SCIENTIFIC AMERICAN

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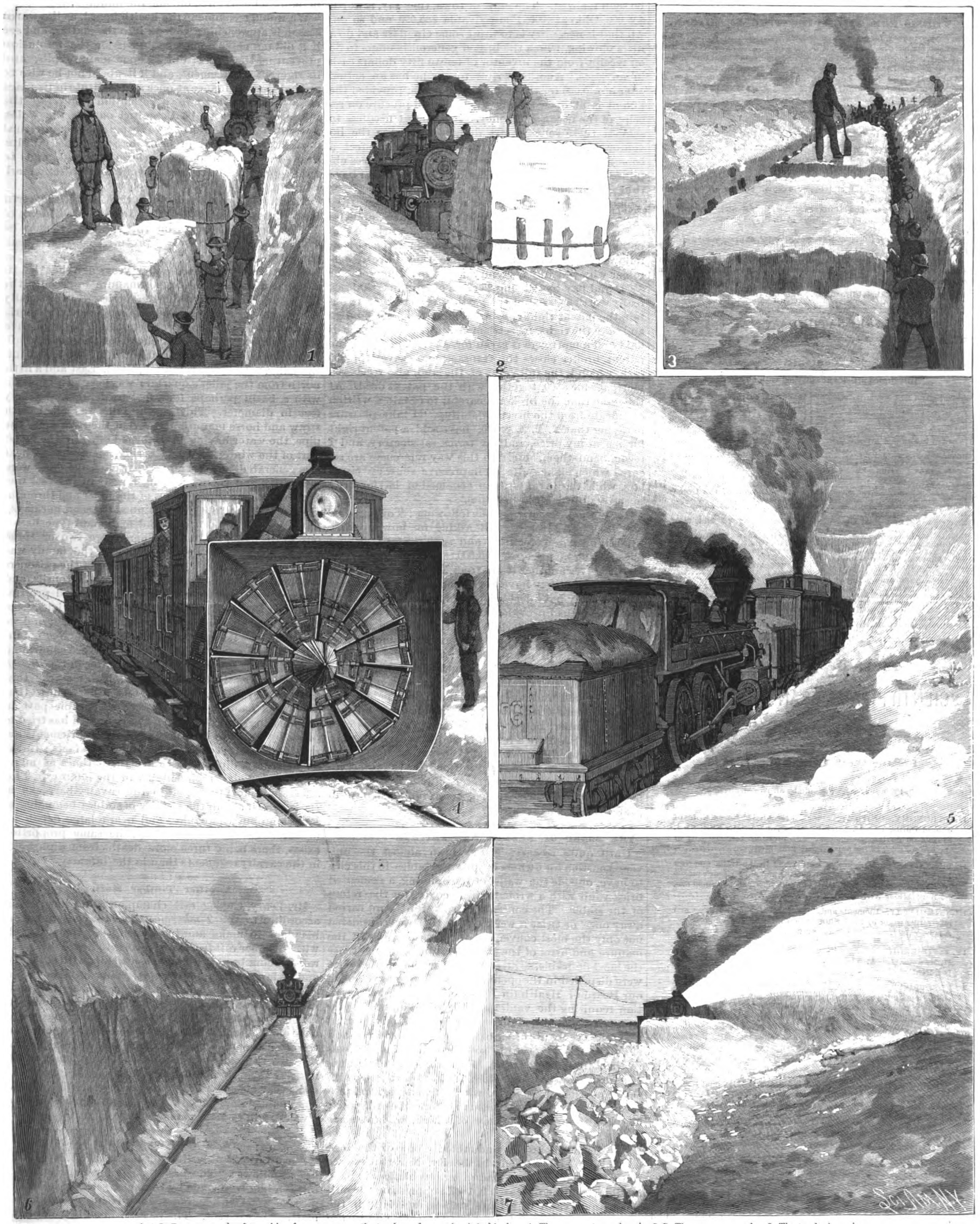

1, 2, 3. Common mode of trenching frozen snow on the tracks and removing it in blocks. 4. The rotary steam shovel. 5, 7. The rotary at work. 6. The track cleaned.

REMOVING SNOW FROM RAILROAD TRACKS—THE OLD WAY AND THE NEW.—THE ROTARY STEAM SNOW SHOVEL.—[See page 277.]

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NEW YORK, SATURDAY, MAY 5, 1888.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 644.

For the Week Ending May 5, 1888.

Price 10 cents. For sale by all newsdealers.

PATENT TRICKS—OLD AND NEW.

When an inventor receives a patent, his name is immortalized in the *Official Gazette*, and he immediately becomes the object of attack from a horde of hungry aspirants for money, among whom are ex-clerks, patent brokers, and pretended legal lights of varying degrees. The patentee is deluged with circulars and letters from this class of gentry. Some write to inform him confidentially that his patent is good for nothing; but on receipt of a certain fee they will set it right and make it sound as a silver dollar. Others pleasantly inform the new-fledged inventor they have read his patent with great pleasure, consider it to be a very valuable invention. If properly introduced, much money can be soon realized. The State of Iowa, they say, is worth $50,000, Ohio $45,000, Pennsylvania $65,000, and so on. All that is necessary is to print some circulars and do a little blowing, which the broker generously offers to do on receipt from the inventor of ten to fifty dollars cash in advance. Another writes to say he has an actual offer of $10,000 for the patent for Canada, provided the patent is at once taken, which he will procure on receipt of the necessary money. It is almost needless to suggest these schemes are designed to fleece the inventor. The so-called patent sellers rarely effect a *bona fide* sale. They depend upon the advance fees obtained as above for a livelihood. Some of them have thus grown rich and prosperous.

These pretended sellers try to make it appear they are reliable by giving respectable references, and cite names of patentees for whom they purport to have sold patents. One mode of procuring these references is as follows: They write the patentee they have a customer who will buy a county right in Minnesota for $500, and pay by deeding 25 acres of land in Arkansas, really worth $1,000, but the parties are so anxious to obtain the patent right they are willing to let the land go and take the right, in settlement, provided $50 cash is paid and a mortgage is given for $500. This done, the patent broker closes the transaction, receives the $50 cash, which is the full value of the land, also receives a mortgage for $500, together with the patent deed. At the same time the broker is careful to obtain a written certificate from the inventor stating, "I take pleasure in saying that X. Y. Z. & Co. have sold a patent right for me, at my price, and on terms satisfactory, and I recommend them," etc. In this way references are secured which make quite an impressive show on circulars, while the inventor is so ashamed of having been so easily duped, he keeps mum.

One of the latest tricks is the following: The patentee receives a letter from A. & B. asking for how much he will sell his patent for such and such a State. He replies, giving a price, say $5,000. The patentee soon after receives another letter from X. Y. Z., saying that A. & B. write they have corresponded with you, and now say they have decided to purchase the patent on the terms named, provided the title and claims are found to be correct. To ascertain this, they require that X. Y. Z. shall examine and report upon the patent, otherwise A. & B. will not purchase; that if the patentee wishes to complete the sale, he must remit fifty dollars to pay for the examination, which is a work independent of the sale, and must be independently paid. The inventor sends the money; a report is made adverse to the patentee; no purchase is made; none was ever intended. Such are a few of the adroit schemes now in vogue for swindling "innocent" inventors.

Bills have been introduced in Congress to protect innocent purchasers of patents, *i. e.*, infringers. Might it not also be well for somebody to formulate a law to protect innocent inventors?

THE BOARD OF HEALTH AND PRIVATE STABLES.

Until quite recently, it has been almost the universal custom for owners of private stables in this city to have, outside the walls of the building, a cemented brick vault with a wrought iron cover, for the refuse of the stable. The contents of this vault were carted away once or twice a week. And this was considered not only the most convenient way of disposing of the manure and litter of the stable, but in a sanitary sense the most desirable, as all emanations from the inclosure were dispelled in the open air. But about one year ago, our Board of Health (in its wisdom?) passed a resolution requiring the vaults outside of stables to be permanently closed. Notices were accordingly served upon the occupants of stables to empty, disinfect, and close the manure vaults, so there shall be no access to them from the outside. Forming part of this notice was a clause stating that, failing to comply with the requirements set forth, within five days, legal proceedings would be commenced to enforce the ordinance, the penalty for non-obeyance of which, we have since learned, is $50 and costs.

Our health board is undoubtedly one of the best administered departments in the city. Nevertheless, we cannot but think it has made a serious blunder in passing its resolution of March 2, 1887, suppressing the outside manure vault of private stables, especially if the measure was adopted for sanitary reasons, and we are reluctant to believe the commissioners had any other motive.

The result has been that the short time allowed for closing these objectionable out of door pits, and providing other receptacles inside, without incurring a penalty of $50, and probably as much more for costs, induced the occupants of the stables receiving the notices to scurry about and provide wood boxes which must be kept inside the walls, without any regard for the comfort, convenience, or health of the occupants.

Most private stables in this city have convenient apartments for the coachman's family, which is largely composed of young children, whose health must be jeopardized by inhaling, night and day, the steaming, odorous atmosphere which always emanates from the manure and bedding of the stable, but which has heretofore been stored outside the building.

We would recommend the health board, as the warm season is approaching, to look into the matter, and see if it did not make a mistake in passing the resolution preventing the use of out of door manure pits, and its rigorous enforcement, and if it would not be wise to rescind that ordinance at once and institute in its place as a sanitary measure a resolution *requiring* the refuse of stables to be deposited outside the walls. And might it not properly go so far as to require that it shall be deposited in brick or stone lined vaults, secured with iron doors, as formerly used, and to which plan we have never heard any objection advanced?

The following extracts from the *Monthly Bulletin* for February, issued by the Iowa State Board of Health, bears somewhat on this subject. It may be well for our health board to procure a copy, and read the entire report:

We had an experience a few years ago that led us to the conclusion that stable manure—especially the straw and litter from horse stables—was specially adapted to the reception and propagation of diphtheria germs under favorable circumstances. We were then county physician, and had charge of the county jail. In the south end of the court house, in the basement, the jailer, with several children, lived. East and a little north from the jailer's quarters was located a fountain with a basin perhaps four feet in depth and thirty feet in diameter. This, in the fall, was filled with straw and horse manure to prevent the freezing of the pipe, the water having been turned off. In the latter part of the winter, or early spring, spontaneous heat was generated. Steam and a very offensive odor were generated, and the wind being largely in the east was carried into the living rooms of the jailer and through the cells. After this had continued three or four days, diphtheria of a most fatal and malignant type broke out in the jailer's family. There were two or three deaths, and almost every member of the family was more or less affected. Quite a number of the prisoners also had diphtheritic exudation upon the tonsils, and there was a general condition of debility and prostration. At the time we believed the exhalations from this manure pit were the cause of the sickness, and we have believed it ever since. The *Medical News*, January 21, 1888, contains, on page 82, an article confirming our opinion. It is as follows: "A writer in the *British Medical Journal* of December 17, 1887, remarks that the works of Klebs, Ferrand, and others show that straw and manure heaps play a considerable part in propagating diphtheria. An army surgeon has tried to prove by statistics to what extent these statements are reliable. He has collected the following facts: In the French army, diphtheria causes three times as many deaths in cavalry regiments as in the infantry. This affection is most prevalent in the cavalry barracks in Paris, which are in the vicinity of stables belonging to Paris omnibus companies, and near a large depot for manure. In the German army, the same proportion exists, there being three more deaths from diphtheria in the cavalry regiments than in the infantry," etc.

Another Timber Raft.

Mr. Leary, the log raft champion and promoter, is, according to the *Timberman*, rapidly consummating his plans to make another attempt to stem the tide with a timber raft from Nova Scotia to New York. His raft is being built in the shape of a ship, with six masts and a large spread of canvas. This is merely a re-adoption of the principle on which timber rafts were built in Maine half a century ago, and sailed across to England. The voyages were uniformly successful, only one being lost; but the exposure and sufferings of the crew were so severe that this plan of transporting timber was finally abandoned because seamen would not risk their lives across the Atlantic. Mr. Leary expects that his new raft, which will be a solid mass of logs chained and spiked together, in the crude shape of a vessel, will be ready to launch by August.

A Remedy for Bedbugs.

A correspondent writes to the *British Medical Journal* as follows: "The best remedy for bugs in hospitals is a bug trap made by boring a series of holes in a piece of wood with a gimlet, and placing this under the mattress of each cot. The piece of wood is to be placed periodically into a basin of boiling water. This is an Indian hospital plan."

Engineering in Japan—the Kioto-Fu Canal Works.

Since 1869, when the central government was transferred to Tokio, the city (old capital) of Kioto began to decline. In order to recover and to flourish the city, Governor Mr. Kitagaki planned a work of constructing a canal from the lake of Biwa to the city of Kioto, the main objects of which are: 1. Creating an amount of mill powers for city manufactures. 2. Opening of a route of canal navigation from lake Biwa (500 sq. miles, 280 ft. above sea, and 30 miles from sea) to Osaka Bay (a commercial center) through Kioto. 3. Irrigation of neighboring rice field. 4. As a source of water works, such as water supply, sanitary works, etc.

Accordingly, an accurate survey of the district began in 1881, and the route and estimate of the canal works were settled in 1883.

In November, 1883, a consulting meeting was held, and upward of sixty chief citizens who were present all agreed to the proposed plan of the governor.

In 1884, city assembly was opened to discuss and decide the matter.

With the agreed decision of the assembly, the governor asked central government for the permission of actual undertaking, the permission of which was given in January, 1885.

Canal works office was accordingly made up, consisting of engineers and clerks. In March, 1885, actual setting out of center line was commenced, the route of which is as follows:

a. Intake—Land reclamation with excavated debris, dredging, breakwater, etc. Quantity of water 300 cu. ft. per sec. Velocity of water about 3 ft. per sec.

b. Open Canal—Width 28-19 ft., depth of water 5 ft., length 592 yards, with a regulating lock at center. Completed.

c. Tunnel No. 1—Passes through range of Nagarayama. Nature of rocks met with were clay slate, hornstone, sandstone, and quartz porphyry. It is 14 ft. high, 16 ft. wide, 6 ft. deep. Length 2,672 yards, with a working shaft 146 ft. deep at a point 807 yards from the west entrance. Shaft sinking commenced October, 1885, reached tunnel in March, 1886. Works from western entrance commenced March, 1886, and met exactly with heading from the shaft in July, 1887. Works from eastern entrance commenced September, 1886. At present about 1,950 yards already excavated, and to be completed till November, 1889. The tunnel is worked by Belgian system. Slope 1 in 3,000. *Longest tunnel in Japan.*

d. Open Canal—Through Yamashina district with cuttings and embankments, something like open canal *b*, slope from 1/2500 to 1/1250. Almost completed.

e. Tunnel No. 2—Passes through a hill at Yamashina, 140 yards long. Completed.

f. Open Canal—Just like canal *d*. Length, together with *d*, is 4,500 yards.

g. Tunnel No. 3—Passes through Hino-oka range. Nature of rocks met with are clay slate, sandstone, and diorite. Commenced March, 1887; to be completed April, 1889. Length 912 yards. Section and slope is same as tunnel No. 1.

h. Open Canal and Dam—Length 300 yards. Already completed.

