SCIENTIFIC AMERICAN

Vol. XCV.—No. 2.
ESTABLISHED 1845.

NEW YORK, JULY 14, 1906.

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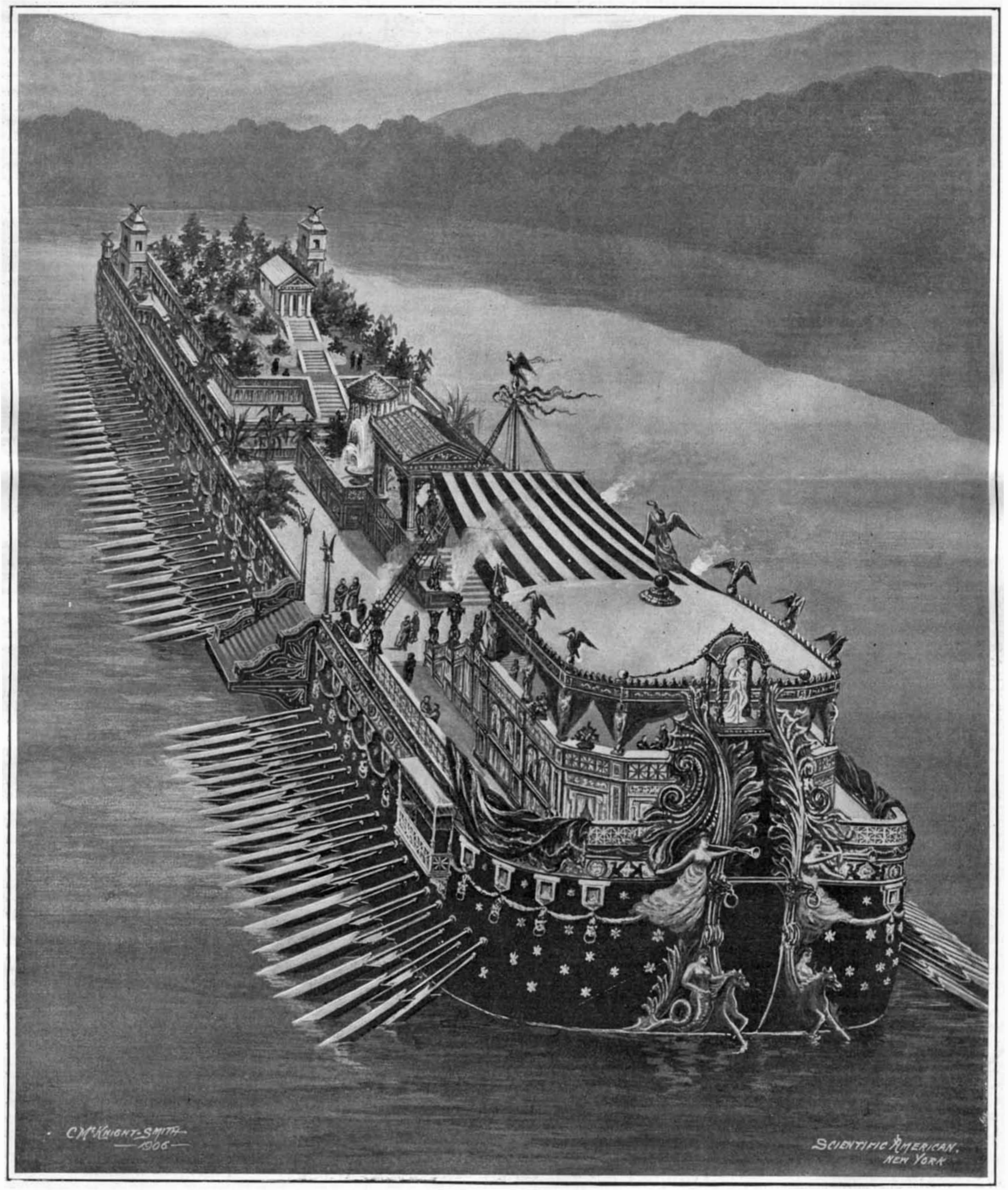

THE GORGEOUS GALLEY OF TIBERIUS AS IT PROBABLY APPEARED WHEN AFLOAT ON LAKE NEMI.—[See page 25.]

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ESTABLISHED 1845

MUNN & CO. - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, JULY 14, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

TUNNELING BY THE FREEZING METHOD UNDER THE EAST RIVER.

In nearly all sub-aqueous tunneling as at present practised, air pressure within the tunnel of sufficient strength to counterbalance at the heading the pressure of silt and water is obligatory. The increase of pressure required above that of the atmosphere is approximately one pound per square inch for every two feet of depth. With a small tunnel of, say, six feet bore, the difference of pressure required between the top and bottom of the tunnel is slight (three pounds), but with a tunnel of a large diameter (twenty-three feet) such as is required for a railway, this difference in pressure becomes four times as great. As the air pressure at the top of a tunnel heading of the latter size is some ten or twelve pounds greater than is needed to properly counterbalance the inward pressure of sand or silt at that point, there is a constant seepage of compressed air through the river bed. This tends to loosen the material of which the bed is composed, and if the thickness of silt is not sufficient, or if its consistency is not good, there may be a blowout, whereby a hole is made in the bed of the river and the tunnel is liable to be flooded. The expedient must then be resorted to of dumping clay upon the bed of the river, in order to strengthen it and fill the hole, as well as to increase the depth of earth above the tunnel roof.

In the two tunnels now being constructed for the Pennsylvania Railroad Company under the East River, there have been a considerable number of blowouts. These occurrences are rather spectacular, as a great column of water is projected twenty-five feet or more into the air. They have been the object of much comment from the newspapers. According to the engineer in charge of the work, however, these blowouts have not been more numerous than was expected. The method of stopping them by dumping clay upon the river bed is an old one, it having been first used some seventeen years ago by the same engineer in the initial work upon the Hudson River tunnel. This engineer is the man who superintended the construction of the Blackwall tunnel under the Thames, in which case there was a distance of five feet intervening between the top of the tunnel and the top of the river bed. A blanket of clay fifteen feet thick was deposited upon the river bed at this place, and the tunnel was driven without any blowouts. Somewhat similar conditions have been met with on the west shore of the East River. The twin tunnels, which are only fourteen feet apart, start from a shaft which was sunk at the edge of the river, and run for about one hundred feet through solid rock. As they emerge from this rock, the face of which forms a gradual incline, they run partly through rock and partly through sand. At this point there was but ten feet of sand above the line of the tunnel, and it was necessary to dump clay upon the river bed in order to obtain a total thickness of twenty feet. After the tunnel had been completed for about one hundred to one hundred and fifty feet, this clay was removed and discharged farther out in the river, thus making it possible to push forward another section of tunnel. This, it will be seen, is a rather laborious method of preparing the way for the tunnel, but despite the fact that this method had to be resorted to for a considerable distance from shore, the tunnels have advanced at an average rate of from five to eight feet a day. The contract time for the completion of the tunnels expires in a little over two years hence. In order to complete them within this time, the contractors have only to progress at the rate of three or four feet a day. Thus it will readily be seen that in all probability they will be able to carry out their contract. Of the four tubes being run under the river, one of each pair has been pushed forward 600 feet from the shaft on the Manhattan shore, while the other two have gone out 110 and 250 feet respectively, the former being just about to emerge from the rock, while the latter is in the section consisting of rock and sand. The reason that one tunnel of each pair is being pushed forward instead of the two is that the contractors did not want to run the risk of a blowout in one tunnel affecting the work in its twin. This would not be liable to happen if one of each pair was pushed forward, since the two pairs of tunnels are 150 feet apart. The total distance under the river is about 4,000 feet. The two tunnels that are farthest along have reached the point of greatest depth—83 feet—below the surface of the river. The tunnels which are being driven to meet these from the Long Island side have been constructed for a distance of 1,500 feet from East Avenue, Long Island City, and they are already out some little distance beneath the surface of the river. At just what point the tunnels being driven from the two shores will meet, it is at present difficult to say. The Blackwell's Island ledge of rock must be penetrated at the center, and the probabilities are that the western tunnels will be driven through this rock, and will meet the eastern tunnels on the other side of it.

