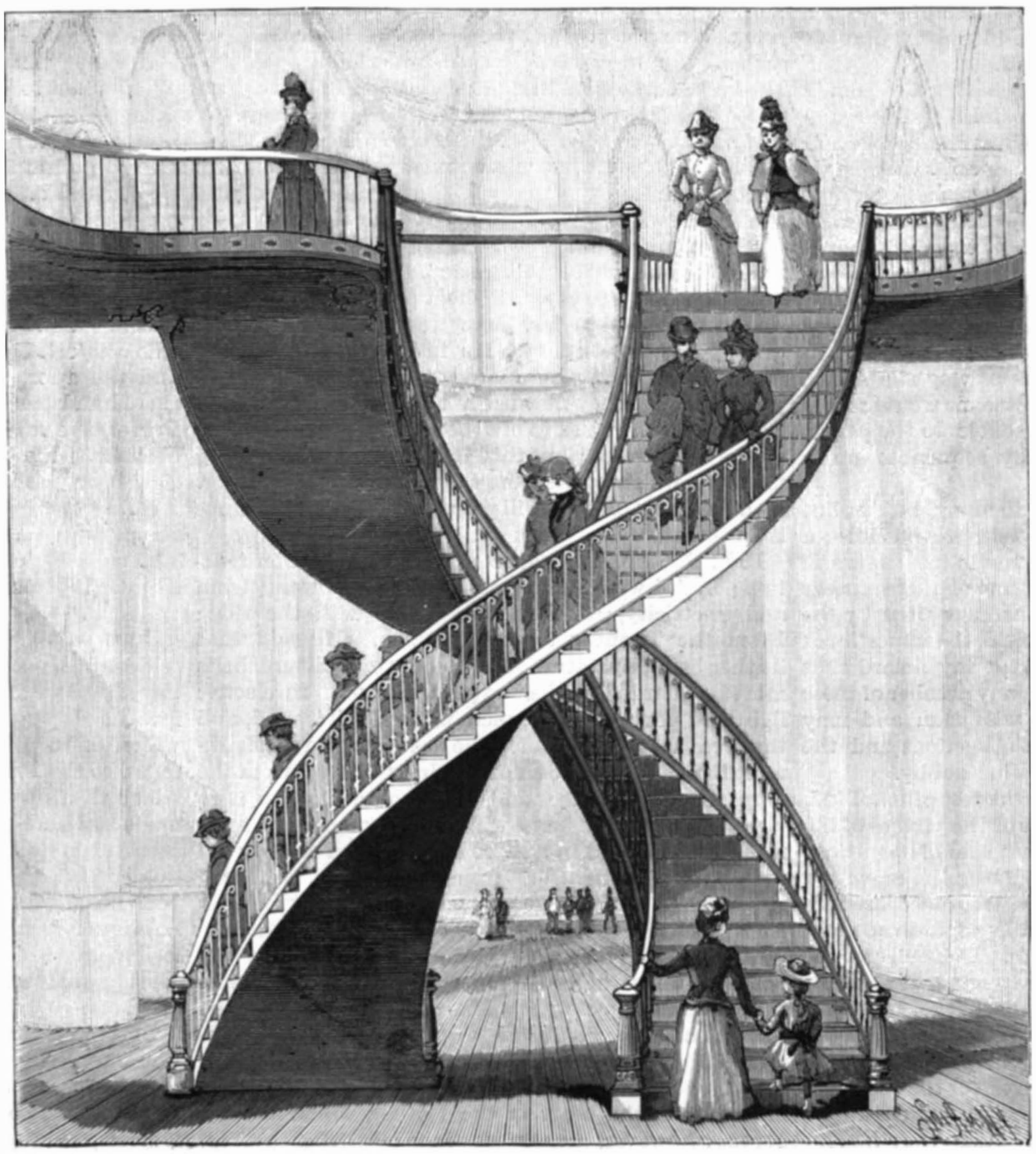
JAPAN—FISSURES PRODUCED BY EARTHQUAKE.

Bleaching Wool.

The following is a new French method of bleaching wool: First, 100 kilogrammes (220½ pounds) wool are washed cold in a solution of 20 kilogrammes (44 pounds) carbonate of soda in 2,000 liters (528⅓ gallons) water. The wool is left in this solution for 45 minutes, and then allowed to drip off. It is then dried, rinsed in clean water, and whizzed twice. In the second operation, the wool is passed for five minutes through a bath containing 200 liters (211⅓ quarts) mineral oil or petroleum ether for each 100 kilogrammes wool. The wool is then washed in clean water, left to drip, and dried in open air with an energetic circulation. The inventor claims that the wool is bleached nicely by this method, and that the oil can be used again.

A TWIN STAIRCASE.

The illustration shows a novel form of staircase adapted for use in places where space is limited, for two staircases are here provided, occupying less room than would ordinarily be required for one. With this arrangement one of the staircases can be appropriated for parties ascending and the other for those descending. This method of construction is suggested as particularly adapted for cabins of ships, picture galleries, show rooms, and temporary structures where there is likely to be a constant flow of visitors, as it can be put up at comparatively small expense. It is merely an adaptation of the properties of the spiral curve or springing arch. The ascent is steep, there being thirty-eight steps in each semicircular flight, the height being twenty-three feet. The length of the step is four feet, and that of the outer string board thirty-seven feet. The rails are continuous ones, so that a person ascending and placing either hand on the rail may continue with the same on the rail during the ascent, all the way across the circular corridor which forms the upper landing, and down by the opposite flight.



A DOUBLE OR TWIN STAIRCASE.

THE electric light is used to a large and most satisfactory extent on the steamers that ply on the Nile. Mr. G. A. McKinlock went up to the second cataract on one of these steamers which was lighted by electricity, and had a powerful search light that was used with weird and beautiful effects at night, being thrown upon the banks and revealing the magnificent temples and other sights.

The Traveling Salesman Estimated by Himself.

Many estimates and specifications have been formed to apply to the traveling lumber and sash and door salesman, but H. H. Collins, of St. Paul, Minn., drew a rather lifelike picture of "him," at the traveling salesmen's banquet in Minneapolis recently. He said, of all men living, I think the traveling man is one whose experience is most interesting and one whose life is one long list of romantic incidents. Some extremely sad indeed and some of infinite mirth. He obtains the experiences of more people than any other man on the face of the earth. And his own experience is the cream of all those poured into his eager, listening ear, or snatched by his watchful eye. The contact with all classes and conditions of people gives him a deep insight into human character, and makes him a philosopher. His nimble wit is at the command of every man he meets, his tongue is tipped with a humorous philosophy that drives away sorrow and robs troubles of all their sting. He is a man of resources and great of heart. He is a walking encyclopedia of everyday knowledge, and I venture the assertion that you can get more real solid, satisfactory information on any subject, be it business or pleasure, from one commercial man than from ten ordinary men. He is a moving, breathing, hustling edition of Rand-McNally, with all geographical attachments, and his brain is one seething mass of fun, facts, and figures. He eats, drinks, and sleeps on the run, and all his thoughts and ideas move at the same rapid gait. To sum up, he is everything that goes to make up a great and splendid manhood.

The commercial man in the beginning is selected for the position he occupies, because of the peculiar ability he possesses of adapting himself to any circumstances; coupled, of course, with the necessary amount of shrewdness and business tact. He is selected because he is able to associate himself with all sorts of people, and make them feel that he is one of them. He must be a man of judgment and a judge of character. He must be able to tell at a glance whether to approach his customer in the common ordinary ogre way or whether to take off his hat and do the Queen Anne act. In other words, he must be a man capable of approaching all sorts of people under all sorts of circumstances without offense to any. He is by education, if not by birth, a gentleman. And I believe that there is no man under the sun to-day that can control his temper under greater provocation. And this is one of the surest indications of a gentleman. There is no better school than the road for the young man, if he has the right sort of stuff in him, and from this school are graduated every year scores of our brightest and most progressive business men.

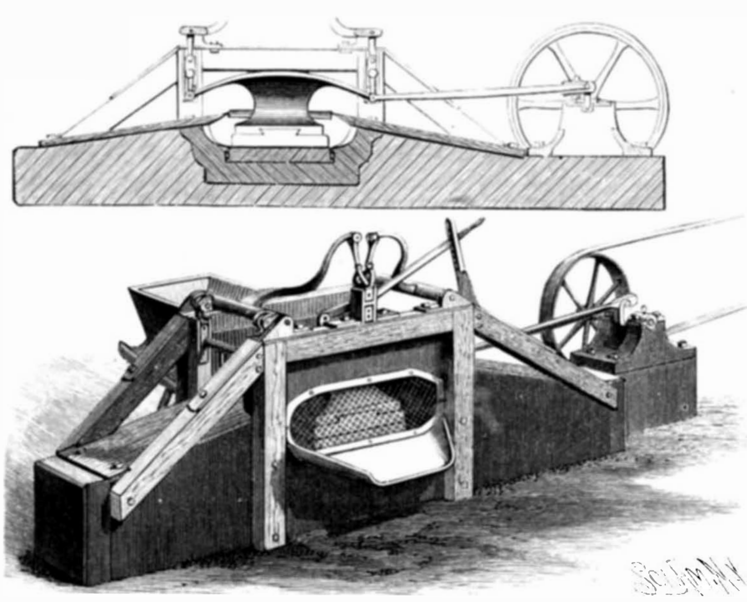
The internal organism of the traveling man should be a mixture of mule, ostrich, and camel. Part mule, that he may be able to sleep on his feet if no better accommodations be at hand; part ostrich, that he may be able to eat and digest anything set before him; and part camel, that he may, if necessary, go a long time between drinks. Especially should the latter be highly cultivated in those men who make Iowa and Dakota territory. Physically, as a rule, the traveling man is a handsome fellow and the best of company. He is bright and witty, and capable of conversing on any subject. If a single man, he is in great demand among the ladies, and is considered the lawful target for the smiles and blandishments of the rural beauty. If he be married, he commands the respect of his neighbors, and the love of his wife and babies is all his. And as we love those things best of which we get the least, the home of the traveling man is to him a sacred joy and a heaven of rest. It is the beacon light that guides his footsteps in the paths of love and duty. And in concluding I will say that I have no doubt that when done with this life, the first to greet us upon the platform, just within the New Jerusalem, will be our commercial friend, with outstretched hand, and a face glorious with a smile of welcome.

Practical Work on Big Guns and Armor.

A party of U. S. Senators and Congressmen recently made a tour of the works of the Bethlehem Iron Company, where the government contracts for guns and armor plates are being filled. The party witnessed a large hammer forge out a 11½ in. plate for the Terror's turret from a 47 ton ingot and the bending of an Amphitrite turret plate under the monster 6,000 ton hydraulic bending press. They saw one of the Terror's side armor plates brought out in a bright red condition from one of the large heating furnaces and lowered slowly into a bath of oil. Then they saw three large circular saws go through steel plates as though the plates were so much wood. Next they saw the method of tempering a 10 inch army tube and the casting of a 42 inch round ingot and the subjection of it while in a fluid state to an immense pressure. All of this is work which could not have been done in this country four or five years ago.

AN IMPROVED ORE CRUSHER.

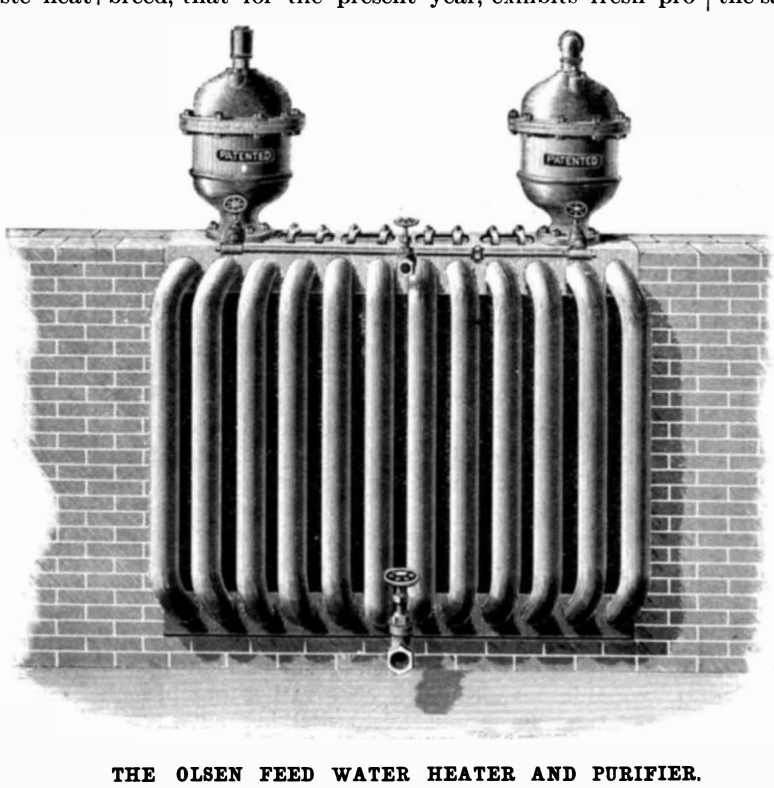
A machine designed to operate as a stamp and pulverizing machine, and which may be nicely adjusted to grind the ore to any desired degree of fineness, is shown in perspective and in section in the engraving. It has been patented by Mr. Joseph Brumbaugh, of Salem, Oregon. Embedded centrally in the base of the machine is a concave bed plate, the cavity carrying the bed plate being partially covered by projecting plates to prevent the ground ore slushing up out of the bed. In the center of the bed plate is the under die, which is vertically adjusted by placing metallic plates beneath it. The upper die is dovetailed into a stamp block which rises above the bed, and has at each end projecting arms pivoted to the lower ends of cranks on shafts extending across the machine above the ends of the bed plate, the ends of the shafts being journaled in vertically sliding blocks moving in slideways in the frame. The sliding blocks are connected by links with other shafts above, turning in boxes carried on top of the frame, and the latter shafts have upwardly extending, forwardly curved levers, to which are pivoted short levers forming toggle joints. The short levers are pivoted at their lower ends to a sliding plate moving vertically in a slideway of the frame, the plate having a series of holes by which it may be connected at different points to a pivoted lever extending through a toothed rack, and held where placed in the rack by a spring latch. By the adjustment of this lever the upper die carried by the stamp block is held the exact distance desired from the lower die, thus regulating the fineness of the grinding. One of the arms of the stamp block is pivoted to a pitman, by which the stamp is moved back and forth in the central cavity, swinging on the crank shafts, the upper die having a rubbing action as it passes the lower die. An opening in front of the dies is closed by a screen, in front of which is a spout, to which the finer portions of the pulp may pass, although with free-milling ore the greater portion of the metal will remain in the crusher. On the back of the machine is an inclined spout which delivers at two points in the crusher, thus causing an even distribution of the ore, the upper end of the spout being supported in a hanger to which is secured the feed trough, a shovel operated from a shaft pushing the ore delivered by a hopper through the feed trough into the inclined spout, sufficient water being run through the spout to wash down and flush the ore.



BRUMBAUGH'S ORE CRUSHER.

A NEW FEED WATER HEATER AND PURIFIER.

In the feed water heater and purifier shown in the illustration the chamber on the left contains the cold water filter, the one on the right the hot water filter. In operation the heater and purifier is placed in the flue between the boilers and chimney, and the feed water fed into and through the cold water filter, then into and through the tubes, where it is brought up to a boiling temperature, or over 212°, by the waste heat from the boilers, when it passes through the hot water purifier, where all the sediment and deposit is removed from the hot water, before going into the boiler. The benefit to be derived from this system of feeding is too apparent to need comment. This improved heater is manufactured by the Campbell & Zell Company, Baltimore, Md.



THE OLSEN FEED WATER HEATER AND PURIFIER.

Fast Torpedo Boats.