Here the canal is divided into two:

Main Canal for Navigation.

i. Canal Incline—Length 600 yards. Slope 1 in 15. In construction.

j. Open Canal—Length 2,000 yards. 60 ft. wide, 5 ft. deep. Level.

k. Kamagawa and Takasegawa Junctions—A regulating lock just same as the entrance lock is to be constructed here. From this point to Osaka Bay is navigable now.

Total length 12,000 yards.

Total work will be completed in November, 1889.

Branch Canal for Water Power, Irrigation, etc.

1. *Tunnel No.* 4—150 yds. long, 8 ft. dia. Completed.
2. *Open Canal*—300 yds. long, 8 ft. wide.
3. *Aqueduct*—300 ft. long. Made up of 13 series of brick arches.
4. *Open Canal*—550 yds. long.
5. *Tunnel No.* 5—200 yds. long. Same as tunnel No. 4.
6. *Open Canal*—Width 20 to 30 ft. Slope 1 in 3,000. Length 10,000 yards.
7. *Kogawa Junction*—Kogawa is an old canal.

Slope from 1 to 5 is 1/1250.

Of the total estimate, which amounts to $1,250,000 (actual amount will be something less), annual estimate of the sum to be spent for coming year is discussed and decided by city assembly, with approval of governor, and actual calculation of past year is then reported to the assembly.

City assembly consists of twenty representatives, of which seven serve as committee for one year, and works in detail are submitted to them.

Of the total sum of money, about a quarter came from central government, and a third from public property (given from Mikado in past year) of inhabitants of Kioto, and remaining sum, amounting to about five hundred thousand dollars, is to be directly or indirectly imposed, partly upon number of houses, and trade and land taxes of Kioto inhabitants (250,000 in number).

TANABE SAKURO, M.E.,
Engineer in Chief, Kioto-Fu Canal Works.
Kioto, February, 1888.

A Submerged Forest.

During the late violent storms in the Channel the sea washed through a high and hard sand bank near the Isle of St. Malo, France, nearly four meters thick, laying bare a portion of an ancient forest which was already passing into the condition of coal. This forest at the beginning of our era covered an extensive tract of the coast; but with the sinking of the land it became submerged and covered up by the drifting sand. Mont Saint Michel once stood in the middle of it. The forest had quite disappeared by the middle of the tenth century. Occasionally, at very low tides after storms, remains of it are disclosed, just as at present. It is believed that some centuries ago the highest tides rose about 12 meters above the level of the lowest ebb. Now the high water level is 15·5 meters above the lowest.

Coral Reefs and Islands.

A lecture was recently delivered by Mr. John Murray, at the Royal Institution upon "The Structure, Origin and Distribution of Coral Reefs and Islands." One of the most important of oceanographical facts, the lecturer remarked, is the continual struggle being carried on beneath the sea between vital and chemical forces. The sea water is continually dissolving calcareous *debris*, the extent of solution varying with the temperature, pressure, amount of carbonic acid gas held in solution, and other local conditions. On the other hand, coral reefs, although principally formed of dead organisms, are covered externally, especially on the seaward side, with myriads of mouths continually employed in extracting carbonate of lime from the sea water.

The organisms by which the absorption of this carbonate is effected furnished what Mr. Murray termed "the most gigantic and remarkable accumulation of organic life upon the face of the earth." The lecturer therefore pointed out that the best method of arriving at an accurate conclusion concerning the vexed question of the formation and distribution of coral reefs and "atolls" would consist in making an elaborate study of the various influences exerted in the struggle of solution *versus* secretion by all the naturally occurring phenomena. Mr. Murray consequently illustrated his lecture by a series of photographic slides, recording miscellaneous observations made upon the subject during the expedition of H. M. S. Challenger. In this way he first showed the irregular configuration of the sea bottom, drawing attention to the numerous dome-shaped expanses reaching comparatively near to the surface, and also to the geological structure of the islands in midocean, rising like mountain peaks from the ocean bed. Among the more important circumstances tending to control the conditions of pelagic life, the lecturer mentioned the influence of prevalent winds, and also the ever-varying composition of sea water.

Thus the prevalent winds of the tropical oceans cause the warm surface water to be continually driven westward, with the result that the waters on the eastern coasts of continents are considerably warmer and better adapted for the sustenance of polyps than on the western coasts. Coincident with, if not a consequence of, this result, coral is generally found in very great abundance on the eastern coasts of continents, and but rarely on the western. The composition of sea water is not only affected by the amount of the constituent salts held in actual solution, which usually bear a mutually constant ratio, but is also considerably modified by the presence or absence of minute calcareous or siliceous organisms. These remain near the surface during the night and in calm weather, but while the sun is hot or rough weather prevails they sink to a depth of from 80 to 100 fathoms. In such enormous numbers do these organisms exist in tropical seas that Mr. Murray computed that a mass of sea water with a superficial area of one square mile and a depth of 100 fathoms would yield 16 tons of carbonate of lime, while he estimated that the total amount held both in suspension and in solution reached the almost inconceivable amount of 628,340,000,000,000 tons.

As all these organisms sink to the bottom after death, they give rise to enormous calcareous and siliceous deposits, and, therefore, the next point to which the lecturer directed attention was to the nature of deposits on ocean beds at different depths. The objects of most general interest found in deposits at great depth are the ear bones of whales, the remains of sharks' teeth, and sponges, which are all usually found in manganese nodules.

The larger bones of the cetaceans, Mr. Murray said, do not appear to resist solvent action so well, while of the sharks' teeth only the dentine generally remains. Shells of any size do not appear among the deposits until much shallower depths are reached, while the depths at which reef-building animals appear vary from 5 to 50 fathoms, according to the temperature and supply of food. The lecturer remarked that the reef-building animals are not absolutely confined to the few species to which naturalists attribute the formation of coral, while single polyps have been observed to attain a diameter from one-eighth of an inch to a foot or more under favorable conditions. Naturally the polyps on the outside of the reef procure the best food, and this is especially the case on the windward side of the reef, while the water reaching the interior is much poorer in carbonate of lime, and consequently possesses less nutrient value and a higher solvent action.

Based upon these observations, Mr. Murray suggested a theory antagonistic to the generally accepted one of Mr. Darwin, which, he reminded his hearers, referred the formation of reefs off the mainland, and also of the lagoons of atolls, to the subsidence of the intermediate ocean bed, presumably of volcanic origin, which had also been equally covered with coral. The lecturer, however, said he considered that reef formations start from a central mass, and, in accordance with the inferences deduced from observation, increase on the exterior side, owing to the better supply of food, while the interior becomes more or less dead, and is gradually dissolved away by water reaching it from which a large proportion of the carbonate of lime it is capable of holding in solution has been removed by the living polyps on the exterior of the reef. In this way a continually enlarging hollow circle of reef would be formed, and would account for the regular circular formation of the Minerva and similar reefs. Irregularities might arise, Mr. Murray said, from either currents or prevalent winds providing one part of the reef with a better food supply, and so insuring a faster growth, or else the reef may have been formed by encircling a number of smaller reefs, which would account for the projections of coral in the lagoons in some atolls. By a number of photographs of coral islands Mr. Murray showed that the general appearance and growth of vegetation on these islands are quite compatible with this theory. The exterior portion of the reef is always rough and barren, while the vegetation grows down to the water's edge, and even into the water, on the lagoon side. The coral island naturally does not reach more than four or five feet above the surface of the water, but the height of the island may be increased by volcanic forces raising it up, or by the accumulation of "blown" sand and rock upon it. The lecturer considered that the Bermudas, although attaining an elevation of 200 feet, have been formed from coral islands by the latter method.

The Simonds Metal Rolling Machine.

In this week's issue of the SUPPLEMENT we give a very fully illustrated article on this remarkable machine, which is the invention of Mr. George F. Simonds, of Fitchburg, Mass. We have before us some of the specimens of work done by this machine, and the range already covered is from a shoe calk for lumbermen's boots to a car axle. The most beautifully finished specimens of work accomplished are the steel balls, of which any number of sizes are produced, and these are perfect spheres, and are made with great rapidity, one machine, attended by two workmen, having a capacity of 850 solid two inch steel balls a day. During a recent visit to the works in Fitchburg, Mass., we were shown several of these machines in operation on all sizes of work, the most interesting operations being the rolling of threaded chair screws and solid steel balls. There is practically no waste, as only enough steel is used by the machine to complete the article, and this process bids fair to supplant many where drop forgings were used. The experimental works of the company are at Fitchburg, Mass., but plants will shortly be established in all parts of this country.

Gen. Quincy A. Gillmore.

Major-Gen. Quincy A. Gillmore, distinguished as a soldier and civil engineer, died at his home in Brooklyn, on Saturday, April 7, 1888. He was born at Black River, Loraine County, O., February 28, 1825. He entered West Point, and graduated therefrom in 1849, standing high in the class. He was assigned by virtue of his class rank to the corps of engineers. After assisting in the construction of Forts Calhoun and Monroe at Hampton Roads, he returned to West Point, and from 1852 to 1855 acted as assistant instructor in military engineering. He served through the war with high ability, receiving the title of major-general of volunteers for meritorious work done against Charleston with the tenth army corps, then under his command. His other services during the war were numerous. At its conclusion, he accepted the charge of the division of the South, and after receiving the regular commission of major-general, he resigned in 1865 for the purpose of pursuing the profession of engineer. Both for the government and for corporations and municipalities, his services have been in great demand. His work on cements and mortars is one of the classic books of the profession. Among his more recent engagements may be mentioned his connection with the Kings County Elevated Railroad. This road, destined to do so much for the city of Brooklyn, was on the point of completion at the time of his death. He was the engineer of the company. He was also one of three commissioners appointed to examine the new Croton aqueduct. He leaves a wife and four sons.

Utilization of Drill Holes.

A novel method of conveying power to mines is described in a recent number of the *Colliery Engineer* as being in use at the Shenandoah mines, Pennsylvania, in which, as the lower level of the Mammoth seam had been, in 1883, nearly worked out, it became advisable to develop new workings. To convey power to these, an 8 in. hole was drilled from the surface to the seam, a depth of 244 ft., and when finished this hole was lined with a 5⅝ in. casing pipe, through which was passed a 1 in. steel wire rope, transmitting the power required for hauling purposes below. A second borehole, 6 in. in diameter and 118 ft. deep, was also put down, and through it was passed two 2 in. pipes to be used as a speaking tube and for a bell wire, to permit of communication between the engine house and below ground.

THE CALIGRAPH DROP CABINET DESK.

The old style of stand or table that was formerly used with all type writers was objectionable for several reasons, one of the chief being that in a great many offices the room could not well be spared, and when one of the firm uses the type writer it is a great convenience to have it on the desk, provided it can be readily removed when not in use.

We illustrate herewith a new drop cabinet desk, which the American Writing Machine Co., of Hartford, Conn., have had made for the caligraph. The cut shows the lid thrown back and the caligraph ready for use. The lid is finished on both sides alike, and as when open it projects over the side of the desk several inches, it gives almost as much space on top of the desk as when the desk is closed.

When closed the desk is dust-proof, and by means of

THE CALIGRAPH DROP CABINET DESK.

a spring at the side the caligraph can be held in desired position and at a height that is best adapted to rapid and easy manipulation. There are no chains, weights, springs, or pulleys to get out of order, and the ingenious mechanism, of which we show a sectional view, is so simple that any one can understand it.

These cabinets are finished with or without rail, in any kind of wood desired, and should go with all the caligraphs. Full illustrated circulars will be mailed upon application.

A NEW SYSTEM OF TEACHING GEOGRAPHY.

In the ordinary method of teaching geography in the schools, maps or charts are employed, either complete with colored subdivisions or in outline; but these maps do not always convey a sufficiently clear impression. The maps are all made, and there is nothing to firmly impress upon the pupil the proper idea of the geographical divisions. Willie M. Bours, of Stockton, Cal., has applied for a patent on a map or chart for teaching purposes, in which the general outline of the whole State or country is made, and within this exterior outline are dots or points so placed that lines drawn through these points will give a general outline of the subdivisions of the country or its configuration, and from these general outlines the more exact indications of the configuration may be drawn. The pupil can, therefore, draw the various lines indicating the general shape of the subdivisions, and may afterward make the more exact contour lines therefrom, thus gaining knowledge of the size, proportion, and general appearance, which it is impossible to obtain from completed maps.

Mr. Bours calls this a "lineal system." The objects are to assist the pupil to grasp the territorial relations of the divisions of a country, and to aid the pupil in the practice of this knowledge by giving directions for its application. The use of the system may be exemplified in a study of the geography of the United States. An outline engraving of the United States is shown on this page, with the dots or points indicating the corners or extremities of boundary lines of the States and Territories.

The general outline only follows the more prominent irregularities of the coast or boundary. The dots are placed in such position that lines drawn from these points or dots will show the general contour of the internal subdivisions of the State. By the aid of these dots the pupil will soon learn to construct all the subdivisions of the country. First, in general outline by drawing approximate straight lines through the dots, and afterward the more minute irregularities of contour may be indicated by dotted lines. For instance, the line drawn from E to F would indicate the southern border of Washington Territory (or northern boundary of Oregon) in an approximate manner, while the dotted line, *e*, would show the more minute contour. The line, M, would indicate the general contour of the coast of Texas, while the dotted line, *m*, would show the features more in detail.

These outline maps or charts may be permanently drawn or indicated upon a slate or blackboard, or they may be drawn on silica slate, where the general outlines and dots may be permanent. Connecting outlines or contours may be drawn with pencil or other marking implement while the lesson is in progress, and afterward erased so as to leave only the permanent outline and dots.

THE LINEAL SYSTEM OF TEACHING GEOGRAPHY.

Ammonia in Distilled Waters.

Professor Schlagdenhauffen, of the Nancy College of Pharmacy, while examining some fenugreek seed water of his own make, for its volatile principles, was surprised to observe the characteristic reaction of ammonia and its compounds when adding to the distilled product an alkaline solution of iodohydrargyrate of potassium. On repeating the operation with great care, not only was the same effect reproduced, but it was equally evident with the water distilled over various other substances. Moreover, upon evaporating the distillates, acidulated with muriatic acid, crystallized ammonium chloride could easily be separated. Fifteen different plants were thus tried, such as pyrethrum tops, mustard seed, angelica seeds, pease, beans, orris root, star anise seeds, etc., and afforded a proportion of chloride varying between the minimum and maximum of 0·03 to 1·10 per thousand. Without attaching too much importance to the facts, in the present stage of his experiments, the professor merely suggests that the presence of ammonia in distilled waters must be the cause, or one of the causes, of their alteration on keeping; that it is always to be found in such waters, and they would keep better if this natural food of microorganisms could be left out.

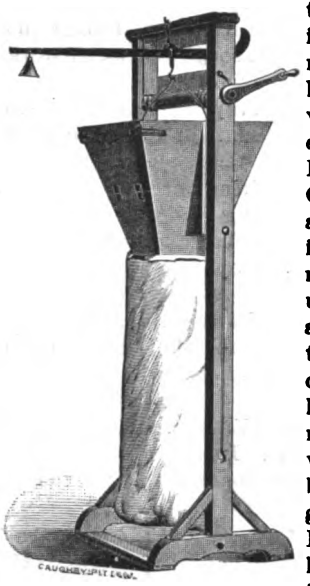
A COMBINED RAIN WATER CUT-OFF AND FILTER.