With a view to using it in future tunneling operations, the Pennsylvania Railroad is experimenting with a new system which was invented by Mr. Charles Sooysmith, and which consists, in the main, in first driving a small pilot tunnel and then, after installing in it a series of circulating pipes, of freezing the moist material around the tunnel a sufficient distance to allow of enlarging the smaller tunnel in the frozen silt. In order thoroughly to test the practicability of this idea, the company drove, from the base of an eighty-foot shaft located at the foot of East Thirty-fifth Street, a seven-and-one-half-foot tunnel, 160 feet long, out beneath the surface of the river. The least depth of material above this small tunnel is about twenty feet. Placed longitudinally along the walls of the tunnel, throughout its entire circumference, are a series of pipes for the circulation of the brine of a refrigerating plant located on the pier. By means of this arrangement a temperature of about 35 deg. Fah. below zero has been constantly maintained in the tunnel for some months, with the object of freezing the sand to a radial distance of thirteen and three-quarters feet. At different points in the tunnel holes have been pierced through the cast-iron shell, and run at varying distances into the sand. Sealed in these holes are thermometers with electric recording devices, which record the temperature constantly at the different depths. The result reached thus far is that the sand has been frozen about the tube a distance of nine feet in all directions, so that about two-thirds of the distance to be frozen has already been reached. The idea is to obtain a frozen cylinder thirty-five feet in diameter, or twelve feet larger in diameter than the completed tunnel. There will thus be a ring of frozen earth six feet thick to sustain the pressure of sand and water above and around the larger tunnel while the plating is being placed. By removing the plates of the small tunnel and quarrying out the frozen material, the enlargement of the tunnel can thus be accomplished without the use of any compressed air and without the danger of blowouts. It is estimated that the enlargement of a tunnel by this method will require from three to six months. The pilot tunnel can be driven in half the time required to construct a full-sized tunnel, and as all delays from blowouts would be avoided, it seems probable that a gain might be made in the time required for construction as well as in the cost of building. Perhaps the greatest advantage would be found in the fact that no air pressure would be required, and, consequently, there would be no delays to the work nor loss of life from this cause. In the present East River tunnels, according to the statement of the engineer in charge, fourteen men have succumbed as the result of working in the high pressure (thirty-four pounds to the square inch above atmosphere), while the work has been greatly delayed by the frequent necessity of changing the pressure when different kinds of material were being passed through.

THE GOVERNMENT AS AN ARMOR-PLATE MANUFACTURER.

Another periodical investigation of the armor-plate industry of this country is about to be undertaken. The House of Representatives has instructed the Secretary of the Navy to ascertain whether or not it is advisable to establish a government mill, thereby placing once more upon record its dissatisfaction with the present methods of obtaining armor plate for our navy.

So highly specialized is this industry of making armor plate, that it may well be doubted whether the government can very successfully compete with the Carnegie, Bethlehem, and Midvale companies, the only three firms which now maintain properly equipped mills for the rolling of armor. Many years ago, long before the Midvale company was started, the public harbored dark suspicions of a secret understanding between the Carnegie and Bethlehem companies whereby the price of armor plate was maintained at an inordinately high figure. Although the investigation which was then instituted for the purpose of determining the advisability of establishing a government plant failed to expose any such dishonest agreement, it may be questioned whether these gloomy doubts were ever removed. The new investigation which has been ordered would seem to show that they still linger.

A very cursory examination of the armor-plate industry should convince even the most ardent advocate of the Federal making of armor how hopeless a competitor of the private steel mills the government would be. In the first place, a plant must be designed and constructed at an expense that may, perhaps, be utterly disproportionate to the cost of its product for many years. In the second place, not every engineer is capable of designing a great mill, and the competent men are in the permanent employ of the great steel mills on a salary princely in comparison with the small sums the government usually doles out to its employés. It may be that Congress by appropriating the necessary funds for the employment of able engineers may overcome this obstacle. Still, the difficulty remains of obtaining efficient workmen. Whatever may be the willingness of Congress to set aside funds for the designing and building of a plant, it is questionable whether it would be willing to pay the salaries now drawn by the superintendents and higher officials of the larger steel mills. To add to the possible troubles in which the government may be involved, we must mention the difficulties which would be presented by the labor unions. The private steel mills have the great advantage over the government in having at their command a large force of picked technical experts skilled by long years of experience in manufacturing armor plate for the special tests which it must withstand at the hands of the government inspectors. Because the labor unions make no distinction between capable men and incapable and because they will tolerate no attempt on the part of employers to pay a competent man more for his labor, the private mills have rid themselves of men whom they could ill afford to pay the disproportionately high wages demanded and have retained only the very flower, as it were, of their operatives. The government can, therefore, hope to secure for its own mill (if it should ever be constructed) merely the discarded labor of the Bethlehem, Carnegie, and Midvale plants. An edifying picture of the possible results of such a course is to be found in the government printing office.

THE CANADIAN COMMISSION'S REPORT ON THE ELECTRIC SMELTING OF IRON ORES.

The preliminary report of the commission appointed by the Canadian government to inquire into the advisability of establishing a plant for the smelting of iron ore by electricity will not be deemed as illuminating or as exhaustive by those metallurgists who had hoped to find in it more trustworthy information than the desultory papers scattered through the technical press are able to impart. The chief criticism to be leveled at the report is to be found in the fact that the experimental plant, the operation of which constitutes the chief topic of discussion, was not worked for protracted periods under commercial conditions, and that the efficiency and cost data given are based on a few very good performances which may or may not be repeated in active practice. Realizing that the conditions which underlie the electrical reduction of iron in Europe must necessarily be different from those which obtain in Canada, it was determined to build a plant at Sault Ste. Marie for the purpose of ascertaining the cost of electrical reduction in Canada. Basing its estimate on a 10,000-horse-power hydro-electric plant, equipped with furnaces for producing 120 tons of iron during a day of twenty-four hours, the commission found as a result of its experiments that a ton of pig iron could be made for $10.69. Assuming that furnaces and accessories would cost $100,800, a charcoal plant $50,000, a power plant $500,000, and a furnace electrode plant $6,000, making a total of $656,800, and, furthermore, allowing 15 per cent for depreciation, interest, and amortization, the commission figures that the cost would be about $2.43 per ton of iron produced. Unfortunately this estimate is based upon the production of 4.32 tons of pig iron per horse-power year, which was obtained only in one instance. Apparently no estimate is available on continuous operation under commercial conditions for any extensive period.

It may be that a plant designed and operated continuously on a large scale would be able to produce its pig iron at a cost within the figures given by the report. Still we are hardly justified in making that assumption on the basis of the experimental tests conducted at Sault Ste. Marie.

A NEW ALGOL VARIABLE.

A few Harvard plates examined by Mrs. Fleming led to the discovery of an interesting variable, RR Lyrae, 192242, described in Harvard Circular 54. From a similar examination of recent plates, Mrs. Fleming

finds that the star C. DM. —30 deg. 16169 is a variable of the Algol type.

From an examination of 324 photographs it appears that the star had nearly its full brightness, magnitude 8.58, on 298 plates. On twenty-six photographs the star was distinctly below its maximum magnitude.

SUMMER MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

BY WILLIAM H. HALE, PH.D.

No more entrancing spot for a meeting of the American Association for the Advancement of Science than the campus of Cornell University, Ithaca, N. Y., was ever visited by that association in all the years of its history; and this return to summer meetings, which have for several years been discontinued, was rendered memorable by the dedication of the largest and best-equipped physical laboratory in America.

The meeting, which began on June 29 and continued till July 3, was a special summer one for the reading of papers only and for field meetings, for which meetings the environment of Ithaca presents many attractions to botanists and geologists. Dr. William H. Welch presided, but the presidential and the several vice-presidential addresses will be deferred till the meeting at New York next December.

Rockefeller Hall of Physics was dedicated on Friday afternoon. President J. G. Schurman, of Cornell, made the opening address. Prof. E. L. Nichols, head of the department of physics, gave some account of that department and of the new hall, which cost $285,000, has some 20,000 meters of floor space and 478 rooms, and will accommodate the 2,000 students who are expected during the coming year—a striking contrast to the conditions existing at the time of constructing the old hall less than a quarter of a century ago, when the lecture room, accommodating eighty, was supposed to be larger than would ever be required.

Prof. William A. Anthony, former head of the department, was unable to attend, and his address on "The Beginnings of Physics at Cornell" was read by Prof. Ernest Merritt. Dr. Elihu Thomson spoke of "Physics and the Industrial Arts," and President Welch of the "Relation of Physics to Medicine."