The torpedo gun vessel Speedy, which is being built for the Royal Navy by Messrs. Thornycroft, of Chiswick, is expected to be one of the fastest vessels of her class in the service. A member of the firm has stated that he anticipates she will attain a speed of between 21 and 22 knots. In connection with this statement and with the controversy which is now proceeding, the *Times* gives a list of the fastest torpedo boats and torpedo gun vessels of less than 1000 tons displacement which have hitherto been ordered by, or completed for, the leading naval powers. These are: Great Britain, Speedy, 21·5 knots; torpedo boat No. 80, 23 knots. France, d'Iberville, 21·5 knots; torpedo boats Coureur, Véloce, and Grondeur, 23·5 knots. Germany, division boats Nos. 5 and 6, 22 knots; torpedo boats Nos. 65 to 74, 24 knots; Nos. 76 to 80, 25 knots; Nos. 75 and 81 to 96, 26 knots. Italy, Tripoli, 23 knots; torpedo boats of Aquila class, 25 knots. Russia, boats of Adler class, 26·5 knots. Austria, boats of Komet and Trabant classes, 20·5 knots; torpedo boats of Falke class, 22·4 knots. United States, Cushing, 22·5 knots. Argentine Republic, six 130 ft. Yarrow boats, 22·5 knots. Chile, Lynch and Condell, 21 knots; torpedo boats of Glaura class, 22 knots. China, torpedo boat (Schichau), 24 knots. Denmark, two torpedo boats, 22·1 knots. Spain, Destructor, 21 knots; torpedo boats of Rayo class, 24 and 25 knots.

Silk Culture in Germany.

The experiments of Professor Harz, of Munich, in the rearing of silkworms by other means than the leaf of the mulberry, have already been noted in these columns, but the subject is sufficiently curious and important to justify further reference. The professor has recently published a pamphlet on the question, from which the following details are extracted. The plant employed is that called in German *Schwarz-wurz*, or comfrey. The results of feeding with this plant for 1889 were as follows: About 9,000 eggs had been obtained, which were hatched in the incubator at 25° C., and the 2,700 worms which emerged in the first three days were taken for rearing purposes. Although cold and damp weather and want of food exerted an unfavorable influence, yet Harz obtained, after an interval approximate to that usually observed when the worms have been fed by mulberry leaves (33 days), 755 cocoons, the threads of which could be easily reeled, and which, in length and durability, were equal to those obtained by ordinary means in an average harvest. Thus, after four years of uninterrupted breeding, he succeeded in accustoming the genuine silkworm to the exclusive use of comfrey, so that the worm has increased thereon, and supplied the cocoon filament in a condition which equals that obtained when mulberry leaves are employed. The cocoons obtained in the fifth breeding year, 1889, in most instances left little to be desired as to magnitude and weight. The largest weighed 1·39 grammes, and the thread attained a length of almost 300 meters, while its diameter coincided exactly with that of the original Milan thread, and it possessed almost the same tenacity, breaking with a weight of from five to six grammes; also the gloss of the silk fibers was exactly that of the normal thread yielded by worms fed on mulberry leaves. The last breed, that for the present year, exhibits fresh progress, Professor Harz reporting that 34·2 per cent of the worms, which, as before, had been exclusively fed with comfrey leaves, yielded normal cocoons. While the heaviest for previous years weighed 1·39 grammes, those of the present year have a weight of 1·83 grammes, and their thread harmonizes completely as to gloss and tenacity with the usual product obtained by means of the use of mulberry leaves. The period of incubation amounted to from 39 to 47 days. These interesting experiments thus appear to promise very important results.—*The Textile Mercury.*

A "Circular Mil."

A "circular mil" is a phrase widely used in electrical affairs. By a little inquiry among a certain class of most excellent practical men, we can easily find persons who do not know exactly what the phrase means. This word *mil* is not found in our school books and has no legal status. By the Constitution of the United States, Congress alone has power to regulate all weights and measures. In 1792, Congress enacted that a "mille" should be the thousandth part of a dollar. This word was only a description of one of the terms of our money of account. We never coined a "mille" at our mints. Our forefathers followed the old Latin spelling of the word meaning the one-thousandth part. In modern times we have changed the spelling to "mill." The newly-coined word used in electrical affairs is spelled *mil*, and means, says *Electrical Progress*, the one-thousandth part of an inch. The phrase a "circular mil," as used in giving the sectional area of wires, means the area of a circle the one-thousandth part of an inch in diameter.

Now, let us inquire why we use the area of a circle in giving the size of a wire rather than the area of a square, as is done in all other mechanical calculations. Why not use a square mil instead of a circular mil?

As far as minuteness in size is concerned, one would answer just as well as the other. A wire of but one-tenth of an inch in diameter has a sectional area of 10,000 circular mils. A circular mil is only about one-fourth smaller than a square mil. If our wires were square instead of round, electricians would have used the square mil instead of the circular mil. So we may answer that as wires are round, and as we frequently desire to compare their respective areas, we can do so most conveniently in circular mils. We can measure their diameters and compute these diameters in thousandths of an inch. As the areas of all circles vary as the square of their diameters, then by having the diameters we can, by one simple act of multiplication, find the number of circular mils contained in each wire. As the electrical capacity of a wire to convey electricity varies as its sectional area, we use this simple method in obtaining the area, which is of great convenience in ordinary electrical calculations.

Dwellers in the Arctic.

In 1813 Sir John Ross discovered an isolated race of human beings, numbering about two hundred souls, living on the inhospitable shores of North Greenland. To this community he gave the romantic name of "Arctic Highlanders"—a name which unfortunately is misleading; for they are a littoral people and *cannot* inhabit the Arctic highland, as it is an everlasting ice cap, and, moreover, they *will* not even visit it, for this inland ice is to them a region of terror, a land where abide their demons and evil spirits. At the present day they number, as near as can be estimated, about the same as when the knowledge of them came to the civilized world; nor have they increased their territory, but live on the narrow strip of mountainous coast, which is left bare during the summer months by the retreat of the winter snows. They could not be more cut off from other human beings did they live on some small oceanic island. Practically, they do live on an island, for they are surrounded by water—by great expanses of solid water; for they never pass the ice barrier of the great Humboldt Glacier, with its sea face of sixty miles; they never ascend to the summer foot of the "ice blink," some two thousand feet above sea level, nor attempt to wander south over the vast ice floes of Melville Bay, one hundred miles in extent. At 79° north latitude, near the southern edge of the Humboldt Glacier, is a collection of huts known as *Etah*, their most northern settlement, while at Cape York, in latitude 75° 55′ N., probably their largest encampment, is their southern limit, and which, as near as we could determine by the sign language, they call *Pitanito*. Their country is about 185 miles long and from three to five miles in breadth.—*Scribner's Mag.*

George the Victorious.

A new Russian ironclad of 10,280 tons has been finished at the Sebastopol ship building yard. Her length from stem to stern is 340 ft.; breadth of beam, 69 ft.; and depth, 26 ft. The engines are of 16,000 horse power, and the speed of the vessel is from 14 to 17·5 knots. The new vessel, which is named George the Victorious, will be armed with six long range 12 in. guns, mounted *en barbette*, seven 6 in. guns mounted on the battery deck, eight quick-firing guns of the Baranovsky model, six 37 millimeter quick-firing guns for the tops, and seven torpedo-propelling tubes.

Correspondence.

Occupations for the Old.

To the Editor of the Scientific American:

While not yet to be considered old, perhaps, I have derived much pleasure in the pursuit of an occupation which may suit some of those more advanced in life, and serve such as both a pastime and the means of revenue as well.

To such I would say, procure a Fleetwood or other good scroll saw, using either a water motor or electricity, if foot power be objectionable; obtain some patterns, fancy woods, a few tools, and many pretty and useful articles can be made. With water power it is easy to cut through several thicknesses of woods tacked together. J. HARMANUS FISHER.

Baltimore, Md., Feb. 18, 1892.

German Labor Stations for Tramps.

There is in the February number of the *Forum* an explanation of the practical results of the celebrated German labor colonies for the abolition of tramps, by Prof. F. G. Peabody, of Harvard, who, during his residence in Germany, where he now is, has studied the system on the ground. Germany was the worst tramp-afflicted country in the world before work stations were established at intervals of half a day's journey. It is assumed that the tramp will earn his food and lodging in a half day's work. In the morning, therefore, he may travel with the assurance of reaching another station, where in the afternoon he must work.

If he presents himself after 2 P. M. he gets no further help. Each wanderer must carry with him a ticket on which is stamped the name of his last station and the date of his reception there. Thus when the network of these stations extends throughout Germany, all excuse for wandering beggars seems to be removed and a positive treatment of friendly aid as well as a negative treatment of refusal at one's door is applied. In the year 1890 there were 1,957 such stations, in which 1,662,606 breakfasts, 972,490 dinners, and 1,871,591 suppers were provided. There were, in the same year, 364 resting places with 12,600 beds, providing in the year 2,223,000 lodgings.

Prof. Peabody explains that it was at first feared that they might be tempted to stay too long in so good a refuge, and a maximum term of two years was fixed; but, in fact, a great proportion of such men cannot bear the restraint for any considerable period. It is estimated that in the years 1887–1889, 7·7 per cent (913) of the colonists left within a week, 4·3 per cent (507) within a fortnight, 23·7 per cent within a month, and 41 per cent within two months. Of all who left the colony, 20·8 per cent had obtained definite occupation; 60·4 per cent left at their own desire, and may be assumed to have renewed their tramp life; 5·5 per cent had remained the entire term of two years; 4·4 per cent were dismissed for misconduct; and 2 per cent were transferred to hospitals for treatment. Finally, 2 per cent ran away. Of 5,556 colonists in 1888, 3,617, or 65 per cent, were at a colony for the first time; and 1,939, or 35 per cent, were at a colony at the least for a second visit. Of these, 8·2 per cent were there for the third time, 2·8 per cent for the fourth time, 1·2 per cent for the fifth time, and 0·05 per cent for the sixth time.

Practical Electrical Mechanics.

The Elektron Manufacturing Company, Springfield, Mass., in connecting with the trade school of the city, has undertaken a work to educate mechanics to work on electrical machinery. The company has agreed to take each year a certain number of selected students and give them the benefit of working in its shops on actual productive work. Each student is expected to work three days in each week in the shops and spend the other three days in studies, a special course having been arranged for them in connection with the high school of the city, which is an institution of a very high grade. The course covers three years, which amounts to one and a half years of study and one and a half years of shop work. The students do not receive any compensation for their work, but the company agrees to give them the opportunity to learn all branches of the machinist's trade so far as they may be learned in the work of the shops.

The officers of the trade school have the privilege of visiting the shops at any reasonable time, and of giving the boys such advice and instruction as seems to them wise, but in almost every respect they are obliged to conform strictly to the regular factory rules governing all employes, and they work during the same hours.

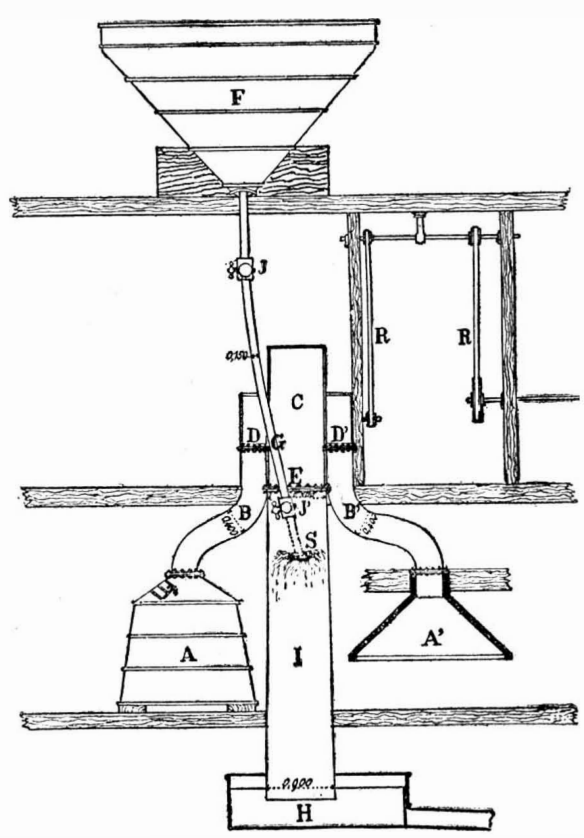
Stevens Institute, Hoboken.

The board of trustees of the institute is now a body of nine members, as follows, the first five being newly elected members: Mr. Andrew Carnegie, of Pittsburg, Pa.; Mr. Charles MacDonald, C.E., of New York; Chancellor Alex. T. McGill, of New Jersey; Col. Edwin A. Stevens, of New Jersey; Mr. Alex. C. Humphreys, M.E., of New Jersey; Mrs. M. B. Stevens, Mr. S. B. Dod, President Henry Morton, Ph.D., and Mr. Wm. Kent, M.E.

DESTRUCTION OF EMANATIONS OF ALL KINDS WITHOUT THE USE OF CHEMICALS.

If there is any matter rigorously governed by French legislation, it is that of dangerous, unhealthful, or offensive establishments. We well know, in fact, the numerous formalities that the law imposes before giving authority to found such establishments, and what measures of precaution and prudence it exacts from those who own workshops or factories.

All the countries of Europe, moreover, have, as regards this, a legislation nearly conformable to our own. As well known, French legislation arranges dangerous, unhealthful, or offensive establishments in three classes. Those of the first class must necessarily be isolated from private habitations, and it is for the local authorities to designate the place where such establishments may be located. Those of the second class are establishments whose remoteness from dwelling houses is not rigorously insisted upon, but the installation of which, nevertheless, must not be permitted until it has been ascertained that the operations to be carried on therein will be performed in such a way as not to incommode the landlords of the neighborhood nor do them any injury. As for the establishments embraced in the third class, they are such as may remain without inconvenience near dwellings, the danger or accidents that their formation presents not being grave enough to cause their removal from the interior of cities. So these latter establishments are distinguished from those of the first and second classes in that they have not necessarily to be relegated to a distance, and in that they are not submitted, when



APPARATUS FOR THE DESTRUCTION OF UNWHOLESOME EMANATIONS FROM FACTORIES.

they are in the midst of habitations, to so severe measures of precaution and to so complicated forms of instruction. Now, it is very detrimental to a manufacturer to be obliged, in order to conform to the prescriptions of the law, to remove his works to the exterior of the city, or far away from habitations; and such removal, indeed, is often attended with the ruin of the industry, and consequently that of the manufacturer. The means of transportation are more difficult and costly, the distance from railway stations obliging the manufacturer to maintain a large amount of rolling stock, and this in every respect appreciably increases the figure of his general expenses. For establishments that can be erected in the midst of cities, the law prescribes measures of precaution which are often very costly. For example, those of building inclosing walls, of leading the fire into long chimney flues, of burning the smoke in the furnaces, etc.

Consequently, an invention that would suppress the inconveniences that cause such or such an industry to be ranged in such or such a class rather than in such another, and that would thus permit, in rendering the exploitation of such industry innocuous or less dangerous, of arranging it in the second or third class, although it was previously arranged in the first, would render a signal service to all manufacturers whose interest it is to remain in a city or to locate themselves near dwellings and relieve themselves from all the police regulations which so disagreeably interfere with the free exercise of such industries. Thus, for example, the works for the preparation of hogs' bristles by all processes of fermentation are, by an order of the 27th of May, 1838, arranged in the first class of unhealthful establishments, on account of the bad odors produced by such preparation. An invention that would cause the disappearance of such offensive odors would thereby suppress the reason for this industry being arranged in the first class, and would thus permit of works being established in the very midst of a city.

As regards unhealthful establishments, an endeavor has already been made to overcome the inconveniences that they present, but without any success until recently. The system proposed by Mr. De Pindray, and which we are about to describe, seems to combine in itself the proper conditions for suppressing the deleterious emanations that escape, despite all precautions, from certain manufactories.

In the accompanying figure is represented the arrangement employed by the inventor of this process for carrying off the emanations produced either in the melting of fat or the scouring of metals. The boiler, A, in which the fat is melted, is connected by a pipe, B, with the ventilator, C. The vitiated air of the works is removed by this ventilator by means of the suction pipe, B, terminating in a funnel, A'. The gases forced into the central pipe, I, are mixed with water derived from a reservoir above. This water, distributed in the form of a shower, forces the gas to the purifier, H, at the lower part of the works, and the mixture is thence led to the sewer, or to a well sunk in pervious ground, by a subterranean conduit.

This invention is no longer in the domain of pure theory. Two applications have thus far been made of it, one at Cambrai, in the metal scouring works directed by Mr. Dupont-Grezeaux, where the process has given very good results; for, since it has been in use, the works, which were on the point of being closed on account of the deleterious emanations that were produced, have been running without any danger to the health of the public.