A simple, serviceable, and substantial device for filtering and straining rain water is illustrated herewith, of which Mr. N. W. Davis, of Port Jefferson, N.Y., is the patentee and manufacturer. Within outer pipe sections is an inner filtering chamber, at the bottom of which is a removable strainer, while near the top is a V shaped strainer, the water from the roof passing down the outer pipe section at the left, as shown by the arrows, up through the strainers and filtering chamber, and down again at the right, through the pipe connecting with the cistern, thus leaving all dirt and other matters in the bottom of the filter. A cut-off valve is arranged, however, near the bottom of the outer pipe section on the side in which the water from the roof enters, on opening which all the water from the roof, as well as all the sediment collected in the filter chamber, are turned down the waste pipe. This cut-off saves all unshipping of leader pipes, by the facility with which water can be turned in or out of the cistern, and the slide cover at the top and removable strainer at the bottom renders it easy to repair or clean any of the parts without taking the filter from its position.

DAVIS' FILTER.

AN IMPROVED BAG HOLDER.

A bag holding device affording simple and convenient means for connecting a sack with the hopper, so that it can be thus used in weighing grain, and readily detached from the hopper, is illustrated herewith, and has been patented by Messrs. Allison M. Roscoe and George E. Grier. The hopper is adapted to move vertically in ways, a windlass journaled between the ways uniting their upper ends and being connected with the hopper by chains or cords, one end of the windlass having a crank and ratchet wheel with pawl, whereby the device may be conveniently used with grain bags of different size. For weighing purposes, the hopper has a bail by which it may be suspended from a suitable weighing beam. In one side of the hopper is a hinged portion to facilitate the filling of sacks, and an aperture in the bottom is closed by a slide having a projecting plate with catches adapted to engage spring arms, whereby the edges of the bag are held in a groove or channel around the bottom of the hopper.



ROSCOE & GRIER'S BAG HOLDER.

For further particulars with reference to this invention address Messrs. Grier Brothers, Dubois, Pa.

Municipal Supervision of Electric Wires.

Almost by insensible degrees, New York, in common with all other large cities, has become covered with a network of electric wires, many of them carrying currents of high potential and great intensity. They have been erected by private corporations, whose only object was to effect their own purposes at the lowest possible expenditure of money and time. No rule as to quality of insulation or route to be followed has been adopted.

Recently, this state of things has been forcibly brought to notice by severe or fatal accidents. Within a few days, a boy, playing in the street, seized the end of a disused wire that hung from a pole, and began running about with it in his hand. This brought it in contact with an electric light wire. Owing to poor insulation, the crossing of the wires made a contact, and the boy was killed by the shock.

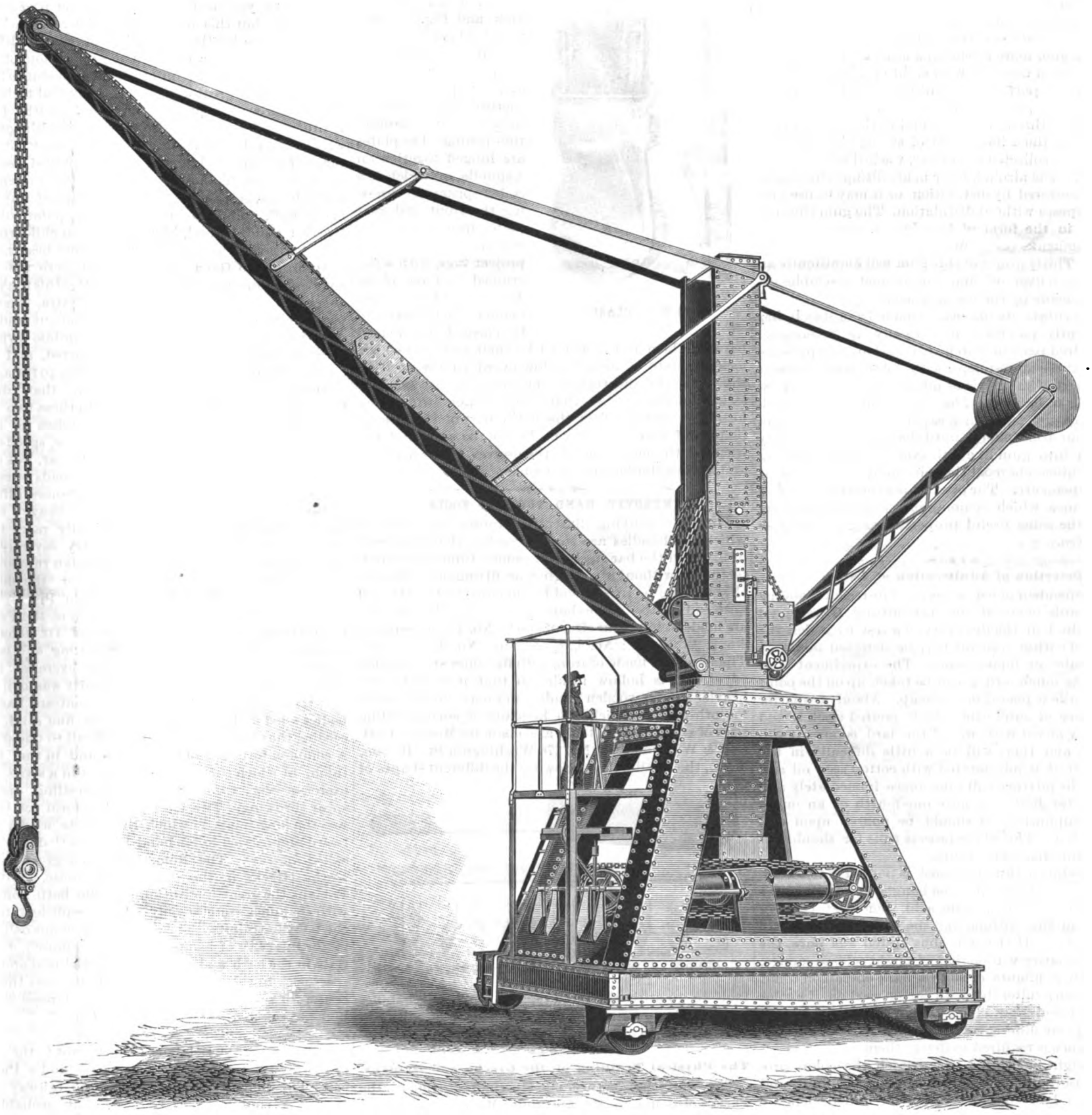
The iron wires erected for telegraphic purposes, when they fail, are not worth removal, and in many cases are abandoned. The fatal accident described above shows what serious consequences may ensue upon such abandonment. But had the electric light wire been properly insulated, the current would not have left it.

The remedy for the evil evidently existing is a simple one. Either the companies jointly, or the authorities, should appoint an inspector, and stipulate for methods to be followed in carrying out electric distributions as regards out-of-door work. The routes should be made as parallel as possible, to diminish the liability of crossing. A telephone wire coming in contact with an electric light wire may bring about the most serious consequences. The insulation of electric light wires should be of the most thorough description, and the abandonment of old wires should be stopped.

It is true that when the wires are to go under ground, that such action would seem unnecessary. But at present it is impossible to say when the underground system will be in use. It seems far in the future. In the meanwhile, more deaths may occur, and the city remains covered by this network of absolute danger to life and property.

TWELVE TON HYDRAULIC WHARF CRANE.

Our engraving illustrates the construction of the 12 ton crane made by the Glenfield Company, Kilmarnock, for the Karachi harbor. The crane lifts a load of 12 tons, at a radius of 34 ft., through a vertical height of 60 ft. and swings through 480 deg.—1⅓ circle. The lifting rams are arranged to lift up to six tons with the smaller and up to twelve tons with both engaged. They have a stroke of 10 ft., a doubled 1 in. chain being wound in multiple of six to give a lift of 60 ft. The crane has a wheel base of 15 ft. in the direction of the rails, and 12 ft. 10 in. from center to center of rails. This gives stability at any horizontal angle of jib, but an additional security is obtained by hooking the pedestal to the wharf girders. The jib and mast are of steel, and the pedestal frame of wrought iron plates and angles. The construction and arrangement of the parts are so clearly shown by the engraving that further description is unnecessary. The pumping engines and accumulator for the harbor were made and supplied by the Glenfield Company. The engines indicate 160 horse power, and the accumulator ram is 17 in. diameter by 17 ft. stroke.—*The Engineer.*



TWELVE TON HYDRAULIC WHARF CRANE

Restoration of a Great Reservoir in Ceylon.

In the last week in February, a succession of festivities and ceremonies took place at Kalawewa, in Northern Ceylon, to celebrate the restoration by the government of the great tank at that place. The policy of restoring the ancient and stupendous irrigation works of Ceylon, though it did not originate with Sir Arthur Gordon, will make his administration memorable in the history of the island, for these huge reservoirs, which are called "tanks" in India and Ceylon, spread cultivation and fertility over large tracts of country which, without them, are given over to marsh and jungle. Northern Ceylon, especially districts which in the early centuries of our era supported large populations, are now, owing to the ruin of the irrigation works of the ancient kings, almost uninhabitable. For some years past the colonial government have steadily directed their efforts to restoring these mighty works, and early in the present year the Kalawewa tank, the largest and most important in Ceylon, was declared completed, the formal opening by the governor taking place on February 22, although the various festivities were spread over several days. The tank was constructed in 460 A. D., to supply the ancient capital of Anuradhapura and the neighborhood, the water being conveyed from it by a canal 54 miles in length, which on its way supplied a large system of village tanks. It has an area of 4,425 acres, or about seven square miles, with a contour of 30 miles. On all sides but one it is surrounded by high ground, from which it is fed. On the remaining side an enormous embankment was constructed, which measures six miles in length, with a breadth of 20 ft. at the top, and an average height of 60 ft. It is formed of large blocks of stone and earthwork, and provided with fine spill wall 260 ft. long, 200 ft. wide, and about 40 ft. high. Just beyond this wall was the great breach which destroyed the tank at some unknown period. It was 1,000 ft. broad, and it is not known whether it was caused by a heavy flood or by an invader. This is the breach which has just been repaired. A huge masonry wall has been thrown across, the canal has been renewed, and regulating sluices and other works have been provided. The whole has taken four years. It is described by Mr. Burrows in his "Buried Cities of Ceylon" as the grandest experiment in irrigation ever undertaken in modern Ceylon, for its completion means the resuscitation of the most important part of the second largest province in the island. When the work of restoration began, the bed of the tank was quite hard and dry. It is now covered with seven square miles of water 20 ft. deep, and supplies towns and villages over an area as great as an English county, and filling tanks belonging to considerable towns more than 50 miles away, which in their turn become centers of distribution. With all this, the government of Ceylon in the 19th century is only restoring the work of the government of the fifth century.

State Taxation of Agents Void.

In its decision upon the commercial travelers' tax question in the Robbins case, last year, the Supreme Court of the United States held that legislation by States or municipalities imposing taxes on commercial travelers engaged in interstate commerce was not warranted by the Constitution, the court taking the ground that a salesman from one State entering another to solicit orders or negotiate sales by samples or otherwise was engaged in interstate commerce. The question has arisen, in a case decided lately in Memphis, whether agents resident in a State, but acting for non-resident principals, come within the protection of this decision. Chancellor Estes, the sitting judge, held that the taxing authorities could not tax such resident agents. He took the ground that the substantial question was whether the legislation imposed a burden on interstate commerce or not. He held that a tax on the agent was a burden on interstate commerce, and that it was wholly immaterial where the agent resided, or whether he was a traveler or had an office in the State. This decision, it will be seen, is an extension of the principle laid down by the Supreme Court in the Robbins case.—*Bradstreet's.*

A Substitute for Gum Arabic.

The high price of gum acacia has led Trojanowsky to seek for a substitute. This he believes may be found in the mucilage of flax seed. By boiling the seed with water and precipitating the strained decoction with twice its volume of alcohol, he obtained a substance which, after drying, consisted of opaque, yellowish-brown irregular fragments, somewhat brittle, but not easily reduced to powder, dissolving in water to a turbid mucilaginous solution. Of this five grains were sufficient to emulsionize an ounce of cod liver oil. The large quantity of alcohol required for the precipitation and the difficulty of drying the adhesive product are, however, serious objections to this product. The author, therefore, pursued his study of the subject further, and believes that he has satisfactorily solved the problem.

He still employs flax seed as the source of the mucilage, but by treatment with sulphuric acid he converts this into a gum more resembling acacia. He directs to boil one part of flax seed with eight of dilute sulphuric acid and eight parts of water until the mixture, which at first thickens, becomes quite fluid. The mixture is then strained through muslin, and to the strained fluid is added four times its volume of strong alcohol. The precipitate is collected on a filter, washed with alcohol, and dried. The alcohol, after neutralizing with chalk, may be recovered by distillation, or it may be used for many purposes without distillation. The gum thus obtained is in the form of translucent, grayish-brown, brittle fragments, easily pulverized, and without odor or taste. Thirty grains of this gum will emulsionize an ounce of cod liver oil, and the product resembles exactly that made by the use of acacia.

Another substitute for acacia, made from starch, has been recently patented in Germany by Schumann. Two hundred parts of starch are boiled under a pressure of two to three atmospheres with 1,000 parts of water and one part of sulphuric or nitric acid, until the mixture begins to be fluid. The acid is then neutralized, and the mixture is again treated under a pressure of three to four atmospheres, until the starch is completely converted into gum-like substances. After filtering through animal charcoal the solution is evaporated at a low temperature. The product is a transparent colorless substance, which is non-hygroscopic, and has essentially the same useful properties as gum arabic.—*Pharm. Era.*

Detection of Adulteration of Lards.

A correspondent of *Science* says: The recent examinations of lards made at the Agricultural Department have resulted in the discovery of a test by which the presence of cotton seed oil may be detected instantly by any dealer or housekeeper. The experiment is as follows: As much lard as can be taken up on the point of a caseknife is placed in a teacup. About a quarter of an ounce of sulphuric acid is poured upon it and thoroughly mixed with it. If the lard is pure, it will coagulate, and there will be a little difficulty in the mixing. If it is adulterated with cotton seed oil and stearine, the mixture will take place immediately and easily. After half a minute one-fourth of an ounce more of sulphuric acid should be poured upon and mixed with it. The whole process thus far should not occupy more than one minute.

The substance thus obtained is poured into a common test tube, such as may be bought at any chemist's shop for a few pennies. The acid, somewhat colored, will sink to the bottom, and the fatty substance will remain on top. If the lard thus tested was pure, the color of the latter will be that of a light colored sponge, changing in a minute or so to a dark cinnamon color. If it has been adulterated with cotton seed oil, the color at first will be darker, changing immediately to a dark brown. These differences of color are so marked that no experience is required to detect them.

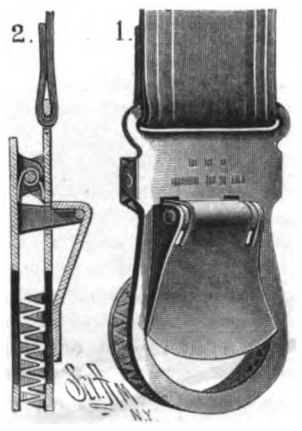
Cards might be printed upon which the colors produced by the sulphuric acid reaction for both pure and adulterated lards might be shown; and dealers, by using this test, may prove to their customers in a minute or two that the lard they are selling is an unadulterated article. The experiment is simple, and the cost of it almost nothing. The novel thing about it is the placing of the mixture in a test tube, in which the acid may become separated from the fatty substance, thus making the test much more decisive and satisfactory. This was first suggested by Dr. Thomas Taylor, who has extended his experiments to a great number of different animal and vegetable oils.