A large number of papers were read in the section of physics. Prof. Wallace C. Sabine spoke of neglected factors in determination of musical quality. When a complex tone is sounded, the fundamental tones do not die away so soon as the overtones, and it is found that the material of which the walls of an auditorium is constructed has a material effect in deadening the overtones, and thus changing the quality of the music or of the voice. Hence it seems that more attention should be paid to the material with which the walls are covered. Prof. Henry S. Carhart and some associates report that silver perchlorate gives better results as an electrolyte in the silver voltameter than the silver nitrate now universally used.

Profs. E. L. Nichols and Ernest Merritt reported results of experiments on the phosphorescence of sidot blende. Light deadens phosphorescence, but not all wave lengths have equal effect. The greatest effect is produced by the infra-red waves, about 1½ millimeters; which, however, while they kill the green phosphorescence, very curiously stimulate the violet, which is conspicuous in sidot blende.

In the Mechanical Section, the paper of Prof. William H. Burr on the Panama Canal was read by title only in his absence, but he still insists on his position that the canal ought to be a sea-level and not a lock canal, not only because it is in an earthquake zone, and liable to derangement, but also because experience with all other important canals shows that they must be enlarged, and this cannot be done with a lock canal without putting it out of business for a long time. Dr. Mansfield Merriman reported on constant and probable errors in the estimation of linear distances and vertical angles determined by 1,712 observations on 128 students at the Lehigh University. He found that in estimating length, width, and thickness of boards, 60 per cent of the estimates were too large, and in estimating angles by degrees 80 per cent were too large, while the estimate of angles by ratio showed 60 per cent of estimates to be too large. The higher classmen made better estimates than the freshmen. Dr. H. T. Eddy gave technical data of interest in a novel line of investigation, the flexure of a heavy horizontal disk on a vertical axis increasing in thickness toward the axis, as used in the Curtis steam turbine.

The American Chemical Society, in joint session with Section C of the association, had a great array of papers covering a wide range of interesting topics. Special interest was shown in the paper of Dr. Eugene Haanel, superintendent of mines for the Dominion government of Canada, on smelting of ore by electricity in the manufacture of steel as now introduced at the Sault Ste. Marie mines, which process promises to revolutionize the steel industry.

The feature of the meeting of chemists was the reports of researches carried on during the past year at leading American universities, which included Toronto, Pennsylvania, Johns Hopkins, Cornell, Yale, Chicago, Columbia, Purdue, Ohio, Illinois, Minnesota, and North Carolina universities, Lafayette College, College of the City of New York, and Massachusetts Institute of Technology.

Dr. L. O. Howard, government entomologist, told the Section of Zoology about the great work now in progress by the government under his supervision, of introducing parasites to prey upon the brown-tail moth and the gypsy moth, which has been carried out on a far larger scale than was ever before attempted. Appropriations having been made both by the State of Massachusetts and by the general government, Dr. Howard visited Europe in June, 1905, and arranged with experts in Italy, Austria-Hungary, South Germany, Switzerland, and France, to send to Boston full-grown larvæ and pupæ of the gypsy moth. The many specimens received were cared for at Malden, Mass., and many different species of parasites issued; the most promising being the tachina fly.

Dr. Howard again visited Europe last April, and secured shipments from many localities, importing into Massachusetts 185,000 nests from forty different localities, ranging from Rennes on the northwest to Buda-Pesth on the southeast. From these nests were bred thousands of parasites of different groups; these have been colonized in the open and in outdoor cages, and placed over good-sized trees thoroughly infested with moth larvæ. It was realized that the introduction of additional pests of the same species could do no possible harm in localities already so thoroughly infested, whereas by such wholesale introduction vastly greater numbers of the parasites would be secured, thus promising earlier relief than by the method of introducing only the parasites themselves.

The Economic Section has maintained the high standard reached at previous meetings, both in the number and interest of the papers presented in the first two days of the meeting, which included a paper on the "Economic Advisability of a National Department of Health," by Prof. I. Pease Norton, in which he strongly urged the project with a cabinet officer, Secretary of Public Health, at the head of the department. The paper was discussed by several eminent sanitarians.

Prof. James W. Crook read a paper on the "Limitation of Great Fortunes." The morning of June 30 was given up to a discussion of Conditions and Problems of Agriculture in the United States, Socially and Economically Considered, led by Prof. Liberty H. Bailey; Rural Conditions and Problems in Europe, by Prof. G. W. Lanman; Causes and Consequences of the Past Ten Years of Agricultural Prosperity in the United States, by George K. Holmes; Economic Geography, by I. Russell Smith, and Investigation of Mathematics and Formal Discipline by Prof. G. V. Collins.

Prof. Carhart gave an evening lecture on the meeting of the British Association for the Advancement of Science in South Africa last summer, which he attended as an invited guest. His story of this new region so rapidly opening up to civilization, illustrated by photographs taken by him on that memorable journey, proved most fascinating to the large audience gathered in Sibley College.

The attendance of members at this meeting was less than usual, hardly over 200 having registered. Sections A, H, and I did not meet, but the proceedings of the other sections were none the less valuable.

THE SENSE OF COLOR IN ANIMALS.

The hypothesis that the sense of colors is possessed to a high degree by animals, and especially by birds, furnished a basis for some of the most beautiful and fecund of the Darwinian theories of sexual selection. No Darwinist doubts that the brilliant colors of the male birds of some species are destined to attract the attention of the female birds, and this presupposes naturally on the part of these birds a fine sense of color. Wallace has asserted that to the fact that certain plants bear fruit of brilliant colors is due their preservation; the animals, attracted by these colors, break the fruits from the trees or plants, carry them off, and thus indirectly assist in the dissemination of the seeds which they contain over large tracts of land. And this function of selection on the part of animals presupposes in them a certain sense of color. Still, scientific documents in support of these hypotheses are rare. Dahl, alluding to the scarcity of them in an article in a recent number of the Naturwissenschaftliche Wochenschrift, relates some interesting experiments which he made with a monkey. He colored some sweets with a certain colored dye, and some bitter substances with that of another color, and declares that after a few attempts, the monkey learned to leave without even tasting those articles of food colored with the dye which indicated bitter-tasting substances, and seized at once upon those which indicated sweets. Varying the experiments sufficiently he found that the monkey distinguished all the different colors readily, save only dark blue. Dahl calls attention to the fact that Mayer has stated that many savage tribes cannot distinguish dark blue from black, and that even children do not distinguish this color until later than all others.

SCIENCE NOTES.

A deep sink-hole near Orlando, Fla., has recently become of considerable geological interest. Through its subterranean outlet it had carried away the overflow water of more than a dozen neighboring lakes, and may have done this for a thousand years; but about two years ago this passage became stopped, and the water, thereby shut off from this means of escape, filled the sink-basin to overflowing and formed a lake which eventually covered nearly 250 acres of the surrounding lower-land, driving many colored people from their homes and covering gardens and cultivated fields. It is not known how the subterranean passage became stopped, but it may have been from a cave-in of the walls, or from water hyacinths which filled the sink basin. Many attempts were made to open the passage, and relieve the rising water situation by dragging the sink bottom, exploding dynamite among the debris collected there, and in other ways, but although much time and money were spent in this work, the opening remained stopped apparently as tightly as ever. A short time ago the idea was conceived of trying to find a new passage, or make a new opening into the old one, by drilling a well near the sink. A two-inch hole was first made and a passage was found, the hole carrying down the water easily and rapidly. Then an eight-inch hole was drilled, and now these holes are carrying away the water so freely that the big sink lake which has been so unmanageable a thing and the cause of much alarm in its ever-enlarging area for a long time is rapidly being drained, and the big sink environment will soon be in its normal condition.