The other experiment was made in an establishment situated in the city of Cateau. Numerous complaints had been made on the subject of the emanations given off from this establishment, which is occupied in the trying out of fat. The owner of the works, Mr. Gerard, addressed himself to Mr. De Pindray, who installed his apparatus therein. A resolution of the Municipal Council (session of November 20, 1888) declared that, owing to the improvement very ably introduced by Mr. De Pindray into the melting of fat in Mr. Gerard's works, no unwholesome odor was perceptible, and that the works no longer offered any danger to public health.

This process, based upon purely mechanical means, is much superior to all processes based upon chemical agents; in fact, on employing a physical process, the expense is reduced in very great proportions, for it embraces only the cost of keeping in repair. The apparatus have no need of any surveillance, and no manipulations have to be performed that are sometimes dangerous.—*Le Genie Civil.*

New Coins.

Recently the mints of the United States commenced the re-coinage of the subsidiary silver—the half dollar, the quarter, and the dime. Artistically, says *Electrical Progress*, they are very much superior to all former issues, and will compare favorably with any coins of the world. As new dies had to be made for this coinage, it may be interesting to refer to them. When the die for a new coin is engraved, it is done with great care and expense. It is used only to make an impression on what is called a hub, which of course is the reverse of the die, when the hub is used only to stamp the working dies, which become a fac-simile of the master die. In coinage these working dies alone are used, and as a matter of course soon become deteriorated. Thus the master die can remain doing very little hard service. As an example, the coinage of the more than 400,000,000 silver dollars which have been made since 1878 are exact duplicates from one master die. On the commencement of this coinage there was some experimenting and some variation in about $1,000,000. Since then all have been alike except in date. These dies and hubs are all made of choice steel.

In regard to the weight of the new coins, it may be interesting to recall the fact that we reduced the amount of pure silver in these coins in 1853. This was done in order to save them from the melting pot and exportation, as they were more valuable than gold and met this fate to the great inconvenience of our people. The half dollar was reduced in weight fourteen and a quarter grains, the quarter and the dime in a corresponding ratio. In 1873, in order to assimilate these coins to the full legal tender silver used in France and to popularize the French metric system, the weight of the half dollar was increased nine-tenths of a grain, or as expressed in our laws to twelve and a half grammes, and the quarter and dime were increased in the same proportion. Thus these coins are at present legal French weights.

The half dollar	12½	grammes.
The quarter dollar	6¼	"
The dime	2½	"

Thus a French kilogramme equals eighty-four half dollars. In 1874 the French metric system was legalized by Congress, the sole authority intrusted with this power.

UTILIZING THE WATER POWER OF NIAGARA FALLS.

According to the census of 1880, the steam and water horse power employed in the manufactures carried on in the United States was 3,410,837, of which 2,185,458 was steam power and 1,225,379 water power. The cost of steam power has been reduced continuously through several years, from improvements made in the construction and operation of furnaces, boilers, and engines, and the thorough dependence which can be placed upon it and exact figures obtainable as to its cost have earned for it a decided preference in many industries, in addition to the main advantage that steam power is always obtainable where desired, while in the case of water power, according to all previous experience, it has been necessary to locate the manufacturing business to be carried on in the immediate vicinity of the waterfall furnishing the power. Still some of our largest industries are and always have been mainly operated by water power, the census of 1880 showing that in cotton goods 148,754 water horse power was employed, against 126,750 steam horse power; in the flouring and grist mill business, 469,987 water and 301,214 steam; in the paper manufacture, 87,611 water and 36,301 steam; and in woolen goods, 53,610 water and 52,897 steam. The industries in which the use of steam most greatly preponderated were: The manufacture of iron and steel, using 380,740 steam horse power against 16,506 water horse power; sawed lumber, 543,242 steam and 278,686 water power; and the vast number of small miscellaneous manufactures, totaling 726,958 for steam, against 161,288 for water power.

The very vastness of the power Niagara at once presents to the eye has long made it one of the most interesting problems for the engineer as well as a fertile subject of speculation to every intelligent observer. The estimates of the total power of the falls vary in somewhat wide limits, but they all place it at several millions of horse power, and it is not an extreme calculation which makes it twice as great as that of the total combined steam and water power at present employed in the whole United States. And yet, although the first rude sawmill was erected at the falls in 1725, there has not been, up to the present time, any adequate attempt made to utilize any considerable portion of this tremendous power. To do this it was obvious that a great initial outlay would be necessary to cut through the high, rocky banks, the required channels for the supply flow, utilization, and escape of the water at its lower level. Something was done in 1873, when the present hydraulic canal was constructed, affording 6,000 horse power, running about a dozen establishments, principally flour mills, but so incomplete was the provision made for utilizing the full head of the water that the tail race of the present mills has, in many instances, a greater fall than that which is used to turn the wheels.

The present Niagara Falls Power Company, whose work thus far forms the subject of our first page illustrations, is making the first noteworthy effort for the development of the power of the falls on a large scale, although the proportion of the total power which will be utilized is so small a fraction of the whole that it is not expected to make a difference large enough to be perceptible in the flow of the river over the falls. The company is the successor of one chartered by the New York Legislature in 1886, and, with the Cataract Construction Company, organized in connection with it, includes among its stockholders and directors some of the leading capitalists and business men of New York City. The company was given power to sell stock to the amount of $10,000,000, and there will be no lack of funds for the full development of the scheme under which it was organized, by which it was proposed to make available 100,000 horse power.

The central feature of the work is the great tunnel, 7,250 ft. long, which will form the tail race, starting from the river at just above the water level below the falls, and running under the village of Niagara, at a depth of about 200 ft. below the surface of the ground, the upper end of the tunnel being beneath a large tract of land the company has purchased adjacent to the river bank above the village. Over 1,400 acres of land has thus been acquired and laid out by the company in mill sites, and for the necessary surface canals, through which water will be supplied from the river to the various wheel pits, all of the latter being connected by lateral tunnels with the main discharge tunnel. The tunnel has somewhat of a horseshoe shape, being 19 ft. wide by 21 ft. high inside of the brickwork with which it is to be lined throughout, and having a cross sectional area of 386 square feet for its entire length. The total amount of excavation, including that necessary for the timbering and brickwork, represented a cross sectional area of 522 sq. ft.

The base of the tunnel at its discharge point in the river bank below the falls is 205 ft. below the sill of the head gate at the entrance of the main canal from the river above the falls, which represents the total fall, of which it is expected about 140 ft. will be practically utilized, the difference being taken up by a liberal allowance for clearance from the wheel pits, incline of the lateral tunnels leading therefrom to the main discharge tunnel, and the incline of the latter, which is made at a grade of 36 ft. to the mile. To prevent damage to the tunnel by the immense rush of water, it is lined on the invert and sides for a distance of 200 ft. back from the discharge point with closely fitting cast iron plates, there being a heavy cast iron frame at the mouth, and the tunnel is lined throughout, including the invert, with four courses, or 16 in., of brick.

In the building of the tunnel three shafts were put down. At the portal, where the top of the river bank is 214 ft. above the level of the water, what is known as the zero shaft was sunk, 10 by 12 ft. in size, and extending down 93 feet, from the top of a ledge to the soffit of the tunnel arch, this shaft being extended up to the top of the bank by open timber work. Shaft No. 2, 2,650 ft. from the portal, was sunk 206 ft. and was 10 by 20 ft. in size, while shaft No. 3, of the same size and 196 ft. deep, was 5,200 ft. from the portal. In putting down the shafts, 140 ft. of the work at the top was through hard bastard limestone, which overlay the Niagara slate or Utica shale, met with for the remaining distance, and through which the main tunnel itself was mostly made, its base, as it reached away from the river, being in Queenstown limestone. In shafts Nos. 1 and 2 water was met with, the average flow in shaft No. 1 reaching 800 gallons a minute, and 600 gallons a minute was found in shaft 2, but none was met with in shaft No. 1 below 105 ft. depth and in shaft No. 2 below 70 ft. depth. This water was readily disposed of by pumps, and none was found in the tunnel excavation proper, which remained perfectly dry.

The work of rock excavation, the average height of which throughout the tunnel was 26 ft., was pushed on three different benches, the top bench, 9 ft. high to the top of the arch, being always extended ahead of the second bench, 8 ft. high, the workmen in the latter bench being covered by a skeleton flooring over which the material excavated from the top bench was conveyed backward on small dump cars. The excavation of the bottom bench, which measured 9 ft. vertically to the bottom of the invert, was not commenced until the work on the other two benches had been nearly completed. Three 18 by 30 in. air compressors were employed, working 25 Little Giant 3½ drills, rack-a-rock being used in the wet shaft work, and a special tunnel forcite in the remainder. The force employed averaged 750 men, working in two shifts of ten hours each a day. The rapidity with which the rock cutting was effected, after the work was well under way, is something remarkable in the history of such enterprises, 338 ft. of tunnel, averaging 14 yards to the running foot, having been excavated in 26½ days. Messrs. Rodgers & Clement, engineers and contractors, who have the contract for the tunnel work, under the Cataract Construction Company, expect that all this portion of the work will be done before the middle of the summer. Of the Cataract Construction Company, Albert H. Porter is the engineer; Coleman Sellers and John Bogart, consulting engineers; Clemens Herschel, hydraulic engineer; and George B. Burbank, resident consulting engineer.

All of the factory buildings on the company's ground above the head of the tunnel will be more than a mile away from the falls, so that they will in no way take from the attractiveness of Niagara for visitors. The general plan of the main supply canal includes a lower reach 200 ft. wide, extending 1,200 feet inwardly from the river, thence parallel to the river in an up-stream direction for nearly 5,000 ft. where an upper reach 500 ft. wide connects this end with the river. Work on the lower reach only has been pushed thus far, but when all are completed the different sections will be separated by gate houses, so that the water can be drawn off in the usual way to facilitate repairs, a floating boom being provided to keep out ice at the upper end. On the lower reach of the main canal are to be located works intended to be run without intermission, and drawing their water outside of the gate houses separating this portion from the rest of the system. On this portion, nearest the river, will be located an extensive establishment of the Soo Paper Company, manufacturing also the wood pulp. This company is arranging to use 6,000 horse power, and has contracted for the construction of a wheel pit 16 × 50 ft. in size and a lateral tunnel 600 ft. long connecting the wheel pit with the main discharge tunnel. Farther back on the lower reach will be two central power stations, a design for one of which forms the principal picture on our first page, while on both sides of the main canal, for a distance extending more than half a mile back from the river, and over a mile in the direction of its course, the ground is laid out for mill sites and the necessary storage houses and other buildings required in manufacturing, as well as for the accommodation of the large population which will have to be provided for.

The best kind of turbine to use, and the method of setting the wheel, as well as the most effective means of transmitting and distributing the power obtained, have each been subjects concerning which the company has endeavored to make the most exhaustive investigations, but in relation to each of them there are still some features which have not yet been finally decided upon. It has, however, been practically determined that, in order to lessen the wear on the bearings of the wheel shaft, the water is to be admitted to the wheel on its under side, the shaft being of large size and hollow, and being journaled at its upper end in a thrust box to allow for any vertical movement. Mr. Edward D. Adams, President of the Construction Company, and Mr. Coleman Sellers visited Europe to examine into systems employed abroad for transmitting power, the advice of Sir William Thomson and others was obtained, and prizes were offered for plans and estimates as to the generation of power by turbines or other water motors, and for the transmission of the power to factories on the lands of the company and to a wider area. A number of systems were considered for the transmission of power by electricity and by compressed air. One prize of £500 was divided between two firms of Geneva, Switzerland, Messrs. Fuesch & Piccard and Messrs. Cuenod Sautter & Co., who acted in association. Several third prizes of £200 each were given as follows: Messrs. Hillairet & Bouvier, Paris; M. Victor Popp, of Paris, and Professor Reidler, of Berlin; Messrs. Vigreux & Levy, Paris; the Pelton Water Wheel Company, San Francisco; and the Norwalk Iron Works Company, of Norwalk, Connecticut.

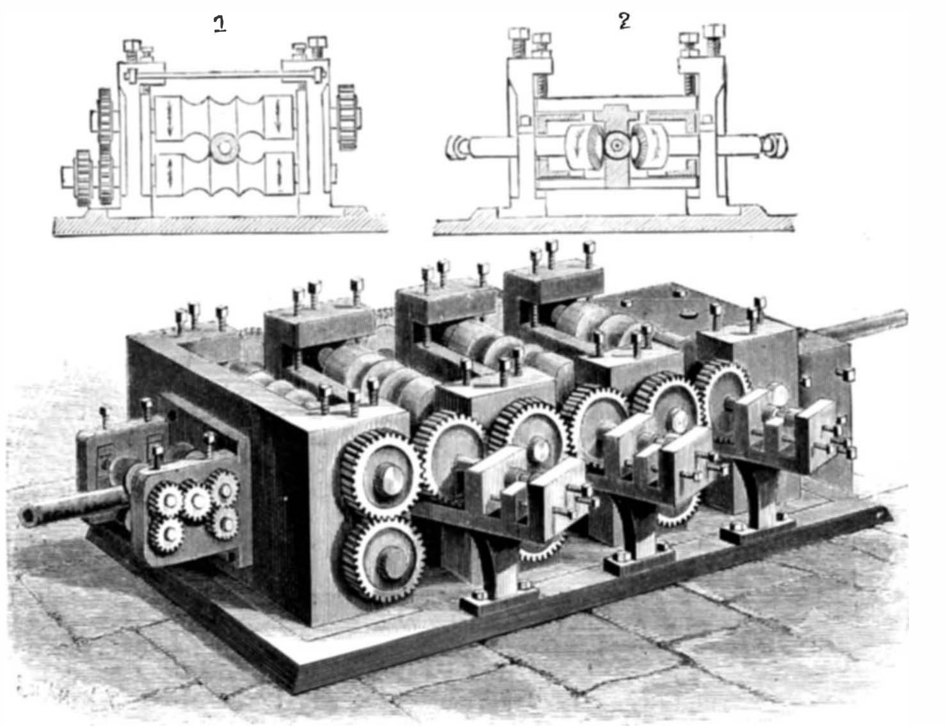
The two firms receiving the largest prize produced two complete projects of similar character for the hydraulic utilization of 125,000 horse power, and its distribution electrically both to Cataract City—the name of the new town springing up on the lands of the company—and to Buffalo. The general features of both projects are the adoption of Girard or impulse turbines, with complete admission and back vanes, permitting the use of suction pipes, so that the fall below the turbines is not wasted; a unit of power of 2,500 horses for each turbine, as the maximum size which it is practically prudent to construct, and as capable of convenient arrangement to give the speed of rotation most suitable for the dynamos; in the electrical distribution, the adoption of continuous currents at constant potential, on the ground that that method has proved in practice safe, easy and simple. The method of continuous currents is preferred as being simpler, exacting less apparatus, and permitting the attainment of a high efficiency. The method of constant potential is preferred to constant current, because in the latter plan the intensity of current would be too great for one circuit, and several circuits would involve complications. As to the greatest power of a single dynamo machine, 1,250 horse power has been favored in one project, and 2,500 horse power in another.

The company has not determined to adopt any of the plans so far, except in a tentative way. A certain proportion of the power will be sold to mills controlling their own wheels, and delivering water into the tunnel, but at the central station the designs are at present limited to the generation of about 5,000 horse power by compressed air, another one of 5,000 horse power by electricity, with the possible extension of either one of these to the amount of 100,000 horse power, added in units of 2,500 to 5,000 horse power to either, one by one, in whichever direction proves the most profitable and is called for by the manufacturers. The company is anxious to do this work cautiously, economically, and thoroughly, so as to avoid mistakes. With this intent the matter has been placed in the hands of a board of engineers, of which Dr. Coleman Sellers is chairman and Colonel Turrettini foreign consulting engineer.

It is now the expectation of the company to make its first large contract for the delivery of power at a distance from the falls, with the city of Buffalo, 3,000 horse power being required for the lighting of the city. The present cost of a steam horse power in Buffalo is put at $35 per year, and the company offers to contract to furnish power on its grounds at the falls according to the following scale: For 5,000 horse power, $10 per horse power; for 4,500, $10.50; for 4,000, $11; and so on down to 300 horse power, for which there will be charged $21 per horse power per annum, each power to be supplied for twenty-four hour days. It is evident, therefore, that if the cost of transmission be within present expectations, the company will be able to furnish power at Buffalo at a much lower price than it is at present to be had at, and for a far larger field of usefulness than the mere lighting of the city. According to the most successful of all the recent efforts in the way of practically transmitting power electrically for a considerable distance, only about twenty-five per cent of the power was lost in transmitting it by wire a distance of 108 miles. This degree of success was attained at the recent Frankfort exposition. And if power can be at present so supplied for a distance of 100 miles from Niagara, it would be but a rash judgment which would undertake to say that it might not be also, in the very near future, similarly brought as far as New York City, in a way to be utilized at far less expense than the present cost of steam power. It is expected that the company will be entirely ready to furnish power, to those arranging for its use by taking water from their canals and discharging it into the tunnel, by October next, their first contract calling for the ability to turn wheels by this time.