Why Require a Seal on Deeds?

In a recent address before the Yale Kent Club, at New Haven, the venerable David Dudley Field said: "Another of the anomalies which should be eliminated from our legal system is the distinction between sealed and unsealed instruments. Can anybody give a reason for this distinction, except the historic one that seals were used when most men were unable to write? Now, when most men do write, why use the seal? Or if the seal is used, why give it a significance and importance not given to the writing? I find in your revised statutes a provision that a deed of real property must have a seal and two witnesses at the least. You cannot transfer to your neighbor a cabin for a hundred dollars without these ceremonials; but you may transfer to him a million dollars' worth of railway stock by a simple signature, without seal or witness. Upon a sealed instrument you may bring suit within seventeen years; but if the seal is wanting you must sue within six years. Is it a reason why these anomalies should be retained in the valley of the Connecticut, because they come from the valley of the Thames?"

AN IMPROVED CLASP.

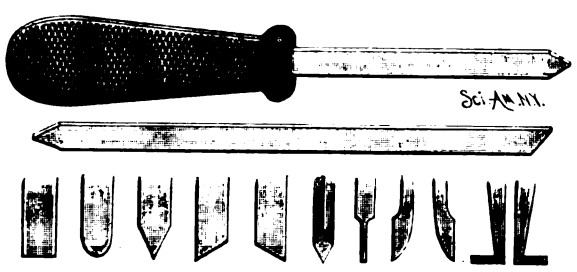
A simple and effective device to attach to the end of a strap or tape for suspending garments, or other uses, is illustrated herewith, and has been patented by Miss Annie Lewis, of 105 West Church St., Galveston, Texas, Fig. 1 being a front view, and Fig. 2 a sectional side view. It has a front and a rear plate, with circular opening, and each provided with toothed jaws, arranged in a semicircle around the opening. The plates are hinged together on a spindle, on which is a coiled spring, for pressing the front and rear plates from each other, and from the rear plate project lugs, with a fulcrumed locking plate. The jaws of the clasp being open, the parts to be clasped are placed between them to be engaged by their teeth, when the locking plate is brought downward to the position shown in the illustration, and the jaws are securely locked in position, so that they cannot swing back until the operator lifts the lower part of the locking plate, and turns it upward. It will be seen that the teeth of the clasp embed themselves in the material and make a double grip thereon.



LEWIS' CLASP.

IMPROVED HAND TURNING TOOLS.

The accompanying illustration represents a tool in which the handles are so constructed that they will firmly hold the bar steel as it comes from the manufacturers, without any forging or fitting, and wherein the steel can be turned end for end in the handle, and both ends of the bar be shaped into tools. The handles are made to hold four sizes of steel: No. 1, ¼ in. square; No. 2, ¼ × ⅛ in.; No. 3, ⅜ × ⅛ in.; No. 4, ½ × ⅛ in. The handle is made of iron, with flat sides and rounded edges, and is hollow inside, so that it is but little heavier than a wooden handle, and may also be useful for other tools which can be made of corresponding sizes of steel. These tools are made by Messrs. Goodnow & Wightman, of No. 176 Washington St., Boston, Mass., the small figures showing the different shapes of tools to go with the handles, the tools and handles being sold separately, or in sets of twelve handles and twelve tools in a neat box.



GOODNOW & WIGHTMAN'S HAND TURNING TOOLS.

The Physical Training of the Greeks and Romans.

The Thursday lecture on March 22, given at the Parkes Museum by Mr. Alexander Murray, the keeper of the Greek and Roman antiquities of the British Museum, was of no ordinary interest. The subject, that of the physical training of the Greeks and Romans, was attractive to the sanitarian, the athlete, and the antiquary, and it is needless to say that it was handled with great ability by the learned lecturer, whose discourse afforded that evidence of research and literary culture which was to be expected from one whose reputation is so well established. "The Greek notion of physical training," we are told, "was associated in one of the oldest Greek legends with the practice of medicine. The Centaur Cheiron not only instructed the young Achilles and others in bodily exercise, but he also taught them at least as much of surgery as to make them able to attend to such wounds and bruises as were likely to arise in the rough life they were to lead." Even Apollo learned something of medicine from the Centaur Cheiron, and Apollo was one of the gods of the Greek gymnasia, of which, however, Hermes was the principal deity.

According to the old poet Simonides, the two things which the Greeks desired most were to be healthy and to be beautiful. "This statement," said Mr. Murray, "is perfectly true as to health, and would be equally true as to beauty if we used the word in the same strict sense as did the Greeks. They applied it to a beauty which was, or seemed to be, the result of careful physical training. And if you wish to see what they regarded as the perfection of beauty of this kind, you have only to go to the Elgin room of the British Museum and observe the frieze of the Parthenon." The sculptor had anticipated Plato in assigning to horsemanship the first place in physical training, and the frieze might be considered as a vast glorification of youth. From this point of view, as well as from the artistic one, the frieze of the Parthenon is unique, and it stands alone as a vast conception devoted to the glorification of youth made beautiful by healthy exercises. It might be suggested that there was too much uniformity in the type of the youths represented in the frieze of the Parthenon, but this objection is the result of tastes formed in the bustle and variety of modern life, and whenever there is a continuous application of many persons to one pursuit, uniformity of appearance is to be expected. The great object of the physical training of the Greeks was to prepare boys and youths for the military profession, and also to insure health for those who were to devote themselves to statecraft or literature. The games which the children played were very much the same as those in vogue at the present day. Balls, hoops, seesaw, knuckle bones, tug of war, blind man's buff, and leap frog were all popular with the Grecian children, and, like the modern childern, they built toy houses and modeled boats and beasts.

According to Galen, boys of seven were allowed to commence horsemanship, and soon after this the youths entered at the public gymnasia or palæstra, where properly regulated exercises were carried out under the direction of a gymnasiarch. In the public gymnasia great and implicit obedience was exacted, and much care was used to proportion the exercises to the age and strength of the learners, and to insure that competitors were selected with due regard to these two conditions. Mr. Murray reviewed the exercises in detail, and dealt in the first place with foot races, speed of foot being of great importance, not only in war, but in carrying messages in a country where roads were bad. These races were mostly for short distances, although it was customary to make the course "heavy" by laying deep sand upon it, and occasionally races in full armor were ordained in order to try severely both strength and endurance. Many Grecian runners were possessed of enormous "staying" power, the most notable example perhaps being found in Pheidippides, who carried the news of the approach of the Persians from Athens to Sparta (a distance of 112 miles over mountain paths) in two days. Wrestling and boxing, and the combination of these two exercises in the "Pankration," was very popular, and it was mentioned that those who took part in these contests had their bodies oiled and then sprinkled with fine sand, a proceeding the object of which it is difficult to understand. A common form of contest was found in the Pentathlon, in which the competitors met in a series of five exercises—viz., running, leaping, wrestling, disk and spear throwing. The most popular form of leaping was the long jump, in which the athlete used a spring board and carried in his hand two iron "dumb bells," called *halteres*. The Romans afford a great contrast to the Greeks in the matter of exercise. With the Romans the great institution was the bath, combined with so much exercise only as was sufficient to keep the body in training. The luxurious Romans delighted, in the intervals of campaigns, to be amused, to luxuriate in the bath and watch the gladiatorial and other spectacles in the amphitheaters. Rome was the great center for professional athletes, while Greece was the home of the gentleman amateur.—*Lancet.*

THE King of the Belgians recently sent to the Sultan of Morocco a present of a locomotive and a Pullman car. The difficulty is that there is no railway in Morocco. A contemporary suggests that probably the first contractor who got there would have the job of making a small line; but there are several obstacles in the way. The secretary of the treasury never pays bills except when he has money in hand, and, as a rule, he never has any. Moreover, when he is impecunious, he has the bastinado and the bowstring quite handy for the contractors. Under all circumstances, we do not suppose that many railways will be made in Morocco just yet awhile.

FROM our foreign exchanges we learn that the preparations for the Barcelona exhibition are progressing satisfactorily, and it seems likely to be a great success. Not only Spanish and colonial, but also foreign exhibitors, are so numerous, that fresh building space has been added to the original plan, for which the government has contributed one hundred thousand pounds. Barcelona is preparing splendid festivities, including bull fights, regattas, races, shows, theatricals, concerts, and literary and other congresses, to give foreigners and natives a favorable impression of the most prosperous manufacturing and commercial city in the kingdom.

THE ROTARY STEAM SNOW SHOVEL.

In our first page illustrations we show the old and the new ways of removing snow from railway tracks. The new way, as accomplished by the rotary steam shovel, has been practically before the public for only a short time, a successful trial of the first machine built in this country having been illustrated in the SCIENTIFIC AMERICAN of May 23, 1885. Perhaps the most common of the old methods consisted in the use of a snow plow, of which there are many forms, attached to the front of a heavy locomotive, the latter itself being sometimes pushed by other locomotives. With all the power it was possible to apply in this way, however, the progress was slow, failures were frequent, and the plow and locomotives would often have to be dug out by gangs of laborers. Many engines have also been wrecked and lives lost by attempting to "buck" a way through snow which had become packed in a cut. The engines would sometimes attack such an obstacle at a speed of fifty miles an hour, so that it has come to be well understood that there was no more dangerous work in the railroad business than that of operating snow plows.

As being better than hand shoveling in such cases, where the snow is sufficiently packed and frozen, a method has been adopted of trenching and cutting out blocks for a sufficient width over the line of track, these blocks to be hauled away by a locomotive to a point where they can be conveniently deposited out of the way. This manner of working is shown in the three views at the top of the page. Pieces of wood are placed around the lower edges of the block, as cut out, to afford a bearing for the lower rope, so that it will not cut through when subjected to the strain of detaching the block from its frozen bedding on the track and ties. Our views are from photographs, showing the cutting and drawing out of these blocks on the Southern Minnesota division of the Chicago, Milwaukee & St. Paul Railway, and on the Winona & St. Peter division of the Chicago & Northwestern Railway.

But by far the most satisfactory method yet devised of accomplishing this work is found in the rotary steam snow shovel, a good idea of the construction of which will be obtained from Fig. 4, while Figs. 5 and 7 show the machine at work.

In the center of the front cylindrical casing of the machine, and projecting slightly into its flaring-edged square hood, is the cone-shaped end of the hub of a wheel which carries the knives and fans. This wheel is mounted on the outer end of a longitudinally extending steel shaft, connected by means of bevel gearing to a cross shaft, actuated by a pair of 17 × 22 inch horizontal steam cylinders. The hub is made in two parts, its inner end carrying a circular plate, near the inner wall of the casing, but not touching it, while spokes extend a short distance from the front end of the hub to a ring, and radial fans or wings extend from the front edges of this ring to the inner disk, to which they are secured. Midway between each two successive fans is a radial shaft or rod, extending from the inner ring, carried by the shorter spokes from the hub, to an outer ring, which covers the front top ends of the fans, and to which the fans are secured. On each of these radial shafts a knife is held to swing, each knife being made with two wings extending at angles to each other, the edges of the knife wings extending radially in line with their respective fans, and resting upon them. Thus, when the cutting edge of one wing of a knife rests against its fan, the other cutting edge extends a suitable distance therefrom to form an opening into the interior of the wheel. By a similar construction, radial shafts or rods extend from the hub to the inner ring, between the spokes, carrying similar, but necessarily smaller, knives and fans, and a less number of them, to operate in the same way.

According as the main operating shaft is rotated, the respective sets of knives and wings open or close in one direction or the other, the snow in either case being acted upon alike, passing into the openings provided, and being forced by the fans out of the spout. The latter is provided with a reversible hood, by which the direction in which the snow is thrown may be changed from one side of the track to the other, or this may be accomplished by reversing the engines, as it would evidently be inexpedient to force the snow in a direction against the wind, and there are many places where it is decidedly advantageous to direct it one way instead of another.

The machine, with the engines and boiler, the latter having more heating surface and a larger fire box than is usual on locomotives, are all mounted on an eight wheeled car, under the charge of a pilot who can, by signals, communicate with the engineers on the rotary and the pushing engines, and by a hand wheel can alter the position of the hood that directs the stream of snow to either side. An ice breaker in front of the front wheels of the front truck is so attached as to maintain a fixed position relative to the wheels, about half an inch above the top of the rail. A flanger is also attached in front of the rear wheels of the front truck, and there are devices by which both the flanger and ice breaker can be instantly raised clear of the track by the pushing of a lever by the pilot, or they will be automatically raised in meeting any unusual obstruction, as in passing switches, etc. These devices effectively supplement the work of the shovel, and are designed to clean the rails as effectually as it could be done by hand with picks, shovels, and brushes. The machine has a weight of some fifty tons, or about that of an ordinary locomotive, and is pushed into the snow by one or two locomotives, as may be desired.

It is obvious that, on account of the great variety of obstacles the machine is designed to encounter, there can be no rule as to the speed of rotation of the wheel carrying the knives and fans. Its action is that of a blower as well as a cutter, and in long sections of track presenting but little difficulty the conditions would be very different from those presented in special places on the line. But this is a matter directly under the control of the pilot, who can regulate the speed of the machine, as well as that of the pushing engines, according to the obstacles presented during every foot of progress. How important this is will be better appreciated, perhaps, by noting the amount and kind of work done by one of these machines last winter, as compared with previous work of this kind, from a report recently published in the Minneapolis *Tribune*:

"One of the rotaries started out in Dakota, in the middle of January, after the terrible storm, and while the thermometer was still 30 degrees below zero. Sidings covered with from 1 to 3 feet of snow were first cleared, the rotary being pushed by one American type engine. The next operation was to open the northern division from Jamestown to Minneawaukon. The first obstacle encountered was a cut filled with 12 feet of solid snow, packed and frozen hard for a distance of abut 25 feet, while for 100 feet more the drift varied in depth from 1 to 5 feet. The rotary was pushed by two 18 by 24 engines, but stalled after penetrating 5 feet into the deep cut. On backing out it was found that the face of the drift on which the rotary cutters had been working resembled polished granite in shine and consistency. The sides of the face were then shoveled down, and the rotary, after repeated attacks, worked through the obstruction. An officer of the company who witnessed the first two trials returned to Jamestown and reported that they would not get to Minneawaukon in six weeks. As many as nine snow plows belonging to the road having been smashed up in trying to open the same cut in the previous spring, it did not seem unlikely that the new machine would also fail. But within three hours the cut was opened, and another cut 500 feet long and varying from 2 to 8 feet deep had also been cleared and an abandoned and buried train had been disinterred. This train was taken back to Jamestown, and the rotary started again next morning, making an advance of 46 miles during the day. Two cuts, 600 and 800 feet long respectively, blocked with snow from 2 to 8 feet deep, were cleared out. In the deepest parts the snow was packed solid and frozen hard. But, notwithstanding this, the worst cut was opened in 50 minutes. On a previous occasion, when this cut was opened by an ordinary snow plow, 35 shovelers were employed, and 11 hours were consumed in opening this cut. It is found that where the snow is not hard packed—of the consistency where an ox can walk on it without sinking in more than 2 inches—the rotary will clear out snow 10 to 12 feet deep while moving two or three miles an hour."