An important scheme has been decided upon for the study of tropical diseases, by the Indian government. At the present time there are scattered over various parts of the country five centers, where the process of research is carried out upon a small scale. These institutions are the outcome of private enterprise, and work independently. Owing to their limited resources, the work they accomplish, while valuable, is necessarily somewhat small in scope. The Indian government has now arranged to consolidate these various institutions, to enlarge their field of operations, to found additional laboratories in other parts of the country where investigation on the spot is urgently required, and to control their operations from one central institution. The latter is to be located at Kasauli, a small hill station in close proximity to Simla, from which point it can be easily reached and the institute supervised by the central medical and sanitary authorities of the Indian government. The situation is well adapted for the work, the temperature being moderate, while scattered among the surrounding hills are numerous sanatoria, each of which possesses a large hospital. There is a Pasteur institute already in operation, but this will be merged with the new building, and the present administrator of the Pasteur institute, who has carried out much important and valuable work, will be the first director. The new laboratory will carry out original researches, and prepare and investigate curative sera for tropical diseases indigenous to this country and other similar climes, and the training of scientific workers. The existing scattered institutes will continue their present operations, original research in particular being stimulated. This new arrangement will prove of great value for all investigators of different countries of tropical diseases, since they will be encouraged to avail themselves of the institutions in India for carrying out on-the-spot investigations.

When we remark that in the manufacture of cocaine it is the percentage value of the alkaloid which determines the value of the raw material, we can see the necessity for the planter of finding a method of drying by which he will lose the least amount. In two series of experiments made by M. de Jong, of France, upon two products having different origins, he obtained the percentages of 1.49 to 2.77, or, in mean, 1.52 to 2.75 and 2.05 to 2.91. The fresh leaf furnishes the greatest amount of alkaloid, or from 2.72 to 2.91 per cent. When dried over lime, the leaf loses cocaine, and the value falls to 2.55 per cent. Drying in the sun is found to give values from 2.38 to 2.50 per cent, while drying at a heat of 40 deg. C. gives 2.28 per cent. A heat of 60 to 75 deg. affords 2.16 per cent of cocaine. By drying in the shade for four days and then for over an hour in the sun, we find from 2.05 to 2.18 per cent. The method of drying in the sun after immersion in boiling water gives 1.50 per cent. From this we find that it is not an advantage to dry the leaf over quicklime in practice. If sun-drying is to be advised, we must remark that the leaves should not be allowed to become overheated. It is not a good plan to let the leaves dry up naturally in the shade, but they should be dried as quickly as possible. By the use of hot water we dissolve out some of the alkaloid. The best yield of cocaine is afforded from the fresh leaf.

A MACHINE THAT SMOKES CIGARS.

BY C. H. CLAUDY.

At first sight it would seem that the most brilliantly unnecessary of inventions is a device to smoke cigars. Nevertheless, such a device has a purpose of its own, which it fulfills with precision and dexterity, for the simple reason that it smokes cigars with an evenness and regularity that the most hardened smoker could not emulate. The purpose of the cigar-smoking machine is to show the comparison of the "burn" of different cigars smoked under identical conditions. No man could possibly smoke two cigars alike—giving the same number of puffs to each, the puffs all the same length and strength, and with the same interval between each puff. Consequently, if one cigar burned worse than another, the tobacco expert could not be sure it was the tobacco which was at fault, and not some unevenness in the "man behind the smoke." With the machine, however, everything is automatic, and one cigar is smoked under identical conditions with its neighbor.

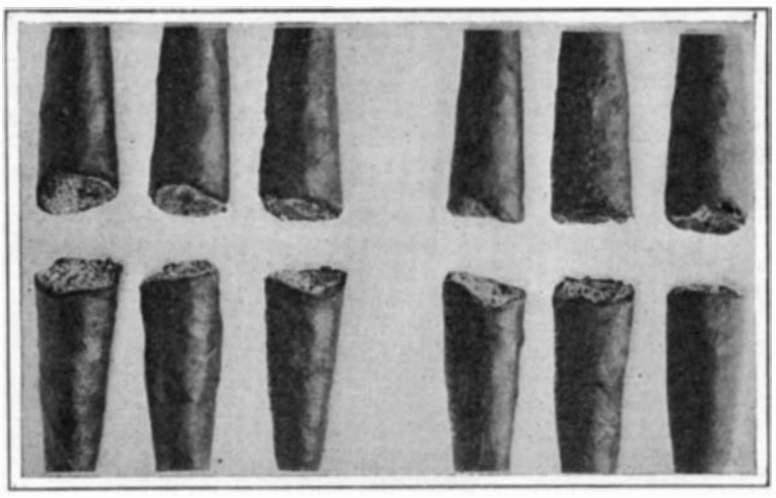
The birthplace of the machine described and illustrated here was in the Bureau of Plant Industry, Department of Agriculture, which bureau is making a systematic effort to improve the quality of the tobacco crop of this country by "employing the latest and most approved methods of selection of the old varieties, and by creating and establishing new strains possessing in a marked degree those characteristics most to be desired in the various classes of tobacco which the market demands." A cigar is made up of three parts—the filler, or body of the cigar; the binder, a leaf which holds the filler in position, and the wrapper, or outside leaf, which still more firmly holds the shape of the whole, gives it a finish, and in a measure controls the "burn."

As the final test of any cigar is the smoking of it, the "burn" is a most important quality of any leaf—its evenness, its speed, its time of holding fire, its coaling, the quality of the ash, the puckering of the wrapper behind the burning end, all entering into that quality called the "burn." It is for testing the "burn" of different cigars, and of cigars made with some elements similar and some different, as one filler wrapped and bound differently, or different fillers wrapped and bound similarly, that the cigar-smoking machine is used.

It is possible that some may quarrel with the word "machine" used in this connection—the device partaking of the nature of chemical and physical apparatus. But surely any piece of mechanism which is automatic in its action, and which performs a piece of work in a prescribed manner, is a machine in the true sense of the word.

This machine, then, consists first of a means for holding the cigars to be smoked, secondly of a means of producing the pull, and thirdly of a means for making the pulls intermittent. As seen in the illustration, the cigars, four in number, are stuck into glass tubes with enlarged ends, similar to ordinary cigar holders. These tubes are bent at right angles, and enter a flask through a cork, their ends, all the same length, dipping beneath the surface of the liquid contained in the bottle. A tube leads from this bottle to a second bottle, and from a T-joint continues to an aspirator—a flask containing a syphon. A third tube from the second or valve flask extends upward and away, carrying off the smoke. Behind the cigars is a screen of white paper, so that the cigars may be compared easily, and the character of ash and smoke noticed without trouble.

The operation of the device is as follows: Water from a constant-level tank is allowed to enter the aspirator from the top. The aspirator fills; the air or smoke it contains passes out of the outlet tube, and is prevented from returning to the cigars by the second flask or water valve, which thus fulfills its function. When the aspirator is filled, the syphon which it contains commences to work, and as the outlet pipe of this syphon is much larger than the inlet pipe for water, the aspirator empties faster than the water fills it. The syhon is so arranged that it "breaks" the water at the bottom of the aspirator, whereupon the aspirator refills. As the water empties from the aspirator, air is drawn through the valve flask from the cigar-holder flask, and that air enters the apparatus through the cigar holders. Obviously, if lighted cigars are in the holders, the air passing through them will make them burn, exactly as if the drawing power were a man's mouth.



Variations in Fillers Shown by the Smoking Machine.

The device smokes four perfectos at once, and if they be of average size, five inches long, will do it in about half an hour. This is somewhat more rapidly than the average man will smoke, but near enough for all practical purposes. The pull on the cigars occurs at intervals of half a minute, and continues ten seconds.