A MACHINE TO ROLL HOLLOW RODS.

The machine shown in the illustration is designed to produce a very durable and simple tube of a uniform size from previously heated hollow ingots, all the rolls and disks of the machine being rotated in unison, driven by suitable machines. The improvement forms the subject of a patent issued to Mr. John S. Griffin, of Roslyn, Washington. The machine has several pairs of horizontal grooved reducing rolls, and a pair of disks arranged between each two adjacent pairs of rolls, there being guides between the pairs of rolls and disks, and the grooves of the rolls diminishing somewhat in size from the front to the rear of the machine. Each pair of rolls is secured on shafts, geared together by gear wheels, and there are two pairs of feed rolls, turning in bracket bearings, secured to the first pair of standards for guiding the ingot to the first pair of reducing rolls, of which an end view is shown in Fig. 1. The arrangement of the disks between the rolls is shown in Fig. 2, the disk shafts being slightly inclined, and the ingot passing centrally between the faces of the disks, which are somewhat beveled and serrated to twist the ingot in passing. The shafts of the disks are readily movable in and out in their bracket bearings, for the adjustment of the disks in line with the grooves of the reducing rolls. Between each two adjacent pairs of rolls are longitudinally extending guides having segmental inner faces corresponding to the size of the bar or rod to be drawn, and at right angles are arranged guide blocks, having curved inner faces, the guides and guide blocks forming a complete circle between the disks and the reducing rolls. At the discharge end of the machine is arranged a pair of finishing rolls, through which the hollow rod passes after it has passed successively through the several pairs of rolls and been reduced to the proper size, the finishing rolls removing any irregularities which may have been left by the previous rolling.



GRIFFIN'S MACHINE FOR ROLLING HOLLOW RODS OR BARS.

A New North Pole Expedition.

Dr. Fridthof Nansen means to leave Europe about January, 1893, and make direct for the mouth of the Lena, in Siberia. It is possible that he may take the Kara Sea route to Siberia, but the probability is that he will go by Behring Straits. Dr. Nansen is confident that a current sets from the coast of Siberia directly across the pole to the north coast of Greenland, and that it is the continuation of this current which flows down the east coast of Greenland. Various objects have been discovered on the Greenland coast which it is believed could only have been floated from Siberia or the sea to the north of it. Dr. Nansen expects that his expedition will be away between three and four years, as the progress will be necessarily slow, and, moreover, the current is believed to oscillate. His specially constructed vessel is now nearly completed. Its net tonnage will be about 250, and Dr. Nansen is confident that it is indestructible by any amount of ice nipping. The accommodation on board will be ample for the twelve men who will compose the expedition. Provisions will be taken for six years, and care will be taken to select these in such a form as will give the greatest amount of nourishment with the least bulk. Of course it is expected that a certain amount of fresh meat will be obtainable in the form of seals and bears, if not of birds. If Dr. Nansen takes alcohol in any form, it will only be in the medicine chest, or as fuel, and even on the subject of tobacco he has notions which may not be quite agreeable to his men. Everything, of course, will be subordinated to the maintenance of the members of the expedition in the greatest possible vigor and to the accomplishment of the great object in view. Arrangements will be made for utilizing the engine for the production of the electric light; and in the winter, when the steamer will probably be laid up, the men themselves will take the place of the engine. This will not only produce the welcome light in the midst of the Arctic darkness, but will give the men exercise and add to the interest of a life that is apt to be depressingly monotonous. A balloon will also be taken, and the gas required to work it will be taken in storage cylinders. Tents will also be taken for use in sledging expeditions, and boats to be utilized in the unfortunate contingency of the ship having to be abandoned.

THE lava electric insulators made by the D. M. Steward Manufacturing Company, of Chattanooga, Tenn., are made from crude steatite mined in the neighborhood. An extensive plant is required for the manufacture, and the production is large, these insulators being known all over the world.

Triple Screw War Vessels.

The fitting of triple screws to the new French armored cruiser Dupuy de Lome, which was launched in October, 1890, and which is now being completed at Brest, and to the German protected cruiser Kaiserin Augusta, which was launched in January at Kiel, is an innovation the results of which will be watched with interest by naval architects. Each of these vessels is upward of 6,000 tons displacement. Hitherto triple screws have only been fitted to small craft, and only to very few of these. Indeed, so far as we know (says the London *Times*), the experiment has been confined to the Italian torpedo gun vessels of the Tripoli class; and, although these boats were by no means failures, their three screws conferred upon them such slight advantages that it was decided to give the improved gun vessels of the same class two screws apiece only. In the case of such large ships as the Dupuy de Lome and the Kaiserin Augusta the conditions are, of course, quite different, and it may therefore be that the anticipated advantages of triple screws will with them be fully secured. The Dupuy de Lome is of 6,297 tons displacement, 374 feet long, 52 feet broad, and having a mean draught of 23 feet 3 inches. Her triple expansion engines have a collective indicated horse power of 14,000, and will give a speed of 20 knots under forced and 17·5 knots under natural draught. The Kaiserin Augusta, lately known as Kreuser H., is of 6,052 tons displacement, and somewhat longer and narrower than the French ship. The engines will have a collective horse power of 12,000. For ordinary cruising at speeds up to 12 knots it is intended to use the middle screw only. The two outside screws, without the middle one, are anticipated to give a speed of 18 knots. The three combined should give a speed of 20 knots.

RAIN MAKING IN INDIA.

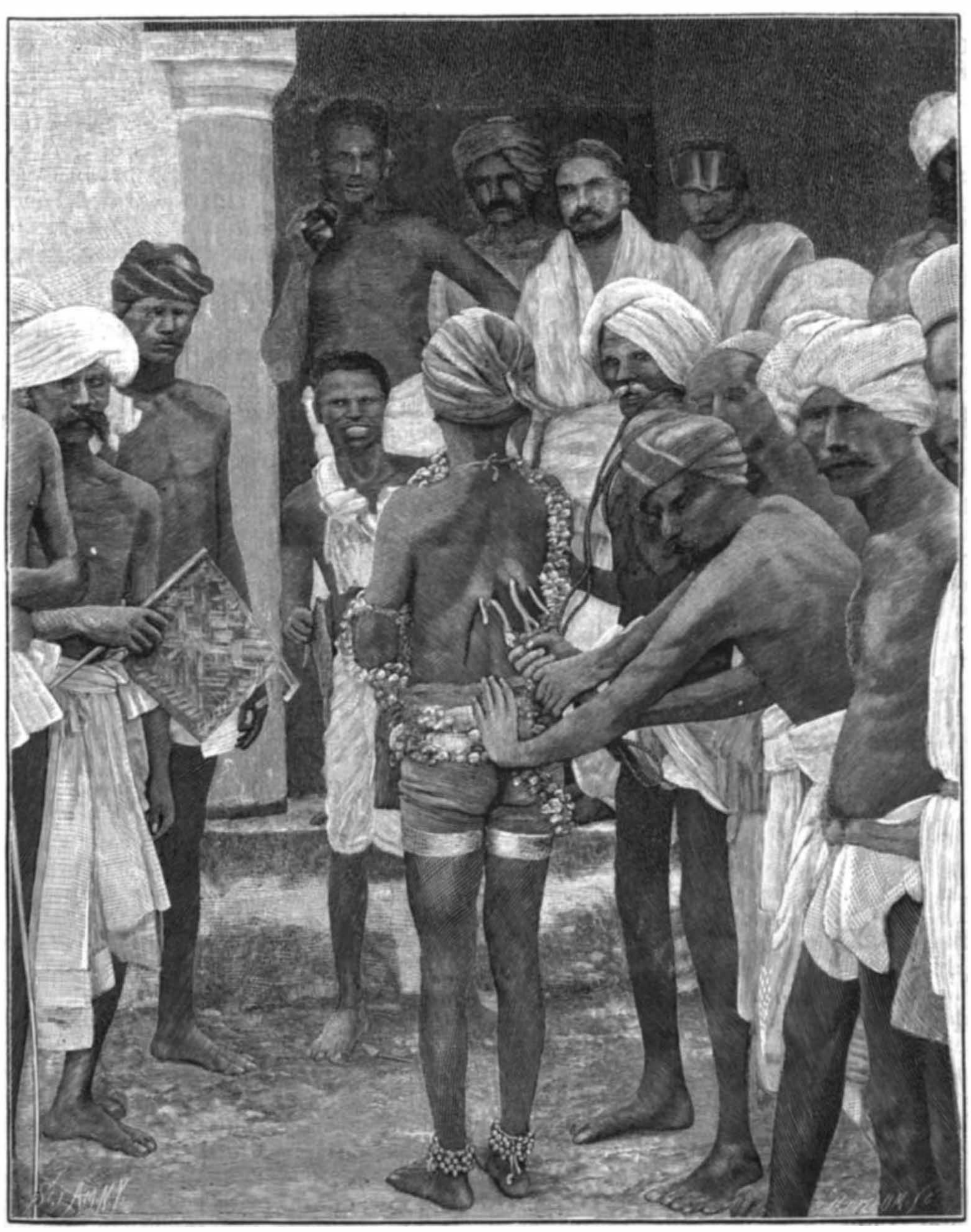
Among the heathenish customs observed by the natives in certain parts of India, having in view the propitiation of the gods, in the hope of obtaining rain in dry seasons, is the practice of hook swinging. This revolting performance was at one time suppressed by the English government, but its revival has of late been allowed, and its observance appears to give much satisfaction to thousands of devotees.

A recent number of the *Missionary Herald* contains a graphic description by Rev. John S. Chandler, an American missionary at Madura, of a festival which took place there in October, 1891, from which we make the abstract below. We are also indebted to the editor of the *Missionary Herald* for the use of the original photographs from which the accompanying engravings were prepared.

Rev. Dr. Chandler says:

"Having learned that the old, cruel practice of hook swinging was about to be revived after having been abolished for twenty-four years, the Madura mission directed me to memorialize the Madras government, and pray them to prohibit its revival. The government replied that they would discourage it in every way, but were not willing to absolutely prohibit it. Their discouragement amounted to nothing at all, and it came off on the 21st instant in the presence of 10,000 people. Dr. Van Allen and I went out to see it, for the sake of being able to give an authentic account of it.

There are four villages in the vicinity of Solavandan, inhabited by people of the Kellar, or Robber, caste. In each village is a family that has the right of selecting two candidates for the operation. Out of the eight thus chosen, one was selected by lot, and the lot fell on a young man of twenty-three years, thick-set and muscular and rather short of stature.



RAIN MAKING IN INDIA—INSERTING THE HOOKS.

These people worship the demoness Mariamman, said to be the spirit of a Pariah woman who formerly was attacked by smallpox and was left to die without assistance. She has now become the patron of smallpox and cholera, and is believed to have the power to send or withhold rain; and hook swinging is thought to be a means of propitiating her, so as to influence her to send rain in abundance.

In 1867 this practice was revived, after having been prohibited for many years. But upon representation to Lord Napier at that time he again prohibited it; and now, after twenty-four years, the people, having learned that the present powers that be would do no more than discourage it, have revived it again with great *eclat*.

It is said that previous to the insertion of the hooks into the middle of the back the muscles and skin are rendered insensible by slapping and pinching. However that may be, there is no doubt that arrack was given to the man at the time. He was brought to the police station with the two hooks inserted back to back, one each side of the spine. The hooks were not large, and the flesh taken up by them seemed very little. The wonderful strength of the muscles of the back was shown by this performance.

The car consisted of a rough platform on wheels, supporting a great frame about ten feet in length and breadth, and fifteen feet in height, the platform itself being six feet from the ground. Up through the middle of the great frame rose a stout circular beam of great strength, three feet above the frame, and on the top of this beam was pivoted the pole, sixty feet in length, from which the man hung thirty-five feet from the ground.

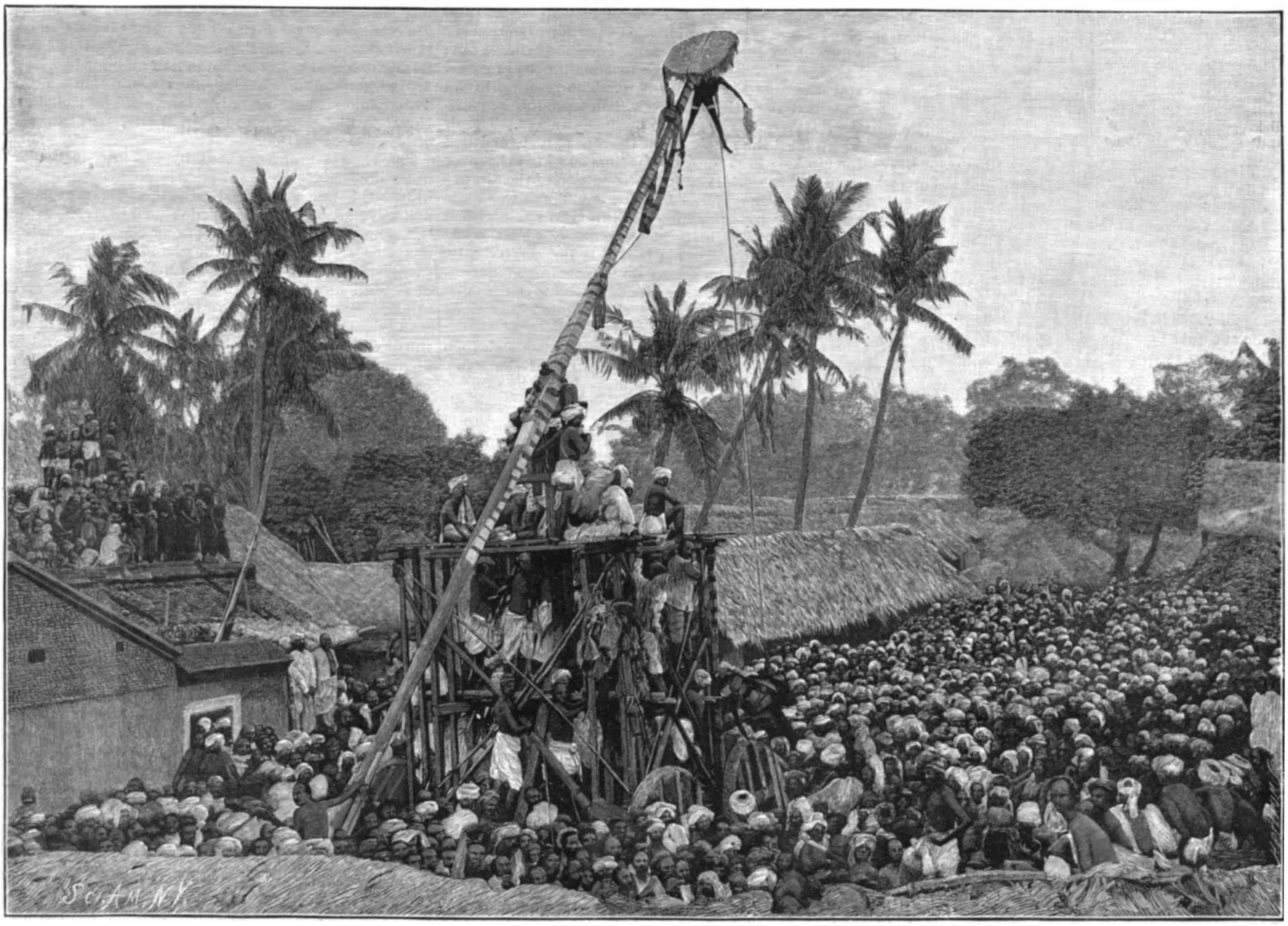
Promptly at three o'clock the hooks were inserted, within some building, and the man came rushing along the street, escorted by constables and others, who beat back the crowd, and kept up a vigorous fanning, urging the man to keep dancing. After the short stay at the police station they made a grand rush for the car, which stood on an adjacent street, and there the end of the sweep was lowered to receive its victim. Soon it was carried up again with the man attached. As he went up he clapped his feet and hands together in a measured way, and this he kept up during the whole performance. His ankles had jingles on them that could be heard as they beat together with a steady "ching, ching."