The operation of the machine is described as being a marvelous sight. Such is the tremendous centrifugal force of the wheel, that the snow is discharged in the form of a great stream or cloud, and hurled to a distance of from one hundred to three hundred feet from the track. An army of ten thousand men could not begin to do the work of a single one of these machines within an equal period of time.

This machine has formed the subject of several patents granted to Mr. Edward Leslie, of Orangeville, Ontario, Canada, and is constructed for the Rotary Steam Snow Shovel Company by the Cooke Locomotive Works, of Paterson, N. J. It has been adopted by all the transcontinental lines, the Canadian Pacific having bought the right for their whole system and intending to manufacture the machine in their own shops.

"Almadina" a New Gum.

Under the various names of "almadina," "potato gum," "euphorbia gum," or, more shortly, "E. G.," a peculiar resin of African origin has been of late years gradually finding its way to the European drug markets in steadily increasing quantities. Hitherto its chief if not its only use in the arts has been as a "substitute" for or addition to India rubber, and we learn it is not only much cheaper than caoutchouc, but actually improves the latter when added to it in certain proportions. Among the advantages over pure caoutchouc which mixtures thereof with "E. G." are said to possess, not the least are diminished porosity and greater durability.

MESSRS. D. F. Dunn & Co. (not B. F. Dunn & Co.), of Columbus, Ohio, manufacture the patented valve dresser noticed in our issue of March 17, and they write us that they are already receiving many inquiries therefor.

Correspondence.

The Uses of Glycerine.

To the Editor of the Scientific American:

Few people realize the importance of the uses of pure commercial glycerine, and how it can be used and made available for purposes where no substitute is found that will take its place; and herein, Mr. Editor, if you will allow me space in your well-read journal to speak of its utility, no doubt many of your readers will find an opportunity to thank you. As a dressing for ladies' shoes nothing equals it, making the leather soft and pliable without soiling the garments in contact. Where the feet sweat, burnt alum and glycerine—one of former to two of the latter—rubbed on the feet at night and a light or open sock worn, the feet washed in the morning with tepid water, will keep them during the day free from odor, so disagreeable to those persons who are sufferers.

For bunions and corns Cannabis indicus and glycerine, equal parts, painted on the bunion or corn and bound around with Canton flannel, adding a few drops of the liquid to the flannel where it comes in contact with the affected parts, will soon restore to health.

As a face lotion, oatmeal made in a paste with glycerine 2 parts, water 1 part, and applied to the face at night, with a mask worn over, will give in a short time, if faithfully pursued, a youthful appearance to the skin.

As a dressing in the bath, 2 quarts of water with 2 ounces of glycerine, scented with rose, which will impart a final freshness and delicacy to the skin.

In severe paroxysms in coughing, either in coughs, colds, or consumptives, one or two tablespoonfuls of pure glycerine in pure rye whisky or hot rich cream will afford almost immediate relief; and to the consumptive a panacea is found by daily use of glycerine internally, with the proportion of 1 part of powdered willow charcoal and 2 parts of pure glycerine.

For diseased and inflamed gums, 2 parts of golden seal, 1 part of powdered burnt alum, and 2 parts of glycerine, made in a paste and rubbed on the gums and around the teeth at night, strengthens and restores the gums to health, provided no tartar is present to cause the disease, which must be removed first before applying.

And finally, Mr. Editor, to the epicure who relishes a nice breakfast dish of fried fish, he will find "a feast for the gods" by frying the fish in glycerine to a brown, adding a small sprig of parsley when nearly done.

J. S. CHARLES, D.D.S.

Omaha, Neb.

Long Distance Telegraphy.

The recently announced claim of a telegraphic circuit of over six thousand miles, surpassing all previous experiments, is somewhat misleading. Many efforts at long circuit work have occurred during the past few years, the distance varying from 4,600 to 8,100 miles.

It is a matter of considerable pride to the old operators of the Western Union Telegraph Company in San Francisco, says the San Francisco *Alta*, that the feat of transmitting clock signals through 7,200 miles of line and communicating directly through that same line has never been equaled. The occasion of this feat was the telegraphic determination of the difference of longitude in time between the United States coast survey station in San Francisco and the observatory of the Harvard University at Cambridge, in the year 1869. In order to determine the time of transmission of a signal either from the clock or from the operator's key over the given length of the line of 3,600 miles, three different methods were devised. One of these was original with Prof. George Davidson, who had charge of the observations. Through the liberality of the management of the Western Union Telegraph Company, a double circuit of line was looped at Cambridge, so that there extended from the San Francisco observatory 3,600 miles to Cambridge, and the return from Cambridge by a somewhat different route of nearly equal length. The two "earths" were under the San Francisco observatory, distant from each other not more than ten feet. The line was first opened by an operator in the observatory, and when the fast connection was made at Cambridge, the San Francisco operator was considerably astonished to get his own message back within one second of time.

Then the astronomical break circuit clock was thrown into line, and made its first break on a pen recording upon a revolving cylinder of paper in the San Francisco observatory, and after this break had traversed the line to Cambridge, it returned and made a break upon a second pen moving parallel with the former, in about eight-tenths of a second of time. This was continued every second for several minutes, and was repeated upon several nights, and when one of the twelve batteries in this long circuit was removed, the wave length time was reduced to only sixty-five hundredths of a second. Communication was, of course, carried on at the same rate of speed. This feat over a line 7,200 miles in length has been unrivaled up to the present time, both as a practical working exhibit and a scientific success.

DANIEL McCARTNEY—THE GREAT PRODIGY OF MEMORY.

BY J. H. CREIGHTON.

Daniel McCartney was born in Westmoreland County, Pennsylvania, September 10, 1817. His father was of Irish descent and his mother German.

I first met him in Delaware, Ohio, in 1871. Notice of his coming and what he would do was given in the papers several days before he arrived.

The meeting was in a public hall. The president and several professors and many students of the Ohio Wesleyan University and also a few citizens were present. Mr. O. C. Brown, of Cardington, O., stated what he could do, and introduced him and conducted the examination.

Mr. S. Moore, of the First National bank, was prepared with calendars and other documents to test his claims. Other gentlemen were also prepared in various ways to decide the truth of Mr. Brown's statements.

Mr. McCartney was then fifty-four years old, of medium height, rather heavy set, with rather large, well formed head; square, large, high forehead; complexion pale. Countenance sober, dignified, benevolent. Eyes defective, not being able to see clearly, and yet not entirely blind.

His speech was deliberate and confident, using but few words. His dress was cheap, but decent.

The audience was requested to ask any questions they chose. As the examination went on, we soon found that everything that had passed before his mind for forty years was remembered. I can only refer to a few things that occurred in the two hours of most varied questioning. He could tell the day of the week (by having the year and day of the month) back for forty years, and tell it instantly. He could tell the dates of most important events from his boyhood. Could give the state of the weather, forenoon and afternoon, for forty years without mistake.

One gentleman asked for the day of the week about fifteen or sixteen years before. McCartney replied *Friday*. No, said the gentleman, that is wrong. That was my wedding day, and it was *Thursday*. Now, said Mr. Brown, can any gentleman in the hall tell who is right. Yes, said Mr. Moore; and in a minute or two from his old calendar he found that McCartney was right. During the evening one or two other questions were raised as to the day of the week, but by the old calendar McCartney was right every time.

He was a complete concordance of the New Testament and most of the Old Testament. Prof. Hoyt (Hebrew professor) read a large number of passages from the Scriptures, till the audience were entirely satisfied that he knew where every passage was.

He could tell what he was doing every day from his boyhood. President Merick having prepared himself on several dates, asked him what he was doing on a certain day, naming the time, several years before. "Looking at the eclipse," said he.

His multiplication table went up into millions. He could give the cube root of numbers up to millions almost instantly. One of the numbers given was ten figures deep, another was eleven figures deep.

He could raise any number under forty to the sixth power instantly. He could raise any number under 100 to the sixth power in ten or fifteen minutes.

He was given the number 89, which is a prime number and more difficult; but he raised it in a few minutes (496,981,290,961). He could instantly give the minutes and seconds of periods of time from the Mosaic creation, and could give the feet or inches of sidereal distances. Prof. H. M. Perkins (professor of astronomy) asked him a question. McCartney said he had never been given such a question, but he would see. What was very remarkable was, he never asked the professor to state it again, although it was most complicated. In about three minutes he said it came out with a fraction, and the fraction was one-eighth. In a few minutes more he told off the long line of figures.

A gentleman wrote five or six columns of figures, seven or eight deep, on the blackboard and read them to him. He could immediately repeat them backward or forward; and being asked the next day if he still remembered them, he told them off again without a mistake.

At the close of the examination, several questions of another nature were asked. Some of them were of a nature not needing any test, for we were perfectly satisfied of the accuracy of all his statements. His powers of memory were noticed when five or six years old, and he could remember a great number of little events from that early age. His full power of memory was attained at the age of about sixteen. He knew two hundred hymns, and could sing one hundred and fifty tunes. He could remember what he ate for breakfast, dinner, and supper, for more than forty years. He learned nothing by reading, but by hearing. His sight was so defective, especially in early life, that he could not read, except very coarse print, and that very slowly, and with great difficulty. He was always poor, and his relatives, with whom he lived, were poor. The question has often been raised why a man with such

DANIEL McCARTNEY.

prodigious memory did not prosper in some business. Doubtless the principal cause of this was his deficient eyesight. Several attempts were made to bring him before the public, but with very little success. At one time, in 1871, he appeared in the Opera House, Columbus, Ohio, when members of the legislature, teachers, and professional men were present. At that meeting he answered questions similar to those above stated, and gave entire satisfaction.

He retained his memory to the time of his death. He was in possession of most all these vast powers for about sixty years. When answering questions about certain things, President Merick asked him how he did it, or if he had any particular mental process or rule. He said, "I just know it." The answers to some questions, however, showed that it was not all entire memory, for they required some reasoning powers. This was particularly so in the question given by Professor Perkins.

It has been considered that the invention of logarithms by Napier stands among the greatest works of intellectual power in the world, and will be a monument to his name and fame forever. But McCartney would not need these tables. He was himself a living table of logarithms. These deductions, that cost Napier long and tedious hours of figuring, McCartney could solve at once without pencil or paper, and without mistake.

Daniel McCartney was supported for the last few years of his life at the county farm, near Muscatine, Iowa, and died in that place, November 15, 1887, aged a little over 70 years.

THE SUPERB BIRD OF PARADISE.

(*Lophorina, Parotia,*)

The paradise birds attract attention less by the brilliance than by the extraordinary development of their plumes.

From the Arfak range we had obtained several species, which at a little distance look a uniform black. Two of these—*Lophorina* and *Parotia*—are furnished with appendages which are, perhaps, as striking as any with which long ages of sexual selection have provided the birds of this group, but until the specimen is taken up in the hand they may pass unnoticed. In the former an immense plume of feathers springs from the occipital region, and reaches to the end of the tail. It is of the deepest velvety black, shot in some lights with oily-green reflections, and with the outermost feathers slightly recurved toward the tip. The top of the head is covered with scale-like feathers of metallic green, and a shield of the same color and nature, but of a still brighter shade, adorns the breast. The rest of the body is dull black. Any further ornament or color would be out of place, and one feels that the beautiful creature fully deserves its appellation of the superb bird of paradise.

Almost more beautiful still is *Parotia sexpennis*, the six-shafted bird of paradise, which Signor D'Albertis was the first European to observe in its native jungle. The curious plumes, which give the bird is specific name, lie so close to the neck in the dried skin as to be almost invisible. They consist of three slender filaments springing from each side of the head, and terminated by a spatulate expansion. A bar of vivid steely-green across the vertex, and a peculiar tuft of metallic silver at the base of the beak—a color which, so far as I know, is unique in the bird world—completes the head decoration. Like *Lophorina*, the rest of the plumage is almost entirely black, except at the upper part of the breast, which is furnished with a collar of green and bronze feathers.

The impossibility of giving all the features of this curious bird in a single illustration has led to its representation in a position which is quite possibly incorrect. As far as could be gathered from the natives, the enormous crest, as it appears displayed during the courtship of the female, is spread more widely, in the shape of a fan opened out to its fullest extent, and the pectoral shield being expanded in a similar manner, the head of the bird forms the center of an irregular circle of feathers of velvety black and emerald, which completely hides the rest of the body when viewed from in front.

The tuft of silvery feathers on the forehead can be either erected, as represented in the engraving, or depressed flat against the skull, where it forms a triangle of regular shape with the apex forward.—*Dr. F. H. H. Guillemard, Cruise of the Marchesa.*

THE SUPERB BIRD OF PARADISE (LOPHORINA PAROTIA).

A New Dynamite Gun.