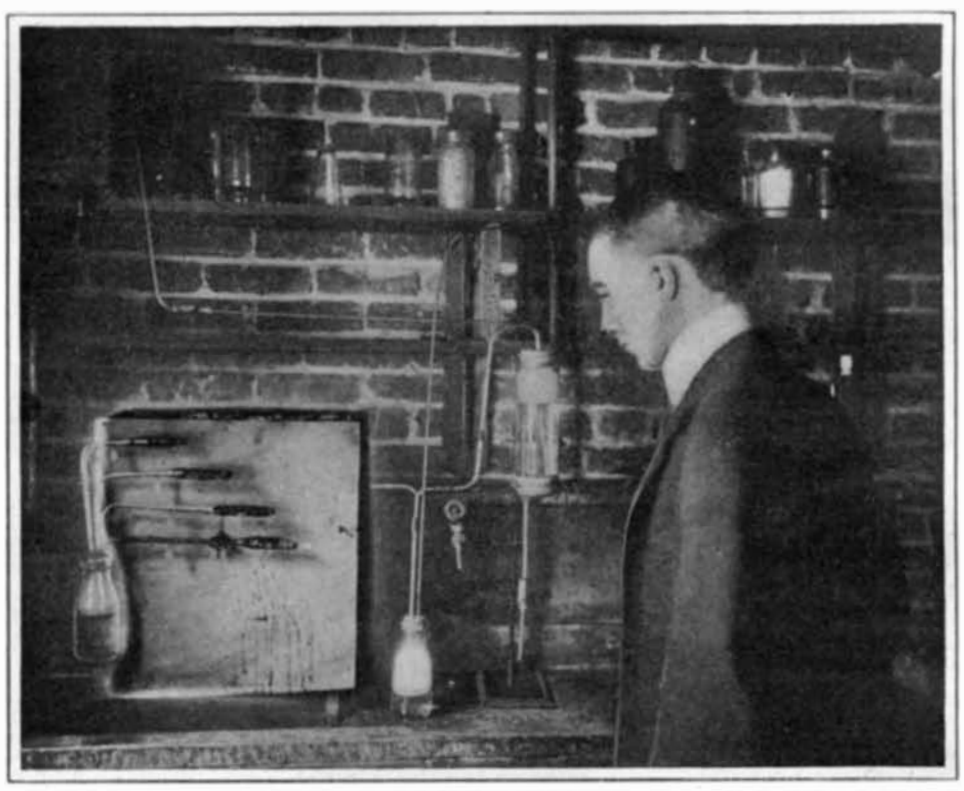
Usually, when a man smokes a cigar and it does not burn well—if one side gets consumed faster than the other—he is inclined to think it either a poor cigar or that it was poorly lit. But the quality of the tobacco may be good and the cigar properly lit, and still the weed may not burn well, if the tobacco forming the different parts has not been carefully selected with reference one to the other. Dr. Garner, who has this machine in operation, has established some peculiar facts in this regard. The testing of the burn and other qualities of the wrapper is accomplished by another cigar-smoking machine, or rather a wrapper-smoking machine. In this device the pull is continuous, from a filter pump, and the wrapper is hollow, and has nothing in it. The burn is supported by the indrawn column of air. Formerly such tests were made by simply lighting the leaf and observing the action of burning in the air without a draft, but the test was inaccurate and unfair, inasmuch as a vein might stop the burning, or some part of the leaf burn longer than the rest. Here the indrawn column of air serves to support the burning, as does the filler in the actual cigars, and the test is much more accurate and complete. The wrappers are wrapped around a collapsible tube, which, when the wrapper is dry, is collapsed and withdrawn, leaving the hollow cylinder of tobacco leaf on the glass tube which is part of the apparatus.

Of course, these experiments are academic as yet—but preliminary apparatus making and lengthy experimentation are always necessary to produce results. It is not hard to foresee how such experiments will act if carried out to their logical conclusion. Mention might be made of the seed-separating device, which was the result of the discovery that tobacco plants grown from the heavier seed were both more hardy and better grown than the others. This device, which is simplicity itself, and is now largely used when extra-fine plants are wanted, is also illustrated. It consists of two sections of glass tube, with suitable connections, a foot bellows connected to the lower tube, and a valve for regulating the amount of air which is pumped in. The mixed seed is put in the lower tube, the large one above is inserted, and air is pumped in. The smaller and lighter seeds fly out of the top of the long tube, and the heavier remain behind. The size of the seeds thrown away is of course governed by the length of the long tube and the pressure of the air. The greater the length of the tube and the less the air pressure, the lighter the seeds which are discarded.

The cigar-smoking machine and the wrapper-smoking device it is hoped will produce some great practical results. The tobacco crop in this country being of such great value, and representing such enormous capital, is thought to be an excellent subject for investigation, and the trained force of the Bureau of Plant Industry is doing all in its power in its home laboratories and field experiment stations to bring to the service of its scientists an exact lot of statistics, by which tobacco plants can be bred and improved as cattle are bred and improved—a process which, if successful, will revolutionize tobacco growing. The cigar-smoking machine, in spite of its element of the humorous and grotesque, is one of the first steps.

Tobacco Seed Separator in Use.

The seed is collected in the lower section of the glass tube.



Cigar-Smoking Machine Which Tests the Qualities of Fillers, Binders, and Wrappers.

Effect of Ballooning on the Vision.

Some valuable experiments have been carried out by Dr. Robert Daulnoy, the well-known Parisian eye specialist, concerning the effects of ballooning at varying altitudes upon the human visual system. The first investigation was carried out at an altitude of 6,000 feet. A bottle was flung overboard into a lake beneath. The occupants of the car were able to follow with ease the descent of the bottle through the air, and also able to watch the neck of the vessel as it disappeared into the water. The balloon then soared to a greater height, and by examination the doctor ascertained that at this altitude there was a considerable diminution of the pressure on the visual organs. The pupils distended, and the sensibility of the optic nerve was appreciably increased. As a result of his observation Dr. Daulnoy is of opinion that certain diseases of the eye, if treated at a high altitude in rarefied atmosphere, would be more beneficial, and attended with greater possibilities of success, than is now the case. Especially would this be so in treating the maladies glaucoma and choroiditis, or the releasing and loosening of the retina, which are two common eye complaints. Owing to the increased sensitiveness of the optic nerve in the purer rarefied air, the action of the liniment or lotion which is dropped into the affected eye under such conditions would be attended, it is maintained, with astonishing results.

San Francisco is to have a fifteen-story building of which all the walls are to be of steel plates.

THE GALLEYS OF LAKE NEMI.

Buried under the waters of Lake Nemi lie two pleasure galleys, which belonged to the Emperors Tiberius and Caligula, and which contain art treasures that have been coveted for five hundred years.

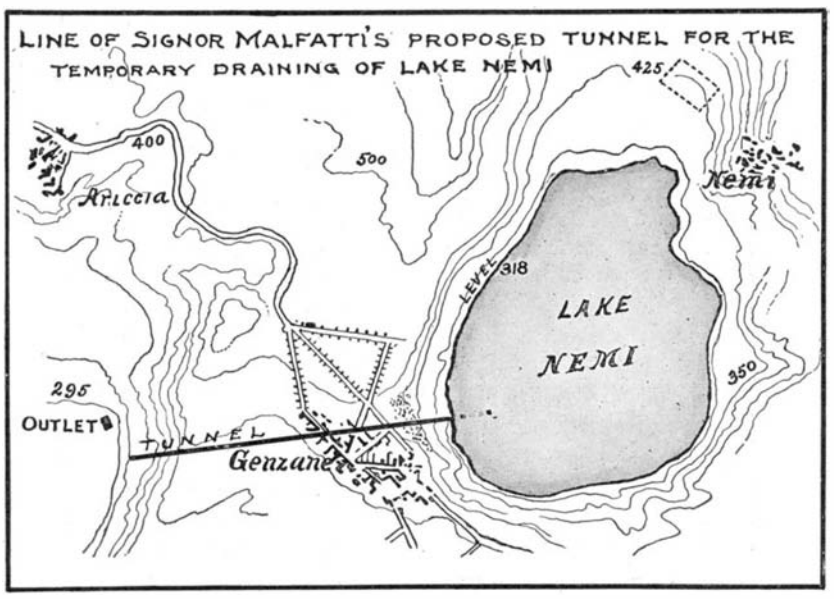
It was Julius Cæsar who first hit upon Lake Nemi as a summer resort; for on its banks he built a villa, splendid in those days, but later far outdone in brilliancy by the floating residences of his successors.

From pamphlets which have been published by Prof. Emilio Giuria and Signor Eliseo Borghi, it seems that Leon Alberti, an archbishop, made some attempts in the fifteenth century to recover the treasures buried in the lake. A hundred years later a fairly systematic exploration of the bottom of the lake was undertaken by De Marchi, a French engineer, who seems to have been the first to have made a fairly thorough survey for that day. He made a few drawings of the probable appearance of Caligula's galley as he conceived it, and from his designs a Flemish engraver prepared what he conceived to be its original appearance.

Although stray relics were found now and then, no further systematic effort was made to recover the contents of the old hulks until Signor Eliseo Borghi came upon the scene in 1895. Divers were engaged, and the two galleys located, measured, and carefully examined. From both, bronzes, pieces of wood, anchors, and ornaments of all kinds were collected.