Before carrying him up to the greatest height the pole was held horizontally and the man was carried around in a complete circle, swinging over the tops of the houses. Then the car was drawn forward to the first corner, where it was delayed, that a kid might be sacrificed. Once in a while the man would draw up, with a rope, plantains and flowers and throw them down to the crowd below. In one place there was a ditch to be crossed and the jolt caused him to seize the rope that hung by his side, but with that exception he seemed to hang entirely by the two hooks in his back. The flesh was gathered up, showing great tension, and his back was bent.

After an hour and a quarter the car returned to its starting place, and the man was released. The hooks were not taken out, but were kept in that they might move the people to be liberal in giving presents to the performer. His pulse was good and his condition seemed normal, but the flesh of the back was so drawn up as to leave deep holes for the hooks. He put on an air of bravado and even offered to swing for a second time if a suitable present should be given. It was only in the evening that the hooks were taken out.

The image of the goddess was carried around on a wooden bull behind the car, but the great object was to get money, and for three months the man can have the hooks and cord and knife used to show to people and beg for presents.

It is said that the present attitude of the government of Madras is due to instructions from the Secretary of State for India. If that is so, there is no hope of our effecting anything here; it must be done in London. The manager declared to the superintendent of police that he proposed to continue the swinging annually."



RAIN MAKING IN INDIA—THE HOOK SWINGING CAR.

Horticultural Notes.

John Craig, horticulturist to experimental farms, before Agricultural Committee of the House of Commons—In large fruits we are making a test of varieties running along two lines; first with the standard varieties chosen from the nurserymen's catalogues of today. These are the product of the first introductions by the early settlers, as modified by selection and cultivation, and now called the American varieties. These varieties have mostly come to us from the western and moister parts of Europe, as our settlers came from that region. The French colonists, when they first came here, brought with them the best fruits of their native locality; the English settlers followed and brought their favorites; and the Scotch, Irish and Welsh did the same with theirs; so that to begin with, as I have already stated, we have the fruits of western and the milder portions of Europe. I might say this class, then, composes one side of the varietal test. Secondly, the other class is made up of east European sorts, which you have frequently heard referred to as the "Russian apples," and I will draw attention to them quite often in the course of my remarks, as we are testing this class extensively. In order to give you an idea as to the causes which led to their introduction for trial into this country, touching upon the early history of the movement, I will state briefly a few facts relating thereto, upon which hinged the beginning of the work.

Ever since the introduction of the Duchess of Oldenburg from Russia, by way of England, about 40 years ago, there has been a growing interest in the fruits of that cold climate. The first large importation was made in 1870 by the United States Department of Agriculture. This comprised 252 varieties, but owing to the crude state of Russian pomology, evidenced by the many synonyms afterward found in the collection, and coupled with long unpronounceable names, the work of sifting the good from the bad in this cumbersome list has been laborious and slow. Without going into details in regard to their merits and demerits, I may say that already a sufficient number of valuable varieties have been found to repay all the expenses incurred in the work of introduction and trial; and when we look at the possible advantages to be derived from these foreigners by uniting them with our native varieties, thus obtaining hardiness on the one side and possibly quality on the other, the benefits likely to accrue are inestimable. I have said the first importation was made by the United States Department of Agriculture, but the credit of bringing this work to a practical and a successful issue is due to a Canadian—one now departed; I refer to the late Charles Gibb, of Abbotsford, Quebec. At great personal expense in company with Prof. Budd, of Iowa, he undertook the arduous task of visiting the various localities in which these fruits were grown, making notes on condition and quality of tree and fruit. The result of those investigations, a fair and unvarnished statement of facts, was published and is now the foundation of our knowledge of the Russian fruits. As far as we know at present, any apple tree not up to the grade of hardiness of Duchess, Tetofsky, Wealthy or Pewaukee is of doubtful usefulness for planting in the district of Ottawa or similar latitudes. I have referred to the work in apples. Experiments of a like nature have been carried on with pears, cherries and plums.

What is Electricity?

BY FOREE BAIN.

The answer to this question has been far from finally and absolutely determined. Certain laws and formulas have been evolved from the study of the subject, which are reliable and accurate in their application. It is certain that the phenomena attending the presence or manifestation of that peculiar power of nature known as electricity are as well organized and are as immutable as in the other better known forces.

In studying this question, it is well to see what other persons have thought and written about it, and then we may be better prepared to determine for ourselves. There is still some question about its identity, so we are at liberty to accept or reject the theories as they are presented.

In a work on electricity published in 1799 I find this definition: "Electricity, a natural agent or power, generally called the electric fluid, which, by friction or other means, is excited and brought into action." This definition would be considered very apt and conservative for this day and generation, notwithstanding the fact that nearly a century has passed since it was written.

Perhaps the latest definition given to-day is: Electricity, the name given to the unknown thing, matter or force, or both, which is the cause of electric phenomena.

Dufaye, Symmer, and other earlier scientists established the hypothesis of two fluids.

They believed that there was electricity of two opposite kinds, positive and negative, each a separate and distinct fluid in itself, but that they were never found singly and alone. The union of equal quantities of the two fluids constituted the neutral fluid, which was supposed to exist in large quantities in all unelectrified bodies. When a body was electrified it was supposed to gain an additional quantity of one fluid, and lose an equal amount of the other, so that the total amount of electric fluid in a body was never changed. This in brief is the two-fluid theory.

The one-fluid theory was propounded by Franklin, and it is the theory generally accepted for want of a better one to-day. It supposes the existence of only one electric fluid, which unelectrified bodies possess in a certain normal amount. A positive electrified body has more, and a negative electrified body has less, than its normal amount. There are a number of complications in this theory which Aepinus modified in order to agree with the Newtonian theory of gravitation, yet, with its faults, it is the one referred to by most of the text books, and the only theory now to explain the various manifestations of electricity. We unquestionably know more to-day about the practical application of electricity than any generation has known before us. The theory of the science has not been as satisfactory in its growth as has been the knowledge of it, although we know more, certainly, what electricity is to-day than we did twenty years ago. Some things are beginning to be known that were only speculation a few years ago, and old theories are being modified to suit our greater knowledge, until the books of our school days seem incompatible to the student of to-day.

The most recent theory of electricity is that it is a mode of ether. In order to establish this theory it is necessary to transfer the question of the existence of ether from speculative philosophy to that of absolute reality. There has been as much doubt in regard to the existence of an all-pervading ether as there has been in regard to the existence or form of electricity, and we are not yet prepared to accept this theory.

Heat was supposed at one time to be a form of matter, now it is known to be a form of energy—or, as Tyndall says, a mode of motion. Indeed, heat, light, electricity, magnetism and chemical affinity have all formerly been regarded as kinds of matter, "imponderable elements" they were called in contradistinction to other "material elements." Each of these so-called imponderable elements is energy manifested by different effects. Heat may be transformed into electricity, which is another form of producing a different effect, or the process may be reversed, and electricity may be transformed into heat. Again, mechanical motion may be transformed into either or all—electricity, heat, light, magnetism or chemical effect—while a reverse process will convert heat, light, electricity, magnetism, and chemical effect back into mechanical motion. We have mechanical motion to produce electricity from our dynamo. We lead a portion of this electricity to an incandescent lamp and produce heat. When the filament has received sufficient heat to bring it to a point of incandescence, a portion of the heat, or primarily electricity or motion, is transformed into light. This light may be used in process of photographing, which is a chemical effect, or a portion of the electric current may be used to electro-plate, which is also a chemical effect. Our chemical bath becomes a storage battery, and if its poles are connected directly to our dynamo, a portion of the energy given to it by the dynamo will be returned as mechanical motion, by turning the dynamo as an electric motor. We see by this illustration that these effects are interconvertible. If these manifestations called heat, light, electricity, etc., are different forms of energy, they have always been such. Thousands of years have passed before this became known, but the lack of our knowledge has not affected the facts.

We are living in an all-pervading atmosphere of pressure, about 15 pounds per square inch. Can you tell me how we know this? If there was a convenient room where this pressure did not exist, we could step into it and note the difference. But suppose there was no way for us to remove the pressure, nor to increase it, we would live forever without any knowledge of its existence. There are several ways by which we become aware of the existence of this pressure. It exists and acts equally in every direction, or, in other words, it is always tending to equalize its effect in all directions. Take a pipe, attach an exhaust fan to one end, exhaust the air (the medium on which the pressure acts) by applying power or motion to the fan. You remove the air from the pipe. The tendency of the universal pressure to establish an equilibrium forces more air in at the other end, in an effort to maintain the pressure of the inside equal to that of the outside. Now if you will place any kind of an air motor, or fan, within the pipe or in the path of the air as it is forced in, the motion of the air will cause your motor to revolve and give back as mechanical motion a portion of the energy supplied to the exhaust fan. Stop the exhaust fan; sufficient air will fill the pipe to equalize the pressure, and the motor will also stop. The pressure in an equalized or satisfied state will not produce any motion. It requires a cause to produce an effect. The air which filled the pipe was not the cause which produced the motion; it was only the medium on which the cause (pressure) acted. It was the condition of the air, not the air, which performed the work. There was more air in the pipe after the equilibrium was established than there was while it was being disturbed, but it was not in a state of potential; that is, it did not have, by its condition, the power to do work. In the illustration the primary work was done by driving the exhaust fan; the transformation of that motion was done through the pressure.

Suppose we take our pipe and close each end, then divide the pipe in the middle into two tight chambers. Now the air within each chamber is at atmospheric pressure, 15 pounds per square inch. Insert an air pump so that a portion of the air may be taken from one of the chambers and forced into the other. We will then have a partial vacuum on one side and an increased pressure on the other side of our partition, and each chamber will be in a condition known as a state of potential. That is, each chamber now has within itself the power to perform work, which may be done when Nature is allowed to equalize the pressure within the two chambers with the all-pervading pressure without. Should we connect the two chambers together by a pipe attached to a suitable motor, work would be performed when the air passes from the chamber of high pressure to that of lower pressure, and as long as we work our pump to increase the pressure on one side and decrease it on the other, Nature's efforts to equalize the pressure in the two chambers will continue. We will call our pump a dynamo. The two chambers are the positive and negative side of our dynamo. The valve of our pump performs that which the magnetism of our dynamo performs; that is, it raises the pressure on one side and decreases it on the other. The pipe by which we connect the two chambers together is our circuit. To assist us in this illustration, we wind up a clock; the main spring is coiled tight. When it is so, it is in a state of potential. The resilience of the spring will give back power when it uncoils. This spring receives and holds in store its power simply by a change of condition. It will do the same if placed in a vacuum, and we cannot see that an improbable ether is necessary to assist the spring in performing its work. In the first illustration a vehicle, such as air, or some other fluid, was necessary to be acted upon; but with the spring we produced the same effect through a change of physical condition.

Pressure is not visible, but it is pressure that performs the work in our steam boilers, and it is through its effect that almost all mechanical motion is performed. Cohesion is not visible, yet it holds great masses together. Sound is a condition, not a thing. Heat is motion, and motion is an effect.

Is it not possible that electricity is merely an effect? Is it not reasonable to suppose that this condition of electrical equilibrium extends to all matters and to all space? Our methods of producing electricity are simple means for disturbing the electrical equilibrium. The forces from which all motion comes—electricity, heat, light, magnetism, and chemical affinity—are the active agents of the universe. All material matter is simply acted upon; and these great vital giants are nothing. They are neither fluid nor solid. We have them as one form of energy; we easily transform them into another. But back of all are they not the several manifestations of some one great form of energy?

In conclusion, electricity is a condition, an effect of matter, and it is not peculiar to any material. This condition in a state of equilibrium pervades all matter and all space, ready to produce an effect when its equilibrium is disturbed; and we know of several ways to disturb the equilibrium—by magnetism, heat, and chemical effects.—*Electrical Industries.*

Probable Influence of Quick-Fire Guns on Naval Tactics.

Admiral Long, of the Britsh navy, read a paper recently before the United Service Institution, on the "Influence of Quick-fire Guns on Naval Tactics and on Construction."

The lecturer began by quoting from "Modern Naval Artillery," the work brought out last year in connection with the Elswick exhibits, the paragraphs describing the power of quick-fire guns in defeating torpedo boat attacks. A comparison is made between a ship using three ordinary and three quick-fire guns, and it is pointed out that not only do the latter guns discharge six times as many rounds as the former, but they also have a much better opportunity of striking the enemy, because she moves comparatively little each successive round. About twelve shots a minute is considered the highest practical speed on service, although some guns fire up to fifteen rounds per minute. With cordite or other smokeless powder, the lecturer suggested that a torpedo boat attempting to get through the zone of fire by daylight was engaged in a forlorn hope. In actions between ship and ship it seems probable that a vessel might be put out of action in half an hour by quick fire without armor-piercing guns coming into play. This opinion is held not only by the writer of "Modern Naval Artillery," but also by Mr. White, the Director of Naval Construction.

The change brought about by the introduction of quick fire is made apparent when it is remembered that in 1880 the ram was looked to as the weapon of paramount value. Then the torpedo rose into rivalry with it, until now the combination of quick fire and smokeless powder seems to put the gun into the important place which it held in the days of Nelson. The bearing of this on tactics is obvious. Admiral Bourgois and others have pointed out the advantages to be derived by a vessel attacking with her side presented at 45° to the direction of the enemy's fire, at and beyond which angle projectiles would not bite, but glance off. The lecturer then followed the probable movements of fleets attacking in certain lines of order, and discussed how far one ship can render support to another.

The question of side armor naturally suggests itself here. Admiral Long, like many naval officers, has "a soft corner" for a belt carried up to the platform of the guns, so as, at all events, to protect their racers, and hence their power of working. He, however, did not desire to push this question far, as he felt that the relative advantages of each system must be worked out by naval architects. The unprotected condition of a cruiser against quick fire was dwelt upon, and it was pointed out that, as the 6 inch gun was likely to be the heaviest employing quick fire, there seemed to be a special advantage in using armor on heavy ships of the thickness called for to resist this gun. This we might, by the way, point out can hardly be taken lower than 12 inches, even allowing for range and some indirectness of impact; in fact, a vessel carrying thicker armor than the Thunderer is needed, and with steel or compound plates instead of iron.

A very interesting point was raised in the now imperfectly protected and conspicuous position of the conning tower. This, the lecturer pointed out, could hardly fail to be destroyed by quick fire, or at all events the connections from it to the various parts of the ship. He argued, with much reason, that what we cannot protect we ought, as far as possible, to conceal. Unsatisfactory as armor may be, seeing that it cannot meet torpedo attack, the lecturer thought that the introduction of quick fire and smokeless powder had made it more than ever necessary.

From his review the lecturer concluded that in naval actions it will now be important to develop as heavy a fire as possible for a short time, with a view to which as many guns as possible of adequate power should be mounted. Coals will have to be replenished so often that other stores can be filled up at the same time, and all available weight should be devoted to offensive power. The naval architect's progress is now difficult, seeing that ships are a mark for destruction above and below water. Admiral Long seemed to think that there was much to recommend increased displacement.

What a Naval Carpenter Must Know.

According to the U. S. navy regulation, a candidate for the appointment of carpenter must be of correct habits and not less than twenty-one nor more than thirty years of age.

He must be a good mechanic, having a practical knowledge of shipbuilding, both in wood and metals, and of the qualities and strength of the materials used therein; he must be able to read plans, make working sketches, furnish estimates of repairs, and keep account of stores.

He must understand the care and preservation of ships and their fittings, and of stores; the principles of docking ships; and the use and care of service diving apparatus.

Metals at High Temperatures.

Professor Roberts-Austen, C.B., F.R.S., lectured recently at the Royal Institution upon "Metals at High Temperatures." Metallurgical problems are seldom dealt with at the Royal Institution, doubtless on account of the difficulty of illustrating them adequately by experiments, but on this occasion temperatures of 1,500 degrees and 2,000 degrees were measured as readily as if they had been within the range of the 300 degrees which marks the useful limit of the mercurial thermometer in daily use. Professor Roberts-Austen first traced the development of research work in apparatus for accurately determining high temperatures. Robert Boyle, some two centuries ago, made what were then considered important developments, but nothing satisfactory was accomplished until Sir William Siemens in 1860 took up the subject, and the Siemens electrical-resistance pyrometer has been until recently the only apparatus of any accuracy in determining high temperatures. The lecturer showed how sensitive is a balanced current of electricity to heat changes, and referred to Callender's recent investigations, by which in laboratory experiments it was possible to determine temperatures of over 1,000° C. to within such a fine point of accuracy as one-tenth of a degree.