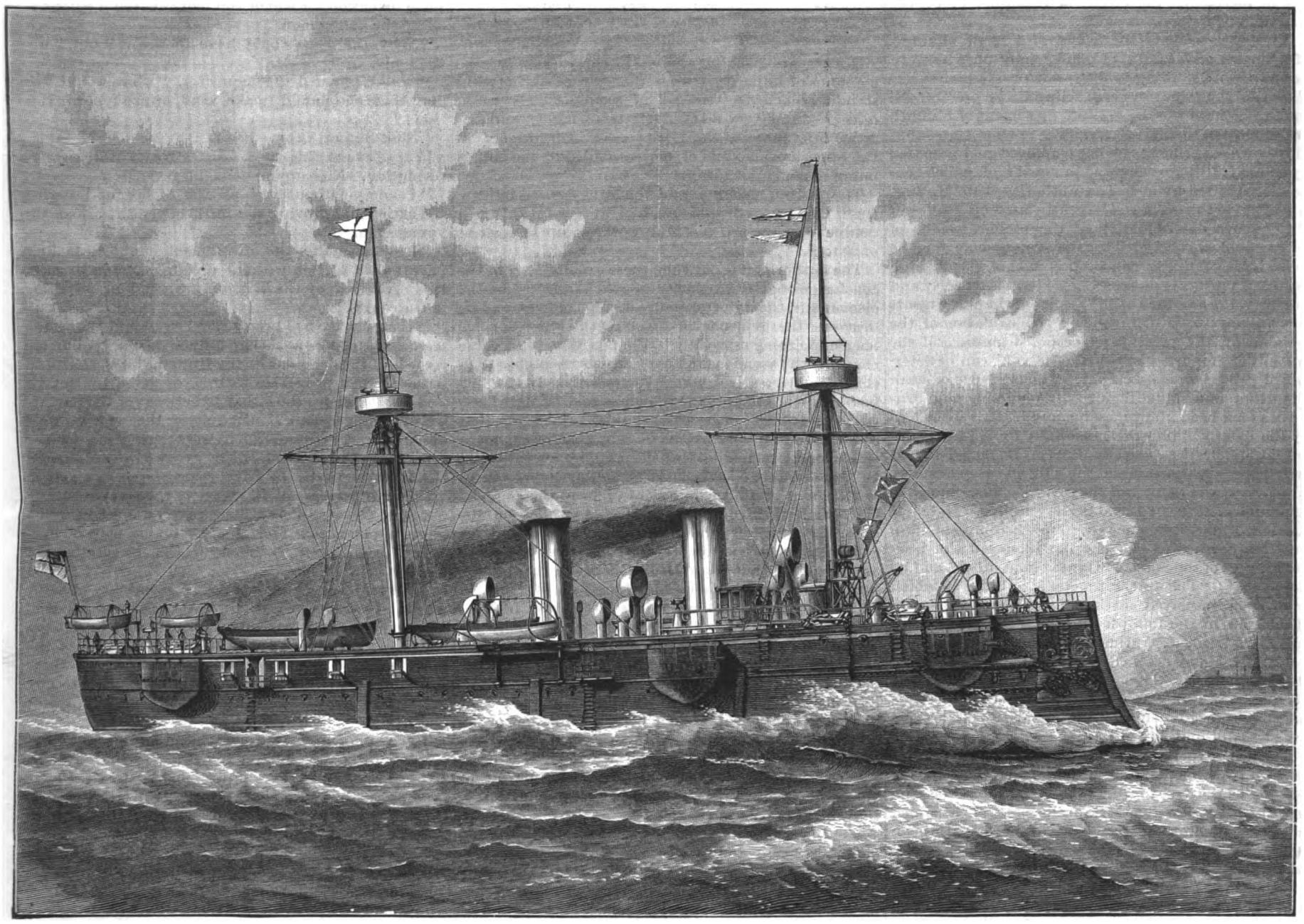
The ordnance department of the army has received from Mr. Hiram Maxim, of England, the description of a new dynamite gun which he has projected, in which he proposes to introduce a new and interesting method of expelling the projectiles from the weapon, and by which he hopes to render the use of dynamite in projectiles practicable in heavy guns. He retains the pneumatic principle which has been utilized with so much success by Zalinski, but instead of using compressed air alone, as Zalinski has done, he mixes with this compressed air a quantity of volatile hydrocarbon, such as the vapor of gasoline. This compressed mixture is introduced behind the projectile and the pressure is applied to start it forward in the chamber of the gun. After it has moved a certain distance the projectile itself uncovers a detonating fuse and an explosion then occurs, the air furnishing the oxygen for the explosion and the pressure being increased about eight times. He claims that by this method his initial pressure does not need to be more than half as great as that used by Zalinski. He does not have to use so much compressed air, nor does he require that the barrel of his gun shall be of such great length. His highest pressure is about 4,000 pounds to the inch, the first pressure being not more than one-tenth of that. His detonator is a very ingenious affair, and is inserted through a small circular opening from the interior of the gun. The ordnance officers are much interested in this new form of the dynamite gun.—*Army and Navy Register.*

THE GERMAN CORVETTE CRUISER IRENE.

The corvette Irene belongs to a new type of vessel not heretofore used in the German navy, being provided with a strong, arched armor deck lying far below the water line. The lines of the Irene are beautiful, and its dimensions are as follows: The greatest length about 340 feet, greatest breadth about 46 feet, and the depth 25 feet. Its displacement is about 4,300 tons.

The vessel is driven by two screws, each having a diameter of 16 feet, and so placed as to be protected by the hull of the vessel. The engines for operating these screws can develop over 8,000 indicated horse power, giving the vessel a speed of 18½ knots an hour. Each engine is placed in a separate watertight compartment. The coal bunkers have a capacity of 900 tons.

The armament consists of fourteen guns, six of which are of the newest construction, being mounted on center pivots in projecting turrets. Four of these guns are so arranged that they can be fired in a line parallel to the line of the keel, or so that the line of fire will cross the extended middle line of the vessel.



THE GERMAN CORVETTE CRUISER IRENE.

The remaining eight guns are placed on the deck and fired through broadside ports, by which their range is, of course, limited. Torpedo tubes are provided in the proper places. A very large amount of ammunition can be carried by the Irene, so that she will not have to depend on ammunition transports during engagements.

No sails are provided to assist in the propulsion of the vessel, and, therefore, there is no rigging except what is required for the support of the masts and the signals. The mast tops are arranged for the reception of a limited number of revolving guns and search lights.

The construction of the vessel, including the equipment, but exclusive of the armament, will cost about $1,080,000, and the guns, torpedo arrangements, etc., will cost about $168,000.

The sister ship of the Irene, the Germania, was built at Gaarden, near Kiel, from the same plans, as was also the Prinzess Wilhelm, which was launched a short time ago.

We are indebted to the *Illustrirte Zeitung* for the accompanying illustration.

A GUN of 150 tons weight is now being constructed at Essen by Krupp. It is similar to the 120 ton gun, but is longer, and will have a much greater range.

Nitro-gelatine Experiments.

We learn from the *Royal Engineers' Journal* for April that "some very interesting experiments have recently been made in firing high explosive shells out of ordinary field guns at the Dardanelles, by Mr. Frederick H. Snyder. The experiments were conducted by the Turkish artillery, under the personal superintendence of General Asif Pasha, inspector-general of fortifications, and under the supervision of Mr. Snyder. The gun used was an American breech loading howitzer of 15 centimeters diameter. The explosive for the shells was prepared nitro-gelatine. The target was made of 12 iron plates welded together, of a total thickness of 12 inches, with very strong backing made of oak beams, of a thickness of 12 inches by 14 inches. The target weighed 20 tons, and was placed at a distance of 200 yards from the gun platform. The first two shots missed the target, but the third struck it, and so completely wrecked both the iron target and the wooden backing and supports that it could not be fired at again. Photographs have been forwarded showing the effect of the shot which struck the target. Mr. Snyder has proved effectually that shells charged with his prepared nitro-gelatine can be fired out of ordinary guns with perfect safety, which in itself is a very important discovery. If a 6 inch shell can produce such results on an iron plate target, it is not difficult to imagine the effect of the explosion of much larger shells on the plated sides of armorclad men of war. Mr. Snyder calculates that a 6 inch shell would strike the armor of a man of war without piercing it, but would produce an explosion capable of destroying the ship. A siege gun of 6 inches would easily carry a shell containing 40 pounds of nitro gelatine, and this gun would suffice to destroy any ship. Mr. Snyder did not expect his shell to pierce iron or steel armor plates, but he calculated that if he could fire a shell with safety out of a gun, on percussion on the side of an ironclad the tremendous explosive force of nitro-gelatine would assert itself, and either shatter the plates or drive them into the ship; the plates being bolted together, if the shell struck on a join or corner, more than one plate might give way. Nitro-gelatine is said not to explode unless subjected to a powerful shock, and it does not explode by contact with fire. Its force, compared with gunpowder, is beyond all ordinary comparison. If powder develops 10,000 feet of gas, dynamite containing 50 parts of nitro-gelatine could develop 100,000 feet. It is also impossible to measure its destructive force as the expanding force of gunpowder is measured. The mode of loading the gun is Mr. Snyder's secret, and prevents the shock caused by the gunpowder, which would shatter the gun to pieces."—*Broad Arrow.*

The Chinese Almanac.

The great value which the Chinese attach to their almanac is shown in many ways. Recently the Chinese residents at Lhassa, in Tibet, implored the Emperor to cause arrangements to be made which would enable them to receive their copies of the almanac at the earliest possible date in each year. A writer in a recent issue of the *Chinese Recorder* says that the most important book to the Chinese is the almanac. Its space is far too important to be occupied with the matter which fills western almanacs. It contains astronomical information which is useful, but its great mission is to give full and accurate information for selecting lucky places for performing all the acts, great and small, of every-day life. "And as every act of life, however trivial, depends for its success on the time in which and the direction (*i. e.*, the point of the compass) toward which it is done, it is of the utmost importance that every one should have correct information available at all times to enable him to so order his life as to avoid bad luck and calamity and secure good luck and prosperity. Consequently, the almanac is perhaps the most universally circulated book in China." The writer speaks of it as a terrible yoke of bondage. It is issued by the government, and the sale of all almanacs but the authorized one is prohibited. Quite recently the new Chinese minister to Germany refused to sail for his post on a day which the almanac declared to be unlucky, and the departure of the German mail steamer was consequently deferred at the request of the German minister to Pekin.

To secure the flap of an envelope so that it may not be readily opened without betraying the fact that it had been tampered with, has been the ambition of a good many inventors. An envelope constructed as follows is the subject of a recent English patent: The flap is so cut and shaped as to bring the point of it to the top right hand corner of the front side of the envelope, where the gummed surface of the flap secures it to the front of the envelope. The postage stamp is then fixed over the flap so that the envelope cannot possibly be unfastened without destroying the stamp.

Importance of Small Quantities of Impurities in Metals.*

BY W. CHANDLER ROBERTS-AUSTEN, F.R.S.

The author points to the great industrial importance of the influence exerted by small quantities of metallic and other impurities on masses of metals in which they are hidden. He states that this is most marked in the case of iron, and that when Bergman discovered, in 1781, that the difference between wrought iron, steel, and cast iron depends on the presence or absence of a small amount of graphite, he was astonished at the smallness of the amount of matter which is capable of producing such singular changes in the properties of iron. The evidence as to the importance of small quantities of impurity is quite as strong in other directions at the present day, as is shown by the statement of Sir Hussey Vivian, that one thousandth part of antimony converts "best select" copper into the worst conceivable, and by the assertion of Mr. Preece, that "a submarine cable made of the copper of to-day," now that the necessity for employing pure copper is recognized, "will carry double the number of messages that a similar cable of copper would in 1858," when the influence of impurities in increasing the electrical resistance of copper was not understood.

Allusion is made to the effect of a small quantity of tellurium on bismuth. Commercially pure bismuth has a fracture showing brilliant mirror-like planes, but if the one thousandth part of tellurium be present, the fracture is minutely crystalline. Specimens of bismuth are submitted to the society. The author states that in his own experiments he has employed gold prepared by himself with great care, the purity of which has been recognized by no less an authority than M. Stas. A portion of this gold was recently used by Professor Thorpe in a determination of the atomic weight of gold. Gold was selected for the experiments for the following reasons: It can be prepared of a very high degree of purity, it possesses considerable tenacity and ductility, the accuracy of the results of the experiments is not likely to be disturbed by the oxidation of the metal or by the presence of occluded gases, and the amount of impurity added to the gold can be determined with rigorous accuracy. The influence of small quantities of metallic impurity in rendering gold brittle has long been known, and is frequently referred to by the older metallurgists, especially by Geber, Biringuccio, and Gellert, and by Robert Boyle. The first systematic experiments on the subject were made by Hatchett at the request of the Privy Council, and were communicated to the Royal Society in 1803. Hatchett concluded that certain metals, even when present in so small an amount as the one one-thousand-nine-hundredth part of the mass, will render gold brittle, and he stated that: "The different metallic substances which have been employed in these experiments appear to affect gold in the following decreasing order: 1. Bismuth. 2. Lead. 3. Antimony. 4. Arsenic. 5. Zinc. 6. Cobalt. 7. Manganese. 8. Nickel. 9. Tin. 10. Iron. 11. Platinum. 12. Copper. 13. Silver." Mr. Hatchett did not, however, employ pure gold, and in his time the importance of submitting metals to mechanical tests was not understood.

The author then proceeds to describe the results of his own experiments, and he states that in selecting tenacity as the test to which the metal should be submitted with a view to ascertain the effect of the added matter, the following considerations presented themselves. W. Spring has built up alloys by compressing the powders of the constituent metals, and by pointing to the evidence of molecular mobility in solid alloys he has done much to show the close connection which exists between cohesion and chemical affinity. Raoul Pictet considers that there is intimate relation between the points of metals and the lengths of their molecular oscillations, the length of the oscillation diminishing as the melting point increases, and, as Carnelley has pointed out, "We should expect that those metals which have the highest melting points would also be the most tenacious." It is known that the melting points of metals are altered by the presence of small quantities of foreign matter, and their cohesion is also thereby altered. The degree of cohesion may thus be investigated either by the aid of heat or by mechanical stress. It might have been well to ascertain the amount of change in the melting point of gold produced by the presence of the different elements in small quantity, but, unfortunately, slight variations in high melting points are very difficult to determine with even approximate accuracy, and it appeared to be better to ascertain the effect of metallic and other impurities on the cohesion of the gold, as indicated by the amount of force externally applied in an ordinary testing machine, and in that way to ascertain whether the effect of added metals is amenable to any known law.

The purest gold attainable has a tenacity of 7·0 tons per square inch, and an elongation of 30·8 per cent on 3 inches. Professor Kennedy found that a less pure sample, which contained 999·87 parts of gold in 1,000, broke with a load of 6·29 tons per square inch, it had an elastic limit of 2·12 tons per square inch, and elongated 18·5 per cent before breaking. In the following experiments only the purest gold that could be prepared was employed. The effect on the tenacity of gold produced by adding to it about 0·2 per cent of various metals and metalloids is shown in the following table, in which the results are arranged according to the tensile strengths:

Name of element added.	Tensile strength of test piece. Tons per sq. in.	Elongation. Per cent (on 3 inches).	Impurity. Per cent.	Atomic volume of impurity.
Potassium	Less than 0·5	Not perceptible.	Less than 0·2	45·1
Bismuth	0·5 (about)	"	0·210	20·9
Tellurium	3·88	"	0·186	20·5
Lead	4·17	4·9	0·240	18·0
Thallium	6·21	8·6	0·193	17·2
Tin	6·21	12·3	0·196	16·2
Antimony*	6·0 (about)	?	0·203	17·9
Cadmium	6·88	44·0	0·202	12·9
Silver	7·10	33·3	0·200	10·1
Palladium	7·10	32·6	0·205	9·4
Zinc	7·54	28·4	0·205	9·1
Rhodium	7·76	25·0	0·21 (about)	8·4
Manganese	7·99	20·7	0·207	6·8
Indium*	7·99	26·5	0·200	12·1
Copper	8·22	43·5	0·193	7·0
Lithium*	8·87	21·0	0·201	11·8
Aluminum*	8·87	25·5	0·186	10·1

Reasons are given for adding the comparatively large amounts of impurity (two-tenths per cent), notwithstanding that even "traces" of certain metals would have produced very marked effects upon gold, and evidence is adduced to show that exact concordance in the respective amounts of matter added to the gold is not of much importance.

The testing machine is of the form devised by Professor Gollner, and used by him at Prague. It is a double lever vertical machine working up to a stress of 20 tons.

The author points out that these results lead to the conclusion that the tenacity of gold is affected by the elements in the order of their atomic volumes, and he discusses the evidence in favor of this view at some length, pointing especially to the fact that while those elements the atomic volumes of which are higher than that of gold greatly diminish its tenacity, silver, which has nearly the same atomic volume as gold, hardly affects either its tenacity or its extensibility. He shows that so far as the experiments have been conducted, not a single metal or metalloid which occupies a position at the base of either of the loops of Lothar Meyer's curve (which is a graphical representation of the periodic law) diminishes the tenacity of gold, while, on the other hand, metals which render gold fragile all occupy higher positions on Meyer's curve than gold does, and he urges that the relations between these small quantities of the elements and the masses of metal in which they are hidden are under the control of Mendelejeff's law of periodicity, which, as originally expressed, states that "the properties of the elements are a periodic function of their atomic weights." Carnelley has given strong evidence in favor of supplementing the law as follows: "The properties of compounds of the elements are a periodic function of the atomic weights of their constituent elements," and the question arises, "May the law be so extended as to govern the relations between the constituent metals of alloys, in which, as is well known, the atomic properties are often far from simple?"