Of the two vessels, the larger measures about 230 feet in length and 80 feet in beam, the smaller 200 feet in length by 65 feet in beam. It is because of their unusual size (war galleys were much smaller) that the vessels, it is inferred, must have been used as pleasure barges. Among the more interesting relics which have been brought to the surface, and which are herewith pictured, may be mentioned a lion's head, cast in one piece and beautifully worked. A ring is held in the lion's teeth. Clearly, the piece formed the top of a wooden column, because wood is still attached to it. Still other pieces which, like this, were intended for the reception of ropes, are wolves' heads, hyenas' heads, and the heads of various animals. A remarkable specimen is a Medusa's head, mounted upon a cap. An interesting rectangular bronze grating, with the two side bars by which it was held in place, is likewise included among the exhibits. The bars have projections at their ends, so that they could be fitted into beams or metal pieces. Inasmuch as there are no holes, it may be inferred that the grating was placed horizontally and held in position by its own weight.

Curiously enough, some pieces of lead pipe were also found, and these bear ample evidence that the galley from which they came had been the scene of the pleasures of Caligula. They bear the inscription C. CAESARIS AUG. GERMANICI, which was the official name of Caligula. Lead plates were also used in sheathing the vessel. They were held by flat-headed copper nails some two inches long. Why lead should have been used is not very clear; it does not form a



IF THIS PLAN IS CARRIED OUT, THE WATER OF THE LAKE WILL FLOOD THE VALLEY OF ARICCIA.

Redrawn from Illustrated London News.

1. Lead Plate with embedded nails, and an iron-shod pawl. 2. Diver's Sketch of the Galleys. 3. Moldings of glazed enamel. 4. Mortise and tenon; joint secured by pins (side and plan views). 5. Reconstruction of the Deck Structure; plan and longitudinal section. 6. Ornamental Woodwork. 7. Small Roller and Hinge. 8. Metal-shod Beam. 9 and 10. Diving Bells used during the researches of 1539. (From De Marchi's descriptions.) 11. Reconstruction of the Galley of Tiberius, from an engraving signed "Del Galle," sixteenth century. 12. Terra Cotta Tube (perspective and sectional views); stanchion and section of same; little latch; joint with nails and mortise. 13. Relics from the galleys. Augural hand; above it lead pipe. To the left, grating. To the extreme left, fragment of the side of the galley covered with sheet lead. At the bottom, bronze rope-rings held in the mouths of animals. 14. Metal caps. 15. How a diver saw Caligula's Galley. 16. Nails bent on being driven into knotty wood.

RELICS FROM THE ROMAN GALLEYS IN LAKE NEMI.

watertight joint, and the absence of organisms in the lake hardly justifies its use as a preventive of fouling.

Signor Borghi recovered many pieces of mosaic, tiles, porphyry, and serpentine, intermixed with colored glass and enameled by fusion. These were probably used for paving the decks.

On the galleys supposed to have been used by Tiberius relics were obtained quite similar to those from Caligula's vessel. One of these has the form of a bronze cap for the end of a beam, and carries a hand, which the Roman navigators always used as a talisman.

From the investigations of the divers we may glean much of the construction of the vessels, even though we may not be able to present an absolutely accurate restoration. Some of the wood which was used was soft, and some hard and resinous. The soft wood, employed mainly for sheathing and deck planking, is white pine, hewn, no doubt, on the shores of Lake Nemi. The harder wood is either red pine or larix, just which it is difficult to determine, because decomposition has set in. Oak pins were employed to hold down the planking. In sheathing the vessels the planks were placed edge to edge and joined by wedges. As the planks swelled, the edges formed a tight joint. Long copper nails were driven through the planks at intervals of four or five feet, the nails passing through one plank down to the next, and the succeeding nail being driven through the second plank to the third. Short copper nails held the planks themselves to the beams of the framework. To render the hull particularly stanch, an outside layer of hard plaster was employed, upon which a woven fabric was laid. Then came the above-mentioned sheathing of lead plates held by flat-headed nails two inches long.

The construction of the beams of the framework is often ingenious. A beam was sometimes formed of a single piece, and in other cases of two superposed pieces nailed together. In order to form a long beam, two pieces were sometimes placed together with a lap joint, and the whole fastened by three large copper nails.

The deck flooring was made of planks nailed to the beams. A method of joining the planks by keys was also employed, the keys running in two rows alongside the beam. Although mostly copper nails were found, it is not unlikely that nails of iron were also employed. At all events, one of iron was found; the others (unless they are still undiscovered) have probably rusted away. The copper nails range in length from twenty inches to one inch; the larger may more properly be called spikes. In driving these soft copper nails it not infrequently happened that a knot or other obstacle was encountered. The result was that they curled into the form of a spiral.

In order to recover these ancient vessels, many projects have been proposed. It is obviously impossible to raise the crumbling hulls bodily. Therefore, Malfatti has suggested the draining of the entire lake by means of a tunnel. Prof. Giuria, however, has suggested the use of the old Roman outlet. According to Malfatti's scheme, the valley of Ariccia would be partially flooded. According to Giuria's scheme, the water will be piped across the valley of Ariccia, and will be made to drive an electric plant. If the bottom of the lake is ever exposed, the bodily removal of the two old galleys will present considerable difficulty. Prof. Giuria has suggested the use of iron cradles built around the barges, upon which cradles the barges will be pulled out upon tracks.

Geology and Geography at the Ithaca Meeting of the American Association for the Advancement of Science.

BY EDMUND OTIS HOVEY.

The Ithaca meeting of the American Association for the Advancement of Science, June 28 to July 3, was an experimental return to the old plan, honored by many years' observance, of having a meeting in the summer. It was, however, only a partial return to that plan, since this was a "special" meeting, without the attractive features of the annual meeting, the addresses of retiring president and vice-presidents and the prestige of such a gathering.

Section E, the section comprising the geologists and geographers of the association, held most of its meetings in the field in the shape of excursions to points of geologic and geographic interest in the vicinity of Ithaca. The first business day of the convention, Friday, was, however, devoted to the reading of set papers, after the passage of suitable resolutions referring to the recent sudden death by pneumonia of former vice-president and chairman Prof. Israel C. Russell, of the University of Michigan.

The first paper read was by Prof. Henry S. Williams, of Cornell University, and was entitled "Revision of the Geological Section Passing Through Ithaca, N. Y." The paper, which had been prepared for the United States Geological Survey, considered in detail the subdivision and classification of the Devonian beds, which are typically and strongly exposed in the vicinity of Ithaca. The beds show intrusions and overlaps of faunas, which have given rise to some confusion in the nomenclature, and the author has devoted much time and thought in laboratory and field to straightening out the order of succession.

The second paper was on "Abyssal Igneous Injection as a Causal Condition and as an Effect of Mountain-building," by Dr. R. A. Daly, geologist of the Canadian International Boundary Commission. In the absence of the author the paper was read by Dr. A. C. Lane. The paper hypothetically extends the contraction theory of mountain-building to cover the explanation of igneous intrusion, geosynclinal downwarps, the location of mountain ranges, and the common association of intense mountain-building with the batholithic (deep-seated) intrusion of liquid igneous magma. Among the chief postulates laid down are two of particular importance: 1. An earth-crust about 25 miles thick, within which is a substratum which, on account of its high temperature, acts as a viscous liquid. 2. The division of the crust into a shell of compression about five miles thick, overlying a shell characterized by cooling tension. The shell of tension extends from the bottom of the shell of compression down to the substratum.

One effect of cooling tension is to produce cracks in the lower shell. These are only partly closed by the shearing of mass against mass. These cracks permit the dike-like injection of the substratum into the crust. The hydrostatic and expansional pressures normal to the walls of such dikes cause lateral creep and special condensation of matter in the shell of tension. A down-warp of the earth's surface results, and the sedimentary filling of the surface depression prepares the way for mountain-building. Mountain-building is accomplished through the shearing of the shell of compression over the shell of tension, breaking the solid continuity between the two shells, permitting the injection of vast bodies of magma from the substratum into the shell of tension, and relieving all the accumulated stresses. From the discussion which followed the reading of the paper it was evident that the geologists of the country would not return without protest to the theory of a fluid interior of the earth.