The necessity for measuring the heat of comparatively small masses of metal led Professor Roberts-Austen to adopt a thermo-junction of platinum and of platinum alloyed with 10 per cent of rhodium, devised by Mons. H. le Chatellier, and later an iridium and iridium-platinum junction, capable of measuring degrees of heat up to 2,000° C., which he had himself devised. The professor went on to show that just as water in cooling down has a freezing point, so it is with metals. Metals also like water have a certain point which may be termed a recalescence, or at any rate a halting point, where for a certain appreciable period the temperature remains constant, or even rises, thus showing that laws similar to those relating to the behavior of water were at work. The freezing points of gold and palladium are 1,045° and 1,500° C. respectively, and the lecturer by means of a graduated scale, 70 to 80 feet long, upon which was thrown a spot of light from a sensitive galvanometer, showed the freezing points of these metals. That is, he melted the metals before the audience, who were thus able to observe the actual occurrence of the phenomena in question. He also showed an experiment which will probably be historic, viz., the actual operation and proof in the same manner as just named of the fusion temperature of one of the most refractory metals known, iridium. This metal only fuses at the enormously high temperature of 2,000° C. (3,632° Fahr.), or probably 400° to 500° C. above the temperature of the hottest molten steel. It was most interesting to see the spot of light travel on the large scale higher and higher until the high fusion point was arrived at. The heat requisite was produced by means of an oxy-hydrogen blowpipe.

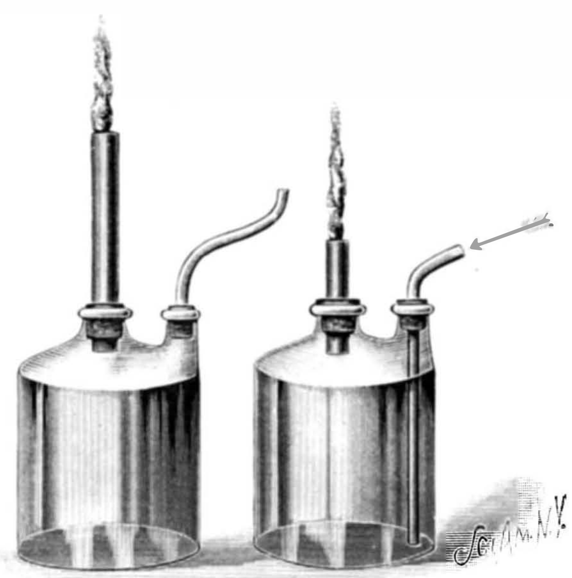
The spectroscopic work of Lockyer on the question of the dissociation of metals at high temperatures was touched upon by the lecturer, who was of opinion that many of the elements now considered as simple were, when at much higher temperatures, really compounds. For instance, the spectrum from iron vapor, supposed to exist in the sun's atmosphere, is not known in the same form on this mundane sphere. Attention was then called to the fact that iron at red heat had its constituent atoms much modified, for at such heat its well known magnetic properties were lost. This experiment was illustrated by similar means to those used for showing the freezing points of molten metals. A small piece of heated iron was shown to be impervious to magnetic influence, but upon reaching a temperature of about 700° C., or a medium red heat, its immediate regain of magnetic properties became apparent, the spot of light from the galvanometer employed showing by its rapid change in position the internal changes going on in the constitution of the metal. Another interesting experiment was shown as to the curious behavior of the metal iron when under thermal treatment. A bar, about 1 in. square and 2 ft. long, was heated for about 12 inches in its center portion. One end was then securely fastened to a support and the remainder overhung. To the overhanging portion was attached a heavy weight. The leverage caused a certain amount of flexion, but the greater portion of the bending occurred, not at the higher heat, but at a much lower one, probably 200° less, clearly showing the alterations of the internal arrangement of the atoms or crystals. In other words, the metal was apparently weaker at a lower than a higher temperature. Professor Roberts-Austen pointed out that, at any rate indirectly, such facts had considerable bearing upon practical every-day work, and he said that the strength of every rivet in the Forth Bridge, or every rail rolled, depended upon a correct appreciation of these and similar facts.

As regards alloys, the lecturer devoted some time to showing how the alchemist in olden times toiled and struggled in his crude way, and often by no means for mere selfish gain. By means of excellent diagrams, and prepared tin foils of different colors to imitate the alloys actually produced, he showed how subject were the metals to the influence of a second element, also into what intimate combinations such alloys entered. Thus gold, a yellow metal, by means of an addition of 10 per cent of aluminum, was turned into one of white color, and by a further 10 per cent into an alloy of wonderful and beautiful ruby appearance. Another interesting experiment was as follows: To molten lead was added a certain amount of gold, which formed an alloy of intimate combination. There was then added a small quantity of aluminum, which caused the whole of the gold to dissociate itself from the lead and to enter into combination with the aluminum. Thus, while gold is, aluminum is not, soluble in lead.

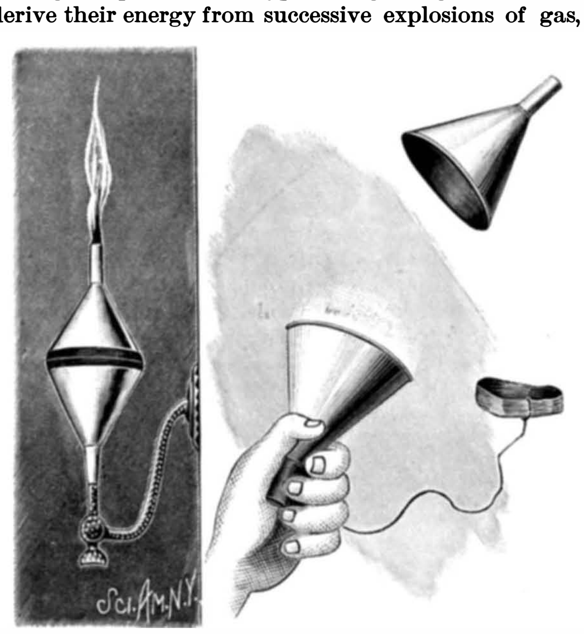
EXPERIMENTS WITH ILLUMINATING GAS.

T. O'CONOR SLOANE, PH.D.

When illuminating gas is mixed with the proper quantity of air, an explosive mixture is formed. If a light is applied to this mixture, a violent detonation occurs. Such explosives have been the cause of many accidents when gas has leaked and accumulated in rooms or cellars. Owing to diffusion, air always mixes with gas under such circumstances, and the first approach of a light causes an explosion which may wreck a building. The same has recently been exemplified in explosions in man-holes of the electric subways. Gas has accumulated in these, has mixed with air by diffusion, and by an electric spark or in some other way has become ignited. The consequence is well known in this and other cities. An explosion occurs, the man-hole is wrecked, the heavy iron lids are sometimes thrown long distances, and the pavement is disturbed often for a considerable area. In the useful sense gas explosions are applied in gas engines. These derive their energy from successive explosions of gas, which take the place of and are analogous to the successive admissions of steam to the cylinder of a steam engine.



GAS EXPLOSION AND BUOYANCY OF GAS WITH WOLFF BOTTLES.



GAS EXPLOSION WITH FUNNELS.

The explosion of gas can be very easily shown with a Wolff bottle. The method was used by the late Dr. Edward J. Hallock. To one neck of the bottle a wide glass tube about one half an inch in diameter and eight inches to a foot in length is fitted. A flexible India rubber tube is fitted to the other neck, so as to be easily removed therefrom. The India rubber tube connects with the gas supply. Ordinary street gas work perfectly.

The gas is turned on, and in a minute or less the bottle is full and gas escapes from the large tube. It is lighted, and may give a flame a foot in height. When the appearance of the flame shows that no air is mixed with it, the presence of the latter giving a blue effect, the gas supply tube is withdrawn from the neck of the bottle, and at once pinched with the hand to prevent further escape of gas, and the gas cock is then turned off. Owing to its light specific gravity, the gas rises out of the bottle and continues burning. Air of course is drawn in by the other neck, and diffuses through and mixes with the gas in the bottle. Soon the flame decreases in size, gets bluer and bluer, and finally sinks almost level with the mouth of the long glass tube. It assumes an almost green color, and the disk-shaped flame runs slowly down the tube and ignites the explosive mixture in the bottle. A sudden explosion occurs, the bottle appearing filled with flame. The glass tube should be held or strongly secured to prevent its being shaken out and broken.

The left hand figure in the cut shows the general arrangements. The right hand figure shows a method of illustrating the gas siphon that possesses some interest in this connection.

The same bottle may be used. For the long gas delivery tube of the first experiment a short one is substituted. To the other neck of the bottle a glass tube is fitted, reaching almost to the bottom of the bottle. Gas is admitted by this tube and is lighted at the mouth of the other tube. Now, on removing the gas supply pipe, leaving both tubes open, the gas almost goes out. There is nothing to force it out of the bottle. If now the experimenter will very gently, and for only an instant, blow against the mouth of the right hand tube as indicated by the arrow, he will blow gas down and out of it and fill it with air. He must at once cease blowing. This establishes the conditions of a gas siphon. The heavier air flows in and displaces the light gas, which at once begins to burn with quite a large flame, which, while it only lasts a short time, demonstrates admirably the principle in question.

A still simpler way of showing a gas explosion is illustrated in the next cut. Two common tin funnels and a wide India rubber band are all that are needed. The funnels are placed mouth to mouth and the band is sprung over their junction. It is well to tie a string to the band to prevent it from being thrown too far in the explosion.

The joined funnels are placed over a gas burner and gas is turned on and, after a few seconds, is lighted at the upper end of the stem of the upper funnel. After the flame is burning well the funnels are removed and the gas is turned off. The funnels are held with the lower opening quite free and not pointing against the hand or clothing. The flame burns quietly as the light gas rises until air begins to appear in it, the flame appearing bluer and less luminous. It gets smaller and smaller, just as described in the case of the Wolff bottle experiment, until it disappears, going down the tube, and in about a second a quite violent explosion occurs, blowing the funnels apart as shown.

To show a hydrogen explosion with this apparatus, the upper stem should be corked and a small hole should be drilled through the tin, just under the base of the stem of the upper funnel. The joined funnels may then be filled with hydrogen, which is lighted at the little opening. They are placed in a ring stand or other support. The tiny hydrogen flame gets smaller and smaller, after a while generally begins to sing, and finally, when it is almost invisible, the explosion, far more violent than that of coal gas, occurs.

Ice-Breaking Ferry Boat.

A most unique combination of mechanical and nautical skill, in its way, is the passenger car transfer ferry boat which for some time past has been operated in the Straits of Mackinac by the Duluth, South Shore and Atlantic Railroad. As described, it has an enormous capacity for carrying cars, but its peculiarities are its strength, its shape and the number of its steam engines. It carries twenty-four steam engines for performing the various requirements of the business in hand. The hull of the boat is a triumph of solidity, and the bow rises up and away from the water, so as to hang or slant over it as if it were a hammer—what, indeed, it is designed to be; this is because the boat is an ice breaker, intended to keep a channel open in the straits all winter, or to make one whenever it is necessary to encounter the massive ice that forms in that cold region, the big boat advancing toward the ice, and shoving its nose upon the edge, lifting herself upon it. Then a screw propeller under the overhanging bow performs the work of sucking the water from under the ice to enable the boat's weight to crush it down the more easily. Thus the monster makes its way steadily through the worst ice of the semi-polar winters of that region, climbing upon the ice, crushing it down, and scattering it on either side.

The New York City Elevated Railways.

On the Sixth Avenue line there are 500 trains daily each way; on the Third Avenue line, 504 trains; on the Second Avenue line, 272 trains; on the Ninth Avenue line, 205 trains—each way daily. The trains are run from one minute to eight minutes apart, depending upon the hour of the day. From midnight to 5 A. M., fifteen minutes apart. Fare, five cents.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM ENGINE VALVE. — Winfield S. Pattin, William M, Morse, and Douglas P. Pattin, Marietta, Ohio. This improvement relates to valves on steam pumps and similar reciprocating engines where the main valve is moved by a secondary steam piston, itself moved in turn by an auxiliary valve, and the latter operated by knockers moved directly by the main steam piston. An improved arrangement of steam ports, valve seats, steam pockets, etc., is secured by means of a central plate, and a novel form and arrangement is provided for the auxiliary valve and knockers. The latter are entirely within the cylinder casing and covered by the central plate and auxiliary valve, and being two solid pieces of wrought iron or steel, are not liable to injury or to get out of order.

Railway Appliances.

CAR COUPLING. — Edgar A. Yeaton, Lyons, Neb. The drawbar, in this coupling, is provided with an improved form of spring, whereby it will have a cushion bearing in whatever direction the car may move, the cushions effectually preventing undue shock to the drawhead or the contents of the car. The coupling pin is pivoted, and has a semi-cylindrical rear portion fitting in a concave rear portion of the drawhead chamber, the forward end of the pin having an upwardly and rearwardly extending horn, while the rear end of the pin overbalances its forward end, normally holding it in a horizontal position. A yoke secured to the pin and connected to elbow levers fulcrumed on the end of the car affords means of manipulating the pin, through pull rods extending to the top and sides of the car, the device being adapted to couple with an opposing drawhead having any form of link.

RAIL JOINT. — George G. Stacy, New York City. According to this improvement, the base plate, secured on the sleepers and supporting the rail, has vertical side flanges widened at the middle, while angle plates fitting the rail have lower recesses to receive the spikes and central recesses to receive the widened flanges, the upper portion of the plates fitting against the upper and lower portions of the rail web, and the upper edges being bent outward to fit against the shoulders of the rail. The invention is an improvement on a former patented invention, and is designed to afford an extremely simple rail joint to hold the meeting ends of rails so that they cannot move laterally or longitudinally.

RAILWAY FROG. — James E. Shaw, Council Grove, Kansas. This invention provides a frog which may be thrown into line with the rails leading to a siding or with the rails of the main track. The invention consists essentially of a plate on which the frog is held to move, while a simple system of connections is arranged between the frog and the switching rails. The frog and its connections are designed to afford improved means of safely and readily operating a railway switch.

TANK PUMP MECHANISM. — Charnick W. McMullin and William C. De Graffenried, Jasper, Fla. This is a mechanism to be operated by a train of cars to pump water to a tank at the side of the track, pumping up as much water as may have been delivered from the tank into the locomotive. A frame is mounted under short rail sections, carrying a crosshead under which are plate springs, and connected to the crosshead by straps is pivoted a rocking lever the outer end of which is connected with a lever in connection with the plunger rod of a pump. The rail sections are each about three feet long, so that the rear truck of one car will clear them before the next car runs on, and the parts are so proportioned that a movement of two inches at the inner ends of the sections will give a two foot stroke to the pump, the cylinders throwing forty gallons each at a stroke.

Mechanical Appliances.

SWING CUT-OFF SAW. — George Luppert, Williamsport, Pa. This invention relates particularly to improved hanger bearings and bracing of the frame in swing cut-offs for saws, in which the usual pendent swinging frame is employed having the saw arbor journaled in its lower end with the saw upon the end of the arbor. The improvement provides an inexpensive, simple, and durable construction in which only two journal boxes are employed where four are usually needed, thus saving considerable power in driving the shaft, besides dispensing with the extra boxes.

GUIDE FOR STAMP MILLS. — Edmund Major, Terraville, South Dakota. This guide has the usual girt or rail secured in the usual manner to the battery posts of the mill, and a hollow keeper is provided for the guide blocks of the stamp stems, this keeper having bolt apertures through its inner wall and being provided with downwardly and outwardly inclined connected sides having oppositely projecting clamping flanges at their outer edges. The arrangement is such as to permit of readily and quickly adjusting the bearing or guide blocks for the stem to take up all wear, and also permit of removing a tappet from the stem without disturbing the entire guide.