The effect on gold of small but varying quantities of metals, singly and in presence of other metals, demands examination, and their influence on the specific gravity of gold must be ascertained. Until this has been done no explanation as to the mode of action of elements with large atomic volumes will be attempted.

* Abstract of a paper read before the Royal Society, March 15, 1888. - *Chem. News.*

A Patent Symposium.

"I tell you, sir, the Patent Office ought to be reformed, every man of them turned out, from the least unto the greatest, and the law altered so that a patent would be good for something!" The speaker was one of those overgrown noisy men with bulbous form and bawling voice, loudly giving his opinions in one of the hotels on Union Square, where electricians do congregate. He said that he came from the State of Kansas, and some accident of hospitality had evidently brought him very nearly into another state—the penalty for which in Kansas is, we believe, death for the first offense and dissection for the second. The results were limited to making him slightly loquacious without further disabling his faculties.

A cool young man inquired if he was interested in any patents.

"Why, yes; that is my business. I am a professional patentee, Col. Grumpus Bloward, of Yates County, sir. I was the first inventor of the telephone. It was in the spring of '37. I didn't make one, but I said at the time that the telegraph was very good, but they ought to talk by telegraph. I conceived the idea and therefore made the mental effort, yet they would never have given me a patent. I was told two years ago that it was no use to apply for a patent—and see what this grasping monopoly of a telephone company now holds!" [The last in the best tones of his voice.]

"Did you fully recognize the value of such an invention accomplishing the electrical transmission of speech?" asked the young man.

"Certainly I did, and never lost sight of it, either. I knew that it was worth millions and millions."

"Ever buy any telephone stock?" was the next interrogatory.

"Now, young man, that has nothing to do with the question, and I don't wish you to try and dodge the subject in that manner! As I was going to say, I invented a perpetual motion, and put in my application for a patent; and what do you suppose they did? What do you suppose they did?" [Second time, voice *fortissimo crescendo.*] "They sent back papers and money with a letter written by an understrapper, and signed by some chief cook, saying that the office did not recognize that the subject was within natural laws, and that it was therefore beyond the scope of the office, and the application could not be entertained by them. It was an infringement of my rights as a citizen. They ought to give every one a patent and one that would be good for something, so that there would be no suing and infringing."

"Suppose that some one would apply for a patent on some invention for which you had received a patent?" asked the young man.

"Why, the office would have to throw it out," was the reply.

"Well," pursued the inquisitor, "what would you do if some one should 'make, vend, or use' your invention?"

"Shut him up at once!"

[Very savage this time, suggestive of retrogressive revolution. No scalping done, however.]

"Possibly without due process of law or bringing the action and proving the infringement?" asked the young man.

"I said once that the government ought to make a patent always good, without obliging people to go to law. Not half of the patents are good for anything in the courts."

"That matter has been looked up," said the young man, consulting a memorandum book, "and the records of the decisions of the United States courts on patent issues from 1776 to 1886, as given in Meyer's Federal Decisions, show that 73 per cent of the patents were sustained and 27 per cent of the patents were annulled. Of those which were sustained, 67 per cent were valid in their entirety and 33 per cent were sustained in part. In later years the percentage of valid patents is largely in excess of the average result, owing to the decisions which have established every phase of patent law, and also the higher class of men which have been engaged in the solicitation of patents.

"The majority of patents possess a stability of value which will compare favorably with that of personal property in stocks, but any lack of value in patents cannot be ascribed to defects in the legal status of the patents, but to the lack of skill in the patentees, whose inventions are either inoperative or not suited to any practical purpose to a degree superior to present methods.

"The art of inventing consists in finding out what is wanted, and then making something to fill that want. By reason of inventions protected by patents, I have been prosperous, receiving at thirty-five a larger annual income than the aggregate amount obtained by my father during a pastorate as long as my life.

"No one has been defrauded, no one has been made poorer, while labor has been made lighter and production increased, giving additional resources to those who would have lacked.

"If there had been no patents, I should not have thought. If I had not thought, I should not have invented, but would have been a laborer—a hewer of wood and drawer of water.

"The moderate pay and the defects of the civil service in regard to appointment and promotion render it a wonder that the vast deal of work imposed by law upon the Patent Office can be so well and so faithfully performed. It is but in the nature of things that there is opportunity, even need, of reform, but it must be the kind of reform which improves, and not the kind of reform which destroys.

"Concede everything alleged against the United States patent system, and then name the nation whose patent system you would take in exchange."

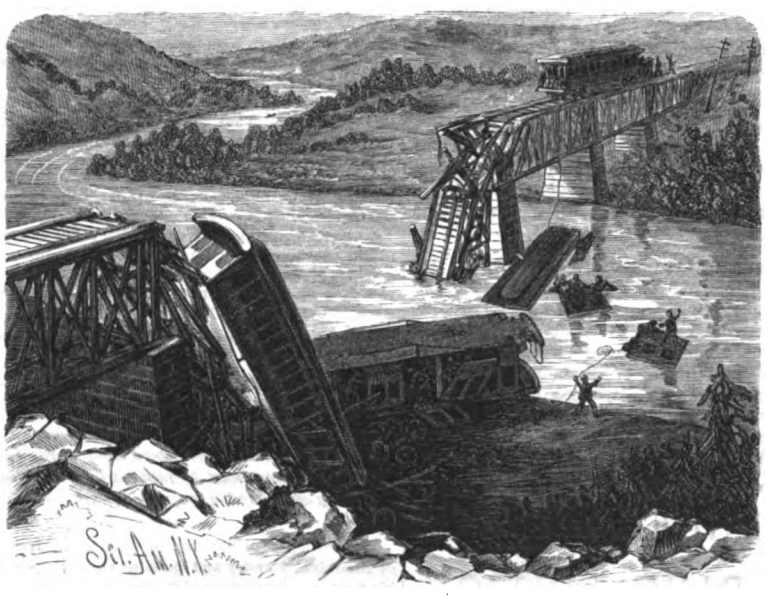
This gentleman, who had joined the group unannounced, departed unattended, while a young stenographer who had reported the discussion without being observed, wrote it out and submitted the foregoing credentials accompanying an application for employment in the office of the *Electrical Review.*

A Stopper for Rats.

A correspondent says: Soak one or more newspapers, knead them into a pulp, dip the pulp into a suitable solution of oxalic acid. While wet, force the pulp into any crevice or hole made by mice or rats. Result—a disgusted retreat, with sore snouts and feet, on the part of the would-be intruders. *Probatum est.*

AN IMPROVED PASSENGER RAILWAY CAR.

A passenger car made with detachable and buoyant side panels, readily removable in case of accident, for the release of the passengers, is represented in the accompanying illustration, and has been patented by Mr. Henry Niehoff, of No. 74 West Fifty-third Street, New York City. These panels, which extend below the windows of the car, have in their lower portions air-tight vessels, or the lower part of the panels may be filled with cork or other light material, the panels having recesses in their abutting edges for the introduction of a double-headed dowel, of which the heads extend to the inner and outer faces of the panel. Below these recesses is a transverse slot, in which is fitted the connecting web of an H-shaped clip, the web entering registering recesses in the abutting edges of the adjacent panels, and the clips being bent down to bear against the outer and inner faces of the panels. One of the end panels is permanently connected to the car, and as many other panels are employed as may be necessary to fill up and inclose that side of the car, their vertical edges connected as described, and each panel being supported at its lower edge by a pin which fits into a socket secured to the sill of the car. In the upper edge of the panels is a slot entered by a tongued shaft mounted in the framing of the car above the space occupied by the panels, this shaft having outer handles and inner handles or lever arms. This shaft and lever handles are so arranged that in case of accident, as by the overturning of the car, the tongues will be carried upward, and a slight push upon the panels will cause them to fall outward from the car frame, thus clearing the whole side of the car; or this turning of the tongues may be effected by parties on the outside or inside of the car by grasping the inner or outer handles. By this construction also, should the roof or floor of the car be badly broken, the panels will fall out, and should the cars fall into the water the air-tight or cork-packed compartments of the panels will make them useful as life preservers.



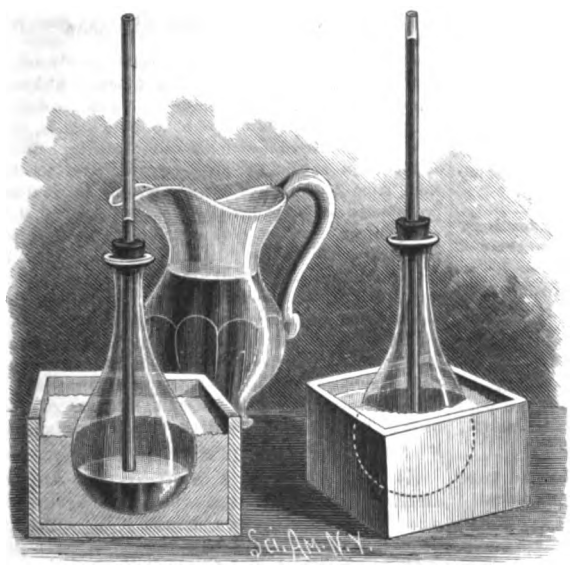
NIEHOFF'S PASSENGER RAILWAY CAR.

EXPERIMENTS ILLUSTRATING PHYSICAL AND CHEMICAL CHANGE.

T. O'CONOR SLOANE, PH.D.

At the present time, when physics and chemistry approach so closely to each other, and may even be said to overlap, it is very hard to furnish definitions that will really distinguish one from the other. When the vexed ground of solution and molecular combination is reached, it is often impossible to characterize reactions as chemical rather than physical, or the reverse. Perhaps the best distinction is to consider chemistry the science of atoms, and physics the science of molecules. Then mechanics is left as a heading for the science of mass.

The general indications of a chemical reaction include the production of thermic changes. If it is a case of combination, an increase of temperature is produced, as a general rule. Heat is always developed, but it may be marked by incidental changes productive of cold. On the other hand, in a physical change, minor thermal activity, as a rule, prevails.



PHYSICAL AND CHEMICAL CHANGE.

Advantage is taken of the opposite thermal effects due to chemical combination and to liquefaction in the experiment illustrated, to produce an example of a chemical contrasted with a physical change. In the first, heat is produced by chemical combination; in the second, cold is produced, or, more strictly speaking, heat is absorbed by the act of liquefaction—a purely physical phenomenon.

Two flasks, of about one pint capacity, are fitted with singly perforated corks. Through each cork a glass tube of about one-fourth inch internal bore is passed, which reaches nearly to the bottom of the flask. A little water, enough to seal the end of the tube, is placed in each, and the corks are pressed home. This forces water up into the tubes. All should be so arranged that when the corks are in place the water will reach to the center of each tube. The flasks thus arranged form delicate thermoscopes or indicators of a change of temperature. To render their indications visible, a little coloring matter should be added to the water. A little sulphocyanide of iron, formed by adding potassium sulphocyanide and ferric chloride (chloride of iron) to the water, is an excellent material. It colors the water red, and, unlike most of the aniline colors, does not stain the glass. For most experiments where water is used, this will be found an excellent substance for rendering the water visible.

Two boxes, which should be as near watertight as possible, and which should be large enough to hold the flasks, are next needed. In each of these a flask is placed. One is packed around with quicklime, preferably in somewhat small pieces. The other is embedded in crystals of nitrate of ammonia. Water is poured into the two boxes, so as to fill them within an inch of the top, while giving the fluid time to percolate through the mass of solid material.

The quicklime has a strong affinity for water, and in combining with it undoubtedly suffers an atomic change. The water and calcic oxide unite, and in a few minutes become very hot. The air within the flask is expanded by the heat, and the column of water rapidly rises in the tube. If left long enough, it will overflow it. This illustrates a chemical reaction with evolution of heat.

In the other box the nitrate of ammonia rapidly dissolves or liquefies. This change requires the expenditure of energy, represented by the absorption of heat. As none is supplied from an artificial source, the dissolving salt absorbs it from the water, and cold is produced. The column of water in the thermoscope tube sinks rapidly, and soon is out of sight. This illustrates a physical reaction, the change of state from solid to liquid without any atomic change.

The water should be added to both boxes from one pitcher. Thus conducted, a very curious and paradoxical effect is produced. Water from the same vessel produces both heat and cold.

As regards the solution of the nitrate of ammonia, possibly an obscure chemical combination, heat may be produced by it. If so, it is overcome by the greater degree of cold which is produced by the change of physical state of the nitrate of ammonia from solid to liquid.

Other substances may be used. Thus anhydrous carbonate of soda may be used instead of the lime, and many salts used in freezing mixtures could be cited as substitutes for the nitrate of ammonia. Ammonic sulphocyanide is an extremely powerful refrigerant. But from its general innocuousness, the nitrate is to be strongly recommended.

Making Sash Weights out of Tin Cans.

The latest use for tin cans, and the chips from the tin shops, is the conversion of the material into sash weights. The *Commercial Bulletin* says: There is no secret about the process. The only thing is to have a proper sized furnace and to get up a sufficient heat. The business has developed of late, but the manufacturers say the margin of profit is small. It costs more to melt the scraps than common iron. Chips ready for the furnace cost seven dollars a ton. The sash weights produced are of a superior quality. The business is, like the case of old rubber, an illustration of the use of waste material. The tin can companies and other manufacturers of tin goods formerly dumped hundreds of tons into space, but now these scraps are utilized, and the irrepressible small boy works the ash fields to his profit in companionship with the blithesome goat.

Careless Handling of Nitro-glycerine.

If there is anything more surprising than the explosive force of nitro-glycerine, says the *American Architect*, it is certainly the carelessness with which that substance is handled. It is well known that nitro-glycerine freezes at a temperature considerably above the freezing point of water, and scores of accidents have resulted from the reckless methods employed for thawing it. Years ago, when pure nitro-glycerine was used for blasting, a workman in Germany found one morning his can of explosive material frozen. Being in a hurry to begin work, he returned to the house, heated a poker red hot, and started off to thaw the nitro-glycerine with this instrument. It is hardly necessary to say that he succeeded to perfection, the nitro-glycerine changing its condition with an energy which pulverized not only the operator, but all other surrounding objects.

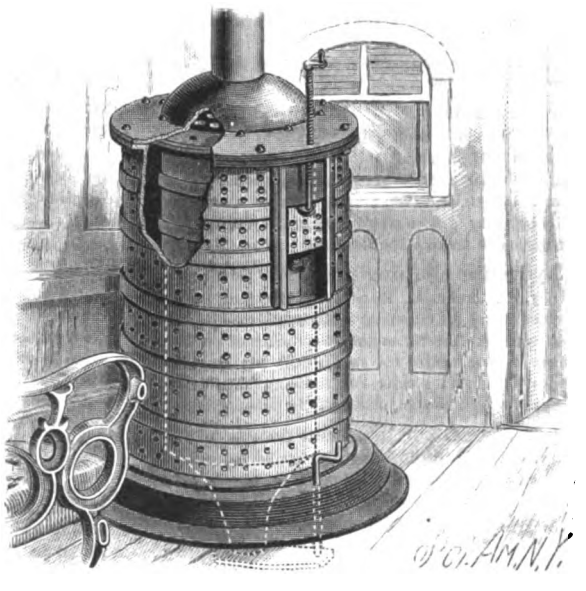
A few days ago, according to *Fire and Water*, five miners in Michigan brought a bent gas pipe to a blacksmith's shop, where it was heated and straightened. Without waiting for it to cool, they then filled it with dynamite, which immediately exploded, killing them all. Almost at the same moment a man in New Jersey brought some blasting cartridges to thaw them out by a fire. He accomplished this result by holding them on the flame for a suitable period, and is supposed to have dropped one during the process, for his remains were found in a fragmentary condition sixty feet away. At Richmond, Ind., on the same day, six tons of dynamite, which had been stored on a farm, exploded, blowing a horse and wagon to pieces, excavating a pit fifteen feet deep and twenty-five feet in diameter, injuring a woman a quarter of a mile away, and breaking every window in a neighboring village.