"Brewster's Neck, Connecticut," was the subject of a geographical paper by Dr. F. P. Gulliver, of Norwich Town, Conn., which in the absence of the author was read in abstract by the secretary of the section. Brewster's Neck is a delta which was formed in a glacial lake and is a form for which the author proposes the name "delta-terrace." A new point in regard to the theory of the formation of waterlaid glacial deposits is believed to be the following: When the margin of the ice-sheet was retreating by the annual summer melting faster than ice was supplied from Labrador, the ice remained longest in the valleys. Some of these valley tongues of ice would stand higher than the surrounding hills, and between the tongues standing water would occur, in which the streams from the melting ice would deposit their sand and gravel. Where the supply of rock waste was sufficient to fill up the space between these ice-blocks and the surrounding hills or other ice-blocks, a flat-topped delta-terrace would be formed; where the supply was not sufficient to fill up the body of water, lobes would occur. The author believes that the Brewster's Neck delta-terrace was formed between a block of ice occupying the valley of the glacial Thames River and a block occupying the tributary glacial Poquetanock Valley.

The next paper on the programme was by Dr. E. O. Hovey, of the American Museum of Natural History, and was entitled "Notes on the Geology of the Guaynopita, Chihuahua, Mexico, Mining District." The Guaynopita district lies in the heart of the western Sierra Madre in northern Mexico. Here are shown cretaceous limestone, schist, and gneiss overlain by volcanic rocks (andesites) and invaded by granite intrusions. Later volcanics (basalts, andesites, and rhyotites) have supervened, great inclosed basins have been formed and filled with wash from the surrounding hills, resulting in the making of local sandstones and conglomerates. The whole region has been deeply dissected by the Aros and its tributaries. Several lantern slides were shown in illustration of this paper.

In a paper on "The Relations of the Drainage of the Santa Clara Valley, California, to That of the Pajaro River," Prof. J. C Branner, of Stanford University, discussed the theory advanced by Leconte many years ago that the Golden Gate was closed by elevation not long ago, and the waters of the Great Valley were discharged through the Santa Clara Valley and the Pajaro River. The author's investigations show that the divide between the Pajaro and Santa Clara valleys is too high to agree with this theory; and that the submerged canyons off the mouths of the rivers point to recent submergence after previous great elevation. There is no canyon outside the Golden Gate, but there probably was one which has been filled up by the vast amount of sediment brought down by the streams discharging that way. The elevation amounted to 3,000 feet or more, and must have caused climatic changes, with greater precipitation and larger rivers. One of the rivers discharged a vast amount of débris on the divide between the Santa Clara and Pajaro valleys, and probably had a variable channel, which may have allowed the fishes of the Sacramento-San Joaquin River system to pass around into the Lorenzo, Pajaro, and Salinas rivers, accounting for the present range of species.

"The Geology of Coon Butte, Arizona," as worked out by D. M. Barringer and B. C. Tilghman, of Coon Butte, was presented by Prof. Branner.

Coon Butte is a strange, crater-like hole with raised rim in the plain about six miles east of Flagstaff, Arizona, which has attracted much attention on account of its form in the midst of otherwise horizontal beds of sandstone and limestone. The nearest volcanoes are in the San Francisco Mountains, several miles distant. Coon Butte is the place from which have come the hundreds of large and small fragments of what is known as the Canyon Diablo meteorite. The authors have made extensive excavations and borings here, and they consider the evidence as all pointing to the impact of a great meteorite as the cause of the hole, although they have not yet found the main mass.

The field meeting of the section consisted of three excursions. Saturday the party went to the vicinity of Union Springs for a stratigraphic study of the Upper Silurian strata. Monday was devoted to the examination of the Ithaca delta and the upper (southern) end of Cayuga Lake, the Devonian rocks exposed along both shores and the Taughanock gorge and falls. These two excursions were conducted by Prof. Gilbert D. Harris, of Cornell University. On Tuesday the section visited Enfield Glen under the guidance of Mr. R. H. Whitbeck, of the State Normal School, Trenton, N. J. This was a study in glacial and post-glacial geology, observing the moraines of the Cayuga Valley, old and new, and hanging valleys, and the great new gorge which has been carved out of the strongly jointed Devonian shales since the last retreat of the ice-sheet. A feature of this excursion was an address by Mr. C. R. Dryer, of the State Normal School, Terre Haute, Indiana, upon the geography of the Finger Lake region of Central New York.

Section E can claim, too, one of the principal lectures of the convention, which was delivered by Prof. Branner upon the scientific aspects of the recent California earthquake, showing that the principal cause of the quake was lateral and nearly horizontal displacement amounting to sixteen feet at maximum along an old fault plane. The members of Section E feel that the Ithaca meeting of the association was a genuine success. The officers of the section are Dr. A. C. Lane, State Geologist of Michigan, chairman, and E. O. Hovey, of the American Museum of Natural History, secretary. The next meeting of the section will be with the association at large in New York city during the week after Christmas of this year.

A New Design in Electric Elevators.

A new and extremely simple design of electric elevator has been recently called to the attention of the public, and the new system is said to combine absolute safety, economy of power, and economy of space. In the latter particular at least it represents a great advance over the present types. All the driving mechanism in this case is bolted to the under side of the car platform, and consists entirely of a horizontal drum revolved by an electric motor. On the periphery of the drum is fitted a spiral track, which engages and travels in two series of rollers set in the guide posts supporting the car. The motor being started, the drum revolves, and the car ascends or descends as desired. As to its economy, this system has the advantage enjoyed by all electrically-driven machinery, in that it consumes power only when in actual use, and another recommendation is that all the machinery being contained in the elevator shaft, much valuable floor space is saved. It is claimed to be absolutely safe, and requires no safety devices of any character. The electric elevator of this design is particularly valuable where there is an intermittent demand for its use and where great speed is not required.

The Current Supplement.

The current SUPPLEMENT, No. 1593, opens with an article on some recent excavations of Roman ruins in North Africa, described and illustrated by our Paris correspondent. Walter J. May writes on the position of patterns in the molds. Some interesting facts about brakes are recounted. To one who sojourns for a few months in the valley of the Nile, new interests are constantly springing up. T. C. Mendenhall tells just what the engineer finds to absorb his attention in the Nile Valley. Joseph H. Painter discusses "Flowers that Feel." Interesting in these days of legion breakfast foods is the article on the "Place of Cereal Breakfast Foods in the Diet." John M. Thomson has taken for his topic the "Chemistry of Artists' Colors in Relation to Their Position and Permanency." Concrete is discussed from the standpoint of a fireproofing material. Dugald Clerk's article on Internal Combustion Motors is continued. Some figures are given of steam and producer-gas tests of coal.

Correspondence.

Locomotive Boiler Explosion.

To the Editor of the SCIENTIFIC AMERICAN:

I would suggest, in connection with the locomotive boiler explosion described in the June 23 issue of the SCIENTIFIC AMERICAN, that imperfect methods of designing and calculating the strength of the longitudinal seams are responsible for many explosions similar to this one. The effects of eccentric loading, elasticity, and fatigue are entirely neglected. In the ordinary lap joint the maximum stresses, due to the fact that the plates are not in line, are four times as great as they are assumed to be. Consequently, they are considerably above the elastic limit. The strength of these joints, as determined by tests of new specimens, is thought to confirm the customary calculations, but the new specimens possess elasticity, allowing a redistribution of the stress, while long use has deprived the old boiler plates of this quality. Of course, the repeated stress in excess of the elastic limit, even though it is less than the ultimate strength of the plate, will in time produce failure. The inside covering strip is offset over the edge of the plate. When a rigid construction and an elastic one are used simultaneously to support a load, most of the weight is carried by the rigid one. With its offset, the covering strip cannot have sufficient rigidity to be of much support for the joint. Only butt joints with covering strips inside and outside are suitable for any but the lightest service. The eccentricity of loading should always be considered in designing lap joints, and the usefulness of covering strips in connection with lap joints is very uncertain. G. E.

The Hot-Air Boiler.

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN for June 16, 1906, there was an article upon hot-air boilers, in the course of which the Editor said:

"The basic idea upon which these generators are built is by no means new. Propositions for the construction and use of such generators, usually for stationary power plants, have formed the subject of a number of patents, and have occasionally appeared in the columns of the technical press; but notwithstanding this, the idea would seem to be little known, and so far as the writer is aware, the method has not yet been practically applied to either road or marine locomotion. This is probably on account of difficulties which arise from defects in the compressed-air and fuel-regulating devices. It seems evident, however, that the system is capable of successful development, and promises advantages of such a nature as to merit further consideration."