BOX NAILING MACHINE. — Frank J. Hawley, Phelps, N. Y. The supporting frame in this machine has transversely arranged abutments provided with longitudinal channels in which slide plungers connected with spring-pressed bell crank levers, connected by adjustable links with treadles, an independent treadle being adapted to actuate the other treadles together or separately. The machine is specially designed for rapidly and conveniently nailing the sides and bottom or cover together to form a box. Its extension frame is arranged to be lengthened or shortened for different sized boxes to be nailed, and the table of the frame is made of two sections adapted to support at their joint the box to be operated on, the abutments being secured on top of these table sections.

MOTOR. — William H. Scheer, Frankfort Station, Ill. This is a device more especially designed to be actuated from a windmill, to drive a churn, grinding wheel, or other similar small machines, and is simple and durable in construction, taking up very little room, and readily connected with a motor or with machines to be driven. There is a ratchet wheel on the main driving shaft, on which are loose pinions each carrying a pawl engaging the ratchet, a gear wheel in mesh with one of the pinions, and a second gear wheel in mesh with an intermediate pinion engaging the other loose pinion, while a swinging lever is connected at opposite ends of its fulcrum by links with the gear wheels. The swinging lever is pivotally connected with a rod or link having a reciprocating motion and driven by the windmill, a continuous rotary motion being imparted to the main shaft on both the up and down stroke of the lever.

Agricultural.

CORN HARVESTER.—Grant Pendleton and McClellan C. Pendleton, McComb, Ohio. This invention provides a machine of simple construction designed to cut two rows of corn fodder at a time and deliver it in bundles at the sides of the machine. As the machine is drawn lengthwise of the rows the stalks are severed by horizontally rotating cutters and fall backward upon shields, from which they slide upon leaves, and when a sufficient number of stalks has accumulated the driver presses down upon a treadle, whereby the leaves are swung upward and outward, depositing the stalks at the sides of the machine.

FRUIT PICKER.—John W. Cain, Rusk, West Va. This is a device to enable one standing on the ground to pick fruit from the tops of trees and deliver the fruit in a sack carried by the operator. It has a two-part handle long enough to reach well into the top of a tree, a movable part sliding in keepers on the fixed part, and two swinging jaws are connected by rods with a lever near the lower end of the handle. The jaws are placed to embrace the fruit, which is cut off when the jaws are provided with a knife, or may be pulled off if desired, when it rolls down an attached spout into a sack.

SEED PLANTER AND FERTILIZER DISTRIBUTER.—Thomas E. Schumpert, Spring Ridge, La. This device is adapted to be pushed forward by hand, and has a single drive wheel journaled in the front end of the frame, behind which is a furrow-opening plow, just in front of a seed hopper and a fertilizer box, both having chutes on their lower end for the passage of seed and fertilizer to the ground. Valves in the bottom of both boxes are operated by a lever extending forward, where it is engaged by lugs secured on the side face of the drive wheel, while crank arms on the drive shaft operate a pitman to give motion to agitators within both boxes. At the rear end of the frame are covering shovels to cover the furrow, seed and fertilizer.

Miscellaneous.

BRICK KILN. — Charles Klose, Doniphan, Neb. This kiln is an elongated structure with adjoining kiln sections having no permanent partitions, each section having a door opening in its side wall and a flat removable top supported by the green brick to be burned, while there are stoke holes with removable covers and a series of fire chambers at one end, a series of perforated transverse flues provided with dampers extending beneath the kiln sections and communicating with a draught stack. The kiln is designed to be constructed at a low cost, and afford means for the continuous operation of one or more sections, the burning being effected in one or more sections while the other sections are being emptied or filled.

PLUMB LEVEL. — Oscar B. Fuller, Pittsburg, Kansas. This is a measuring instrument with a stock on which is a degree scale, in the center of which is pivoted an arm having an indicating line, a tongue hung on centers in the arm having its lower end weighted and its upper end pointed, while a pointer is secured in the outer end of the pivoted arm and arranged in line with the indicating line, registering with the tongue. The instrument is of simple and durable construction, and adapted to conveniently and accurately indicate in degrees the position of a beam or similar object, while it can also be used as a level, plumb or theodolite.

AIR COOLING AND PURIFYING APPARATUS.—Israel F. Good, Allentown, Pa. Rotating centrally in a casing is a vertical shaft carrying a fan wheel at its lower end, above which is a tray containing an aromatic substance, and above the latter a gravel tray in which is rotated a water sprinkler, while still higher up are trays containing charcoal and lime. As the shaft revolves, the air is drawn downwardly through the machine, first having contact with the lime, then being filtered through the bed of charcoal, after which it is cooled and brought in contact with the aromatic substance, from which it is drawn through the fan wheel and discharged at the base of the apparatus, the movement of the wheel causing a lateral distribution of the cooled and purified air.

REFRIGERATING COVER. — James B. Mitcheltree, Burnet, Texas. This cover consists of a dished receptacle adapted to contain water and provided with a central covered ventilating tube. The cooling of the vessel to which the cover is applied is effected by capillary attraction, water being placed in the dished cover, and the bottom and sides of the vessel covered by an absorbent envelope, preferably strips of woven fabric, whose upper edges are immersed in the water in the cover. The entire vessel may thus be kept cool, while the interior is thoroughly ventilated and the entry of dust and insects prevented.

BOOK REST AND WRITING SLAB.—Charles K. Gaines, Canton, N. Y. This invention provides an improved adjustable attachment for the arm of a chair or other seat, the device being adapted for dual use as a book rest and book holder, and also to support writing paper, movably retaining either article in any desired position. The prop bar of the writing slab has an interlocking engagement with a ratchet-toothed rack for adjusting the slab at any desired inclination, and the attachment of the clamping bar to slide blocks is so arranged that the reader can instantly change the degree of inclination of the book ledge to raise or lower one side edge of the book, to suit the incidence of light rays or the vision of the occupant of the chair.

COMBINED CRADLE AND CHAIR. — Calvin T. Freid, Allentown, Pa. This device is composed of end uprights from which a bed bottom or platform is suspended, a detachable articulated body section being adapted to receive the raised bottom, and the latter section, when detached from the platform or bed portion of the cradle, constituting a crate-like chair or inclosed seat within which the child may stand or sit, with freedom for exercise.

PLAITING MACHINE — Alfred Olson, Galveston, Texas. This is a machine upon which a dress skirt or similar article may be readily placed to secure the plaits or folds in the skirt and hold them so that they may be conveniently ironed. It consists of a table on the top of which near the ends are arranged cross strips carrying a series of plait-holding clasps, each clasp comprising a swinging plate adapted to be pressed on the cross strip, while in arm supported above the plate is mounted a screw impinging on the plate. The strips may have gauge marks to assist in making plaits of equal width.

INKSTAND.—Liston B. Manley, Duluth, Minn. The novel form of inkstand provided by this patent is designed for attachment to a desk or other support in such way that it may be quickly and conveniently adjusted vertically or laterally, an attaching bracket being used in connection with a vertically and horizontally swinging arm, and the improvement being especially designed for use with a roll top desk. The ink bottles or wells are so hung in the stand that they may be turned as upon a universal joint, to carry them either to the right or to the left, or to tilt them upward or downward. Means are also provided whereby coverless ink bottles may be effectually closed when not in use.

LADY'S WORK BOX.—Thomas Harper, Redditch, England. This is a portable sewing cabinet composed of a series of folding panels inclosing a central chamber or box-like compartment, and being in the form when closed of a satchel or reticule. It may be made of leather, plush, silk, or similar suitable material, to form a neat and ornamental work box of great convenience for ladies in doing fancy and domestic needle work.

HYDROCARBON BURNER. — Lewis B. White and John V. Reitmayer, New York City. This is a burner of simple, durable and inexpensive construction, in which means are provided for quickly and easily cleaning the oil duct, while the arrangement is such that the air may be brought in contact with the oil, to spray it, at the upper portion of the burner. The amount of air supplied to the burner may also be regulated at will, or may readily be entirely cut off.

OIL CAN AND LAMP FILLER.—Henry C. Atkinson, Franklin, Ky. This can has air inlet and air-compressing devices, in combination with a discharge pipe to which a filling tube is detachably connected. Connected with the air inlet is a simple form of bellows, by working which the air is forced against the oil to cause the latter to flow out through the filling tube into the lamp. The can is also adapted for use as a shipping or storage can, when caps are placed over its openings to seal the can.

BARREL RACK.—John A. Browning, Iowa City, Iowa. This device is made with two side pieces or runners having casters and connected by girts or brace beams, and in connection with the rack thus formed a lever is employed, by means of which, with a chain and claw, a barrel may be readily brought to a vertical position upon the rack, for ready conveyance to any desired place. The device is very simple and inexpensive, and the rack is adapted to hold the barrel while its contents are being drawn off.

WAGON RUNNING GEAR.—Gustav W. Loeffler, Apopka, Fla. The standards of this wagon are preferably formed with side plates, and have an opening to receive the ends of the spring, the plates being lapped at their lower ends alongside the bolster or axle, the connection facilitating the easy application and removal of the springs, and permitting them to be set sufficiently high to bring their maximum elasticity into play. The perch also may be quickly applied and removed and the rear axle may be adjusted along the perch as desired.

VEHICLE. — Richard Rodgers, Cheyenne, Wyoming. This invention relates to an improvement in that class of vehicles known as carts or sulkies, providing therefor a simple, durable and economic construction, and means whereby a tongue or pole and shafts may be used interchangeably, and adjusted to bring the horse as near the driver's seat as desired, or remove him as far away as may be wished, the vehicle being especially adapted for use in breaking horses to harness.

CARRIER.—William C. Hall, Pine Bluff, Ark. This carrier is more especially designed for transporting merchandise to and from warehouses, and unloading boats, railroad cars, drays, etc. It is constructed with a frame in the top of which are journaled parallel rows of friction rollers to support the load, which is engaged by arms extending from a carrier belt traveling in the frame. The carrier is made of any desired length by means of additional frames and sets of friction rollers, the last extension frame in the row being connected with an inclined frame.

ELASTIC TIRE CLAMP.—Jesse T. Morris, Jr., Portsmouth, Va. This improvement provides for securing elastic tires to bicycle wheels without cement. An elastic clamping ring of metal is embedded within the continuous hollow tire, when the latter is formed, or may be inserted in a slit in the tire, a stud bolt on the ring passing through slots in the tire and the wheel rim. This means for holding the tire in place on the wheel rim leaves the tread portion of the tire unstretched, so that a transverse cut in its outer surface will not cause a gaping fissure.

ARTIFICIAL ARM.—William Boardman, Chicago, Ill. This is an attachment for crippled or weak arms, to permit the wearer to use the arm for conveniently manipulating hammers, saws, and other tools. It consists of a clamp adapted to receive the handle or other part of the tool, in connection with a frame to be secured to the arm and rigidly engaged with the clamp.

ATOMIZER.—Antoinette Howard, New York City. From the bottom of a small cup extends an upwardly curved suction pipe, terminating in a nozzle, and on the back side of the pipe is a brace to which is secured a blow-pipe arranged at right angles to the nozzle of the suction pipe, there being a handle on the under side of the blow-pipe. As the air from the contracted outer end of the blow-pipe passes over the open end of the nozzle of the suction pipe, the liquid is drawn upward from the cup and sprayed by the current of air.

PHOTOSCOPIC ADVERTISER. — Paulino Ortega, Mexico, Mexico. This is a device for attachment to electric lamps, for projecting upon the sidewalk or other surface words, figures, characters, etc., for advertising purposes. An adjustable mirror is attached to the frame of the lamp, an adjustable condensing lens placed between the source of light and the mirror, while a screen attached to the support of the lamp bears a device for casting a shadow, the mirror being arranged to receive light from the lamp condensed by the lens and project it onto and through the screen.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

NEW BOOKS AND PUBLICATIONS.

SEEGER & GUERNSEY'S CYCLOPEDIA OF THE MANUFACTURES AND PRODUCTS OF THE UNITED STATES. New York: The Seeger & Guernsey Company. 1892. Pp. cxc, 902. Price $10.

This voluminous work contains a classified list of leading business and manufacturing firms of the United States. The first part, numbered in Roman numerals, is an index of articles of manufacture with reference to the parts of the work where the firms handling such articles are indexed. Nearly two hundred pages are occupied with this index alone. The main body of the work, over nine hundred pages in length, gives the firm names classified by their business. Thus section VI, *chemicals, drugs and dyes*, fills about 18 pages. It is divided again into such headings as *acetanilid*, acetone, *acids*, and others, and some of them are again subdivided, as *acids* into *acetic acid*, *arsenious acid*, benzoic *acid* and many other subdivisions. The utility of such a work is so manifest that it need not be dilated on. The system of division is especially dwelt on, as it gives the character of the work. The last part is devoted to advertisements of firms, which for reference are often as useful as any other part.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Wanted—50 second-hand screw-cutting lathes, 8 to 12" swing, either foot or steam power. Will pay cash. W. P. Davis, Rochester, N. Y.

Acme engine, 1 to 5 H. P. See adv. next issue.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

6 Spindle Turret Drill Presses. A.D. Quint, Hartford, Ct.

For foundrymen's metallic pattern letters and figures send to H. W. Knight & Son, Seneca Falls, N. Y.

Patent Open-Side Planing and Shaping Machines. Pedrick & Ayer, Philadelphia, Pa.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Job lot of small electro motors. Send for circular. Goodnow & Wightman, 63 Sudbury St., Boston, Mass.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Centrifugal Pumps for paper and pulp mills. Irrigating and sand pumping plants. Irvin Van Wie, Syracuse, N. Y.

Machine shop, with established business, for sale. Or will take expert machinist as partner. Apply Ward's Ship Yard, Astoria, L. I. City, N. Y.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For the original Bogardus Universal Eccentric Mill, Foot and Power Presses, Drills, Shears, etc., address J. S. & G. F. Simpson, 26 to 36 Rodney St., Brooklyn, N. Y.

Competent persons who desire agencies for a new popular book, of ready sale, with handsome profit, may apply to Munn & Co., Scientific American office, 361 Broadway, New York.

For Sale—A valuable invention, drill hole magnet used for railroad building, mining, rock quarrying, and artesian well boring. Will sell the whole right cheap. Address J. Burton Peirce, Ivanhoe, Wythe Co., Va.

A middle aged married man, a traveled salesman of experience, now permanently located at Denver, Colo. (pop., 150,000), where he has extensive acquaintance, desires agency of some Eastern or foreign specialty. Address Brewster & Co., Mendota Block, Denver, Colo.

For Sale—Half interest in patent on machine for rolling hollow rods and bars, dated Feb. 9, 1892, No. 468,655. Also on casting machine for moulding hollow ingots and billets, patented June 30, 1891, No. 455,200. No agents need apply. See illustration, page 150. Address J. S. Griffin, Roslyn, Wash.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

INDEX OF NOTES AND QUERIES.	No.
Gilding solution, to correct	4079
Photography, double	4081
Gold solution, to precipitate	4082
Oxygen, to make	4084
Gas generating under pressure	4085

(4078) C. D. asks: 1. What would be the pressure of 1 square inch of coal gas when heated in a brass box that would barely hold it with heat applied from a common gas jet? A. About three or four atmospheres, depending on the size of the flame and its quality. 2. What is the heat from a common gas jet? A. About 2,000° Fah., but no definite figure can be given. 3. Will water or steam be forced through the pores of brass with a pressure of three pounds? A. No. 4. Will brass tubes rust when filled with water? A. A little. 5. Or gasoline? A. No. 6. At what heat will gasoline explode without fire being applied? A. Gasoline will not explode. Mixed with air, the mixture will inflame at a red heat.

(4079) J. L. M. writes: 1. I have a cyanide of gold solution for plating which is too yellow. What will I do to give it the proper color? A. If it plates well, do not mind the color. Otherwise evaporate to dryness, redissolve in two-thirds the original volume of distilled water, add a little fresh cyanide and filter. You have possibly plated dirty articles in the bath. 2. Also please give me the proper dimensions of the coil in Blake transmitter, the number of turns of primary and secondary wire and gauge, length of coil when wound. A. See our SUPPLEMENT, No. 250.