An Unlooked-for Explosion.

A little knowledge of chemistry has often, from ignorance or when possessed by a person of an experimental turn of mind, led to disastrous results. *Hospital* tells of a nurse in a London hospital who was cleaning a bottle which had contained glycerine. To facilitate matters she poured in some nitric acid, thereby unintentionally forming the explosive compound nitro-glycerine. The bottle burst in her hands, and one piece flew up and struck her face with such violence that her cheek was badly cut and one eye seriously injured.

AN IMPROVED CAR-HEATER.

A car-heater designed to be capable of sustaining great weight, and not allow the escape of fuel should the car be overturned, is illustrated herewith, and has been patented by Mr. James Wardle, of Hope, British Columbia, Canada. It is constructed of two concentric cylindrical casings of malleable steel or iron, both cylinders being strengthened by outer attached metal hoops or bands, and between them a space for the circulation of air. The centrally-apertured base to which both cylinders are attached is secured to the car floor, the inner cylinder having a conical bottom projecting downward through the floor, as shown in dotted lines,



WARDLE'S CAR-HEATER.

a horizontal plate beneath acting as a damper, and also as a means whereby ashes may be dumped through the conical bottom. The outer cylinder is provided with a series of apertures between the encircling bands, and the inner cylinder is capped by an apertured plate, to prevent fuel entering the smoke-pipe should the car be overturned. The latched fuel door of the inner cylinder corresponds with an opening of the outer casing, covered by a door adapted to slide in ways, and operated by a screw rod which travels in a threaded aperture in the flange of the top.

ENGINEERING INVENTION.

A changeable gauge truck has been patented by Mr. Samuel R. Wilson, of Adelaide, South Australia. It is to effect the automatic transfer of railway cars from tracks of one gauge to another, for which the axle ends and wheels are threaded, and midway upon the axle is a square block, which, on coming in contact with an elevated ridge or rail in the center of the track, locks the axle, causing the wheels as they revolve to approach or recede from each other as they pass into a changed gauge.

AGRICULTURAL INVENTIONS.

A corn planter has been patented by Mr. Charles C. Du Cray, of Iowa County, Wis. It is designed to provide for the smoothing of the ground in advance of the wheels, for the marking off of the adjacent rows as the planter advances, and for improving the corn-delivering mechanism, the invention covering various novel details and combinations of parts.

A planter and fertilizer distributer has been patented by Messrs. Lewis and John Charles, of Clear Spring, Md. Its construction is such that the dropping devices can be readily thrown into or out of gear with the drive wheel, and the fertilizers agitated and forced outward as desired, the invention covering various novel features and combinations of parts.

MISCELLANEOUS INVENTIONS.

A reversing gear for saw mills has been patented by Mr. Europe N. Collett, of Whelen Springs, Ark. This invention covers a novel construction and combination of parts and details for a simple and durable device to impart a forward and backward motion to the saw mill carriage.

A saw jointer has been patented by Mr. Charles R. Black, of Topeka, Kansas. It has two plates recessed on their inner adjacent faces to form saw and file receiving spaces, with a slot and a locking projection engaging them, to facilitate the jointing or leveling the teeth of saws prior to filing them.

A leak stopper for vessels has been patented by Mr. Louis Weihe, of Connellsville, Pa. It consists of a canvas sheet with horizontal stay rods at suitable distances apart, ropes for suspending the canvas sheet, and means for releasing the rolled-up sheet to cover a leak in the side of a vessel.

A vegetable cutter has been patented by Mr. Anthony Lethert, of Jordan, Minn. It is a machine whereby vegetables of all kinds may be cut in slices and the slices cross-cut if desired, in a convenient, speedy, and efficient manner, the machine being simple and durable in construction.

A bulletin board has been patented by Mr. Levi J. De Land, of Fairport, N. Y. This invention provides a simple construction by which to hold a number of tablets or cards which may be differently inscribed, and changed as often as desired, for exhibiting different signs from time to time.

A bag fastener has been patented by Mr. Henry A. Martens, of St. Joseph, Dakota Ter. It consists of two clamps hinged together, one formed with a toothed arm and the other having a spring bolt adapted to engage the toothed arm, making a simple metallic fastener especially designed for use on grain bags.

A brace for bedsteads has been patented by Mr. Charles P. Lewis, of Sweet Springs, West Va. From hooks on the inner corners of the posts, below the rails, bands extend to a central head, in which a bolt is held to be turned by a wrench or other suitable tool, for strengthening bedsteads and holding the posts firmly in place.

A slate for telephone desks has been patented by Mr. Emil T. Mueller, of La Crosse, Wis. It consists of a sheet of suitable material covered with a slate composition, and having retaining clips adapted to clamp the edges of a desk, and hooks to hold a slate or lead pencil, to be constructed of various sizes to fit different desks, for conveniently recording messages.

The manufacture of thimble skeins for axles forms the subject of a patent issued to Mr. Joseph F. Davidson, of Columbus, Ohio. The method consists in bending the metal blank until the longitudinal edges meet, or nearly so, and then uniting them by a separate strip, by bringing all to a welding heat and welding the parts together to make a double seam.

A hydraulic shaping press has been patented by Mr. Arthur E. Hobson, of Hartford, Conn. It provides means for clamping a flange formed at the edge of a blank directly to the upper edge of the die, the press having means for raising the die from its holder or case, and means for drawing the blank whereby embossed faced articles may be produced.

A portable fence has been patented by Mr. Albert Wheat, of Reading, N. Y. It is made of sections of posts and rails mounted in an inclined position against inclined braces, the inclined braces and fence sections resting against pegs driven into the ground, flexible strips extending over the braces and sections and being fastened to the pegs.

A heating furnace has been patented by Mr. James White, of Brooklyn, N. Y. It has separate air ducts through the combustion chamber, in combination with an air chamber surrounding the furnace, and other novel features, for heating a number of rooms independently and uniformly without regard to the length of pipe necessary, supplying also the requisite amount of moisture to the air.

An automatic fire extinguisher for car heaters has been patented by Mr. Louis A. Lyon, of Shorter's Depot, Ala. With a pipe extending into the fire box of a car heater are connected a funnel, hammers, and glass vessels holding a fire extinguishing liquid, so held relatively that the vessels are broken by the hammers and the liquid runs into the fire box when the heater is upset in any direction.

A saw filing machine has been patented by Mr. David W. Johns, of Allegheny City, Pa. It has a rotary file having a segment removed and replaced by an adjustable cam for automatically feeding the teeth of the saw forward, with mechanism for holding and guiding saws, and other features, being adapted for filing all varieties of saws, including circular, cross cut and rip saws, long saws, and band saws.

A frame for use in the manufacture of oil press mats has been patented by Messrs. Marcus T. and Junius A. Murphy, of New Orleans, La. This invention covers auxiliary pusher bars, used in connection with the regular mat plates, making a machine to stand a great hydraulic or other pressure for pressing the warps into a compact form without breaking the mat plates or injuring the warps.

A hot air furnace has been patented by Mr. Philip H. Scheurer, of Nashville, Ill. There are side flues between the fire box and casing, opening at their lower ends below the fire box, and down flues for the passage of the heat to the side flues, in connection with various novel features of construction and combinations of parts.

A telephone transmitter has been patented by Mr. John M. Graham, of Pittsburg, Pa. Two pairs of contact springs are arranged to press opposite ends of electrodes carried by springs bearing on the diaphragm, one contact spring of each pair being connected with one terminal of the induction coil, the electrodes operated by the diaphragm being connected with the terminals of the local battery, whereby the current in the local circuit is reversed during each vibration of the diaphragm.

Special.

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 next issue.

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.

(1) P. D. asks: How ought the word dynamo be pronounced? Should it be pronounced "dy-nam'-o," with the accent on the second syllable, like the word "dynamics," or should it be pronounced "dyn'-a-mo," with the accent on the first syllable? A. Analogy favors the pronunciation "din-a'-mo." It is of course an incomplete word—the first component of dynamo-electric.

(2) H. D.—Violin strings are made of the coatings of the entrails of sheep.

(3) P. B. asks: 1. Are magnetism and electricity the same substance? Does an electric light dynamo make the electricity, or simply collect it from the elements? If an electric light dynamo were placed in a perfect glass vacuum, insulated and run as intended, would it produce any or more or less electricity than as now run? A. Neither magnetism nor electricity can be called a substance. Magnetism is a force supposed to be due to magnetic energy; magnetism is a manifestation or phenomenon of electricity, according to the most recent theories. An electric light dynamo converts mechanical energy into electric energy, and would work equally well in a vacuum.

(4) W. F. P. asks: 1. Will a bichromate battery with half as much surface of zinc and carbon as another, have half as much power? A. Practically speaking, yes. The smaller battery will give the same difference of potential, but will have double the resistance, if the plates are at the same distance. 2. Is the carbon obtained from gas retorts the kind used for these batteries? A. Battery carbons are generally made from a carbon composition paste, which is baked and ignited. 3. How many cells of the simple plunge battery described in vol. lvii., page 116, of the SCIENTIFIC AMERICAN will it take to run the simple electric motor, with sufficient power to operate a sewing machine? A. This battery is too small for the purpose. 4. Also how many will it take to run a three candle power electric light? A. For a three candle incandescent lamp, use four to six cells.

(5) M. O. G. asks: 1. Could the armature core be made of cast iron, or is it better to have it of soft iron wire, and why so? A. The armature core is subjected to rapidly recurring changes of polarity. To enable these to take place and to prevent the formation of Foucault currents, wire is used. 2. Would a battery comprising 12 cells, having 2 carbons each 2 inches by 3 inches, and 1 zinc of the same size in each cell, give enough power to run one sewing machine? A. The plates of your battery are rather small. It would probably drive a light sewing machine. Your plates should be of double the area given.

(6) E. A. writes: I have built a dynamo electrical machine, combining some of the features of the machine described in SUPPLEMENT, No. 161, with the one in No. 600. I made my patterns after the one in No. 161, but made them three times as large as drawings instead of twice as large. Shuttle armature wrapped with No. 18 double covered wire; magnet wound same as the 8 light dynamo in SUPPLEMENT No. 600, but with No. 16 wire. I have 72 convolutions on each limb, and eight wires deep. Dimensions of magnet as follows: Height 9 inches, width 6 inches, thickness 4 inches, magnetic field opening is 2¼ inches diameter, magnet and armature weigh about 30 pounds, that is of iron. I started it with one cell of gravity battery, and it works splendidly, gives very powerful shocks. Now, from these data, would you inform me what the probable power of the machine would be, that is E.M.F. and quantity of current produced, running at a speed of say 1,500 revolutions per minute? And what would be its lighting capacity, if any? Is there not some simple way in which to measure its power, say by heating a given amount of platinum wire of a given size, say No. 36? What is the power in volts of the machine described in SUPPLEMENT, No. 161? A. You can measure the power of your machine by comparing it with 6 or 8 cells of gravity battery, by the aid of a tangent galvanometer. The machine described in SUPPLEMENT, No. 161, yields a current of 6 volts and 3 amperes.

(7) G. A. writes: I wish to run an incandescent lamp, one now, may be later on lighting the whole house, but of course a dynamo is too expensive for this, so I am going to use a storage battery, charging it during the day with cells. Will you please tell me what is the cheapest, best storage battery I can use, and how it is made? Also, what cell had I better use? A. For information on storage batteries, consult SUPPLEMENT, Nos. 304, 370, 382, 354, and 215.

(8) W. J. B., referring to the 8 light dynamo, asks: 1. What size wire should be used for main circuit? A. It depends upon the length of the circuit. If the circuit is short, No. 16 copper wire will do; if long, the size should be increased to No. 14 or even No. 12. 2. Must not the current pass through each lamp in succession? As I understand the diagram in SUPPLEMENT, No. 600, it seems not. Will you explain or refer me to some paper on the subject? A. The dynamo is unable to produce a current of sufficient voltage to run through eight lamps in series. The dynamo referred to, in which the lamps are arranged in parallel, is cor-

rect. 3. Should the wire on dynamo be single, double, or triple wound? A. Fine double wound armature wire is the best. 4. Should joints in main circuit be made with solder? A. Not necessarily; if the wires are well twisted togther and the joint is protected, there will be no appreciable resistance. It is, however, advisable to solder the joints of conductors wherever it is convenient.

(9) C. M. H. asks: What changes are necessary to convert the motor described on page 165 of SCIENTIFIC AMERICAN of March 17 into a dynamo? And how many 16 candle incandescent lights will it furnish? How should it be connected? A. Provide a cast iron field magnet as described on page 229 current volume of SCIENTIFIC AMERICAN, and wind the armature with No. 20 wire. Connect as in the motor. The number of lamps it would run could be determined only by experiment.

(10) J. S. M. asks how bromide prints are made. A. You purchase the paper, called gelatino-bromide paper, already sensitized, from dealers in photographic supplies, and expose it in contact with a negative to lamp or gas light, holding the frame about three feet therefrom, for about two or three seconds. The exposed sheet when removed from the frame (in a room lighted by a ruby orange light) has no apparent image on it. But it is wet with water, laid in a tray, and over it is poured a developer as follows:

Saturated solution oxalate potash.... .... 6 oz.
" " sulphate iron..... 1 oz.

In a few minutes the positive picture comes out. When finished, it is removed from the tray, washed with water, and immersed for five or ten minutes in a fixing bath (hyposulphite soda one ounce, water six ounces). It is then washed for two hours, and dried. If dried on a sheet of hard rubber, the surface will possess a beautiful glaze or polish.

(11) E. W. J. writes: I have a zinc and carbon battery consisting of eight cells, and I use for a fluid sulphuric acid and bichromate of potash. I wish to change it to a zinc and copper battery. What I wish to know is, will I have to use a different liquid? If so, what? And how will it compare in E.M.F. to the common zinc and carbon? A. You will have to arrange your zinc copper battery as a Daniell or gravity combination, whose electromotive force will be 1·07 volts per couple, or a little over half that of the zinc carbon cell. A solution of sulphate of copper will be the proper exciting fluid.

(12) B. N. asks if the potato is a fruit or a vegetable? What is the definition of the word vegetable? What is the difference between a fruit and a vegetable? A. The potato is conventionally called a vegetable. It is a tuber, or subterranean stem. A vegetable is a plant, part or all of which is used for culinary purposes, or for feeding animals. A fruit is the edible succulent portions of certain plants generally edible by man without cooking. It is impossible to draw a sharp line between them.

(13) J. M. S. should have patience and try to improve his spelling and handwriting. If he proves able to do good work, he will advance slowly, but surely.

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