(4080) H. W. W. writes: 1. I have got a spring of water that discharges a hundred and fifty gallons a minute. I have got a fall of eighteen inches. It revolves a model breast wheel ten inches diameter, eight inch face, a hundred and twenty-five revolutions a minute. Will you please let me know what power it develops? I want to find out if I can get power enough from the stream to run a pump to elevate half of the discharge twenty feet into a tank. A. Your water power is one-twentieth of a horse power. You cannot raise more than 6 gallons per minute to the height you state with the power of the stream by a wheel and pump. With a well arranged hydraulic ram you can raise about 20 gallons per minute to your tank. 2. How to take the gold from platinum that has been used to solder platinum to platinum and not injure the platinum and save the gold. A. To separate gold and platinum, boil with mercury. The latter will take up the gold and leave the platinum. After treating several times with fresh mercury distill off the mercury, to obtain the gold from the amalgam.

(4081) P. M. T. says: I have seen, both in professional and amateur work, photographs of one person in different costumes and yet in the same picture; will you please explain through your paper how I can take these double pictures? A. Box placed in front of the lens, having doors or slides to permit only one-half of the lens being exposed, takes the picture only on one-half the plate. The door or shutter is moved sidewise to expose the other half, showing the same party looking at himself. See SUPPLEMENT, Nos. 818, 825, 826.

(4082) W. H. H. writes: I have some chloride of gold in solution and do not know the strength or how many grains to the ounce. Can you give me a rule whereby I may determine how much gold is in solution? A. Precipitate a measured quantity with ferrous sulphate solution (green vitriol) and wash the precipitated gold, dry, ignite, and weigh.

(4083) R. M. asks for the chemical action in a galvanic cell when iron is used for the positive plate and the liquid is a saturated solution of common salt. A. The iron oxidizes slightly and the cell becomes polarized. $2 Fe + 6 H_2O = Fe_2(OH)_6 + 6H$.

(4084) D. F. asks: I would like you to give me some information in the SCIENTIFIC AMERICAN: 1. How to make oxygen for inhalation without much expense and for home purpose. A. To make oxygen, heat 2 parts chlorate of potassium and 1 part manganese binoxide mixed. 2. What effect have the fumes of burning saltpeter on the air in a bed room? A. We do not know what you mean by "burning saltpeter." Heated saltpeter would give off nitrous fumes that would act as a disinfectant, but would tend to corrode metal fixtures. 3. What greater per cent of oxygen in an altitude of 5,100 feet than 200 feet? A. The proportion of oxygen in the air is practically the same at all altitudes.

(4085) G. L. G. says: If a sufficient quantity of muriatic acid and soda were put in a very strong vessel, would the reaction continue until it burst the vessel, or would it stop at a certain pressure? At what pressure would it cease? What would be the approximate weight of a reservoir, capacity one cubic yard, capable of sustaining a pressure of 500 atmospheres? A. The reaction would continue until the combination is complete. The highest pressure would be from 600 to 1,000 lb. per square inch, at which pressure the gases will be absorbed or condensed into a liquid state. The shape of the reservoir has much to do with the pressure it will bear. A steel tube 4 in. bore, 1 in. thick, 14 ft. long, will hold one cubic foot and be safe for 75,000 lb. pressure per square inch.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

February 23, 1892,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Accouterment, J. W. Frazier ... 469,444
Adjustable die, F. Armstrong ... 469,622
Advertising apparatus, automatic, W. C. Jennings ... 469,652
Alarm. See Burglar alarm. Fire and burglar alarm. High and low water alarm.
Amalgamator, J. H. Hawthornthwaite ... 469,566
Animal trap, G. H. Wells, Jr ... 469,429
Atomizer, electrical, C. Lightbody ... 469,481
Auger, earth, T. Smith ... 469,307
Auger, earth, W. H. Tyler ... 469,427
Auger heads, die for forming, S. H. Jennings ... 469,448
Auger, post, O. P. Whipple ... 469,290
Autographic register, J. Kirby, Jr ... 469,666, 469,667
Automatic brake, G. Bowler ... 469,535
Badge and pencil holder, combined, J. J. Phare ... 469,529
Bar. See Pantograph bar.
Basin strainer and stopper, H. H. Craigie ... 469,513
Bath and wash tub, convertible, N. F. Hurdel ... 469,570
Bed covering, atmospheric, W. Holder ... 469,247
Bed, folding, W. S. Gunn ... 469,518
Bed lounge, W. Petersen ... 469,567
Bicycle, F. Douglas ... 469,339, 469,627, 469,630
Bicycle handle, spring joint for, W. Parkes ... 469,592
Bicycle lock, A. Israel ... 469,651
Bicycle pedal, F. Douglas ... 469,295
Bicycle saddle, F. Douglas ... 469,628, 469,629
Binder elevator, self, J. J. Jones ... 469,572
Blasting plug, timber, M. L. Finley ... 469,297
Block. See Paving block.
Board. See Bread board. Pastry board.
Boiler. See Steam boiler. Water tube boiler.
Boiler feeder, automatic, G. B. Hutchings ... 469,250
Bolts, making, M. Moran ... 469,261
Book, ledger, sales, and billing, J. E. Depue ... 469,549
Book, trade, W. R. M. Cooper ... 469,546
Boot or shoe counter, W. T. Martin ... 469,258
Boots or shoes, dyeing and polishing parts of, W. W. Crooker ... 469,385
Boots or shoes, machine for finishing parts of, J. F. Swain ... 469,379
Boring tool, J. T. Kiehner ... 469,503
Bottle holder, nursing or feeding, C. H. Leonard ... 469,480
Bowling alley, portable, S. Hoyt ... 469,249
Brake. See Automatic brake. Car brake.
Brake handle, Fosburgh & Milligan ... 469,401
Bread board, J. Woolridge ... 469,413
Brick grinding machine, W. F. Stedman ... 469,643
Brick machine, M. Bierline ... 469,225
Brick machine and mould sander, Farnen & Mulloy ... 469,399
Brick mould sander, Farnen & Mulloy ... 469,400
Bridge gate, J. Scheubeck ... 469,321
Bridges, shaft coupling for lift, G. B. Clark ... 469,314
Bridles, elastic overdraw head check for, P. F. King ... 469,653
Brush, shoe, M. A. Goodman ... 469,633
Brushes, machine for making, P. Kennedy *et al.* ... 469,479
Buckle, D. L. Smith ... 469,440
Building, exhibition, O. Hammerstein ... 469,472
Building, portable, A. Chase ... 469,638
Bureau, D. C. Clapp ... 469,542
Burglar alarm, L. Pentz ... 469,365
Burglar alarm for windows, electrical, F. C. Page ... 469,266
Burner. See Gas lighting burner. Stove burner. Vapor burner.
Cable grip, T. Otto ... 469,318
Calculator, mechanical, T. Mader ... 469,579
Can. See Sliver can.
Can cooling machinery, C. B. Kendall ... 469,389
Can filling device, A. Siebert ... 469,278
Can head feeding apparatus, C. B. Kendall ... 469,388
Can tester, B. F. Buckley ... 469,396
Can testing machine, W. B. Page ... 469,302
Car brake, M. H. Molloy ... 469,423
Car brake, electric, E. S. Amrock ... 469,383
Car coupling, J. L. Carr ... 469,540
Car ceupling, L. W. Carson ... 469,541
Car coupling, A. Frantz ... 469,340
Car coupling, J. W. Klingler ... 469,576
Car coupling, S. J. Meeker ... 469,327
Car coupling, P. M. Reagan ... 469,409
Car coupling, T. M. Stuart ... 469,284
Car coupling, automatic, E. Bowen ... 469,228
Car pilot, street, J. W. Abrahams ... 469,291
Cars, spark deflector for railway, L. C. Terry ... 469,609
Carbon pencils, apparatus for pointing, P. Moses ... 469,486
Card or picture support, P. Lindemeyer ... 469,436
Carding machine, E. O. Zeunert ... 469,381
Carpet sweeper, G. W. Kelley ... 469,573
Case. See Piano case. Traveler's case.
Cash carrier apparatus, J. Starr ... 469,282
Cash register and indicator, H. Cook ... 469,544, 469,545
Chain, drive, H. Guthrie ... 469,298
Chain link, H. E. Kelley ... 469,449
Chair. See Railway rail chair. Reclining chair.
Check hook, T. H. Gordon ... 469,418
Check row wire, G. D. Haworth ... 469,403
Chisel for mortising machines, F. E. Viger ... 469,360
Churn, H. C. Anderson ... 469,511
Clasp, B. Fontan ... 469,237
Clasp, J. G. Schmidt ... 469,274
Cleaner. See Seed cleaner.
Cloak hanger, W. Bardsley ... 469,223
Clock, alarm, S. N. Behrman ... 469,644
Cloth pressing machine, D. Gessner ... 469,372
Cloth stretching machine, C. Laval ... 469,256
Clothes drier, S. Steuert ... 469,308
Coal, etc., machine for automatically moving, W. Keenan ... 469,478
Coat hook, H. C. Hart ... 469,564
Coin-operated lock, B. S. Dodge ... 469,294
Coin or check controlled device, E. I. Wilson ... 469,393
Commutator cleaning device, W. J. Phelps ... 469,319
Composition tub, tank, etc., W. E. Clow ... 469,416
Compound engine, H. See ... 469,455
Cooler. See Milk cooler.
Copy holder, H. A. Isberg ... 469,251
Corn sheller, G. N. Joss ... 469,523
Corset, D. H. Warner ... 469,616
Cotto napparatus for and process of cleaning seed, W. P. Groom ... 469,560
Cotton, process of and apparatus for ginning, W. P. Groom ... 469,459
Coupling. See Car coupling. Hose coupling.
Cow tie, H. E. Kelley ... 469,254
Crucibles or other vessels, process of and apparatus for controlling the discharge of molten contents of, A. J. Rogers ... 469,454
Crusher. See Stone crusher.
Cultivator, C. W. Clark ... 469,659
Cultivator, Nehf & Mitchell ... 469,588
Cultivator, F. R. Winter ... 469,311
Curling iron, R. Nicol, Jr ... 469,375
Cutter and cutter holder, E. W. Cooke ... 469,625
Derrick, D. Crowley ... 469,497
Desk, school, C. Schuster ... 469,378
Die. See Adjustable die.
Disconnector, automatic, A. L. Johnston ... 469,253
Draught regulator, automatic, I. F. & F. C. Beers ... 469,462
Drier. See Clothes drier.
Drilling machine, multiple, C. H. Scott ... 469,600
Drying kiln, J. S. Parmenter ... 469,268
Duplicating register, J. Kirby, Jr ... 469,665
Dust collector, A. C. Brantingham ... 469,646
Dye, blue, A. Weinberg ... 469,329
Dynamos or motors, speed regulator for, L. H. Leber ... 469,257
Edger, gang, F. W. Cook ... 469,543
Electric cable, H. V. Hayes ... 469,522
Electric cable, Hayes & Stone ... 469,475
Electric conductor conduit, E. T. Greenfield ... 469,470
Electric conductor for metallic circuits, S. W. Holman ... 469,248
Electric conductor tube, E. T. Greenfield ... 469,469
Electric elevator, R. Watson ... 469,361
Electric lighting system, J. F. McElroy ... 469,656
Electric machine, M. Von Dolivo-Dobrowolsky ... 469,515
Electric machine, dynamo, J. Sohlman ... 469,281
Electric wires, moulding for, Gritten & Parmley ... 469,241
Electrical cells, diaphragm for, C. N. Waite ... 469,428
Electro-magnetic reciprocating engine, M. J. Wightman ... 469,441
Elevator. See Binder elevator. Electric elevator. Hydraulic elevator.
Elevator, Bell & Welsby ... 469,368
Elevator controller, E. S. Matthews ... 469,655
Emery wheels or grindstones, hood, casing, or covering for, G. W. Wilson ... 469,310
Engine. See Compound engine. Electro-magnetic reciprocating engine. Pumping engine. Steam engine.
Engine attachment, steam or other, Powers & Grevert ... 469,303
Engine stopping apparatus, J. P. Tirrell ... 469,669
Engines, electro-magnetic stop motion for steam, W. W. Hailstone ... 469,471
Engines stop motion for, J. A. Matteson ... 469,326
Envelope machine, W. Piper ... 469,391
Eraser, ink, G. W. Prouty ... 469,304
Eyeglasses, E. B. Meyrowitz ... 469,437
Feed water heater, T. Lyman ... 469,405
Fence, S. S. Barrett ... 469,532
Fence machine, T. W. Carmichael ... 469,539
Fence post, R. R. Spoore ... 469,322
Fence stay, wire, W. M. Skelton ... 469,604
Fence support, wire, F. B. Weeks ... 469,492
Fencing, metallic, B. F. Randall ... 469,596
Fertilizer distributer, C. D. Cutts ... 469,370
Fertilizer distributer, T. A. Hightower ... 469,245
Fiber cleaning machine, J. G. Badia ... 469,222
Fibrous materials, rotary disintegrator and separator for, B. Ziegler ... 469,495
Filter, V. H. McConnell ... 469,450
Fire alarm system, H. Redding ... 469,376
Fire and burglar alarm, T. J. Gordon ... 469,648
Firearm, breech-loading, A. A. Haines ... 469,561
Fire escape, friction, J. L. Gardner ... 469,239
Flags, making, H. A. Bowman ... 469,395
Floor cloth or like fabrics, manufacturing, H. W. Godfrey *et al.* ... 469,240
Flounce and belt, combined, A. Neuville ... 469,637
Flower pot tray, W. Steers ... 469,490
Foot, artificial, J. H. Kane ... 469,348
Forging wrought metal wheels, die for, A. A. Stevenson ... 469,457
Funnel cut-off, automatic, J. H. Driller ... 469,639
Furnace. See Glass furnace. Tire furnace.
Furnace, C. B. Hughes ... 469,664
Furnaces, device for increasing the draught in steam boiler, P. E. Williams ... 469,620
Game apparatus, M. E. Favor ... 469,554
Game apparatus, T. J. Loveland ... 469,578
Game counters, etc., making, J. A. Devantery ... 469,344
Game counters, mould for forming, J. A. Devantery ... 469,345
Gas, apparatus for the manufacture of, J. R. Kendall ... 469,574
Gas lighting burner, automatic electric, Nourse & Lane ... 469,408
Gas regulator, B. F. Day ... 469,464
Gate. See Bridge gate. Sliding gate.
Gate, W. Curtis ... 469,514
Gate hooks, manufacture of, J. H. Alker ... 469,621
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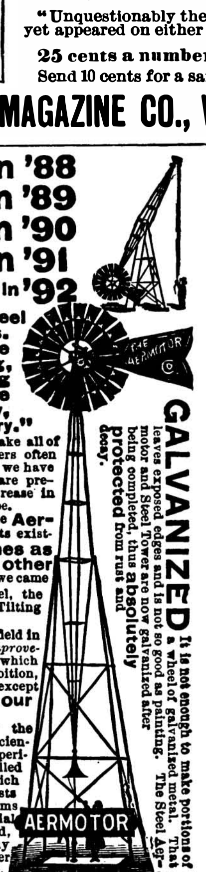

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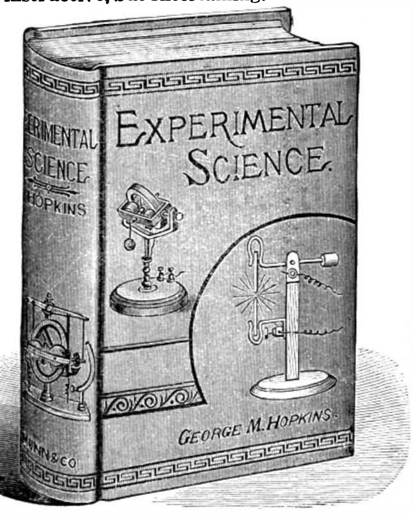

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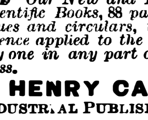

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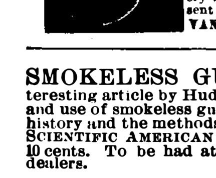

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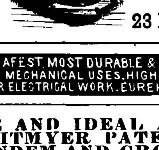

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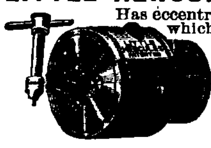

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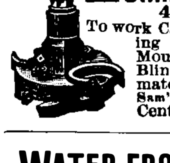

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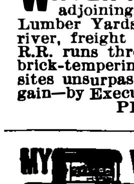

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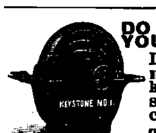

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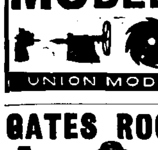

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