It so happens that I can supply a few facts upon this subject, which are subjoined; about 1853 or 1854 an experiment with an apparatus similar to that described in the aforesaid article from the SCIENTIFIC AMERICAN was tried at the Boardman-Holbrook (I am not certain of the exact title of the firm) Iron Works, then at the foot of Eighth Street, New York, but since destroyed, upon a considerable scale; a steamboat about 150 feet long was built and fitted with a beam engine of about 200 horse-power and a peculiar boiler. As I now recall it, chiefly from personal observation, it was intended to operate by compressed air forced directly into the furnace, having a very short, inadequate stack. After steam had been generated at a certain pressure, communication with the steam space was opened, and the products of combustion, gases, etc., were forced directly into the steam space, and thereafter used in the cylinder of the main engine. I recall clearly the operation of this experiment, as I sat on the dock directly over the boat in question, having "played hookey" from the shop—the old Morgan Iron Works—where I was employed as an apprentice. There was a great rumbling and uproar in the firerooms, accompanied by an all-pervading odor of gas, but nothing happened of a serious nature, and after awhile the engine began to turn over. Beginning to fear a reprimand from the foreman for "absence without leave," I returned to my own shop, but continued to visit the queer steamboat as occasion offered thereafter. The compressed-air boiler was experimented with for a few days, and then the lines were cast off and she went out into the river, where she maneuvered for a short distance, but soon returned to her dock, as it seemed to me for want of steam, which was afterward proved to be the fact. There is no question, however, but that the vessel was actually moved under way by this system, and it might have proved successful if the experimenters had been able to overcome the difficulties arising from the cinders and dirt carried into the steam space, to such an extent that the valve faces were practically destroyed in a short time. They also lacked knowledge of the physical difficulties involved in the use of mingled coal gas and steam; in a word, they were years ahead of their problem.

Nevertheless, their first failure did not deter them from trying another experiment, this time with a locomotive, which was built in the old Novelty Iron Works, when Horatio Allen was at the head of it. Presumably, this trial had the benefit of Mr. Allen's experience, but "one event happened to this experiment also"—total failure. The locomotive was taken over to the Erie Railroad, and there tried, but in a short time the smoke-box filled up with cinders and the boiler became inoperative.

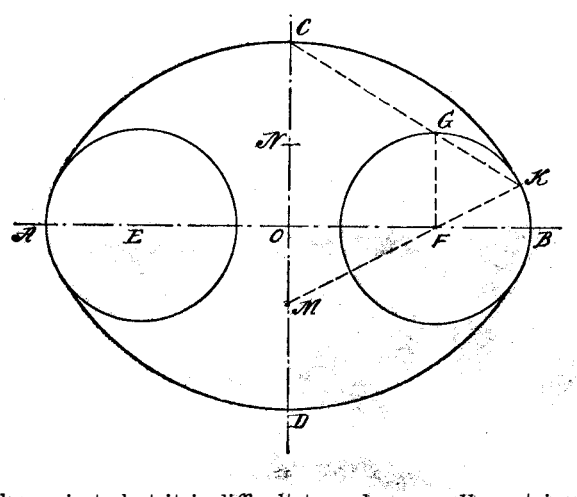
I have endeavored to get more details of this experiment with a hot-air boiler, but alas! all who were likely to have had knowledge of it have passed away. The only engineer still living who may recall the events related is Mr. Thomas F. Rowland, of the Continental Iron Works, Greenpoint, Long Island. Mr. Rowland was in the Morgan Iron Works at the time, and may have some knowledge of this experiment of fifty-odd years ago. EGBERT P. WATSON.

Elizabeth, N. J.

How to Draw an Ellipse.

To the Editor of the SCIENTIFIC AMERICAN:

In your recently published "Scientific American Reference Book" I find several methods given for drawing an ellipse. Of these, the one with the string seems



the easiest; but it is difficult to make an endless string exactly equal to the three sides of the triangle, and again the knot in the string interferes with the correct drawing of the figure. Of the methods given for drawing an ellipse with a pair of compasses, the one headed No. 51 is the easiest, but is applicable to only one kind of ellipse in which the two axes bear a certain fixed ratio to each other. The other methods are very cumbersome, as we have to proceed slowly from point to point. I give below my method, by which an ellipse can be described in a very short time by means of a pair of compasses, whatever be the proportion between the two axes:

Let *AB* be the major axis and *CD* the minor axis, intersecting at *O*.

From *A* and *B* measure *AE* and *BF*, each equal to half of *CO*.

From *F* and *E* as centers and with radii *EA* and *FB* describe circles.

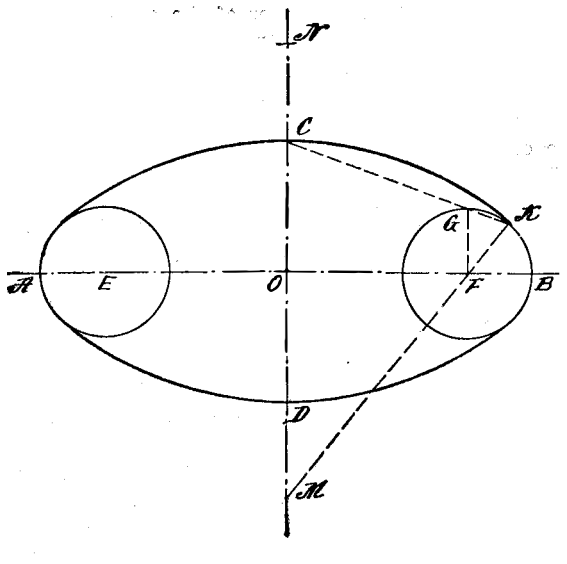
Draw *FG* at right angles to *AB*, cutting the circle at *G*.

Join *CG* and produce the line so as to cut the circle again at *K*.

Join *KF* and produce the line to meet *CD*, or *CD* produced if necessary, at *M*.

With *M* as center and radius *MC*, describe an arc which will touch both the circles.

In the same way the arc may be described on the



opposite side with *N* as center and *ND* radius, *ND* being equal to *MC*.

Then *ACBD* is the ellipse required.

I am, however, unable to prove that the figure is an ellipse; can any of your readers supply the proof?

There is one great defect in this method, which is that when there is very great disproportion in the size of the two axes, it is necessary to employ a very large pair of compasses such as cannot be readily obtained anywhere. Can your readers improve upon the above method and show a way of drawing an ellipse easily even when the major axis is very much greater than the minor? M. N. KUKA.

Bombay, April 19, 1906.

The Salisbury Railway Accident.

One of the most appalling accidents on record in the annals of English railroading occurred early Sunday morning, July 1, when an express train of the London and South-Western Railway jumped the track at Salisbury, between Plymouth and London, and was shattered into a tangled mass of wreckage against the side of a bridge spanning a roadway. Of the passengers, twenty-three were killed outright and many others crushed and maimed, while four members of the train crew also lost their lives in the accident.

This, the most recent railroad horror in England, appears to indicate that even the admittedly excellent British transportation systems are not free from the taint of speed mania, and that despite close supervision and safeguarding of the traveler's interests the rivalry between the various companies is apt to result in those attempts at record-breaking which have so frequently been attended with disastrous results in this country. The accident in question is particularly brought home to us on this side of the Atlantic because of the sad fact that nearly all who lost their lives in the train crash were American tourists. The train was the so-called American Line Express, from Plymouth to London, on the London & Southwestern Railway, which carried the passengers from the American Line steamship "New York." The true cause of the accident is not as yet apparent; the inquiry, however, will probably show that it was due to the high rate of speed at which the train was traveling upon a section of road not peculiarly well fitted for such travel. It has been stated, too, that the train was too light for high speed. It appears that it was moving at the rate of sixty miles an hour, as the engine driver was apparently attempting to lower the record, or at least to approach it, for the journey from Plymouth to London. While swinging around a very sharp curve at Salisbury the engine suddenly left the rails, crashed through a milk train on a neighboring track, and was shattered into a tangled mass of wreckage against the iron girder of the bridge, after destroying a locomotive standing on another track. The engine driver seems to have made no attempt to save his own life, for his charred body was found hours afterward in the wreckage of the locomotive cab. From statements of survivors, it appears that the swaying and jolting of the cars as the speed increased had become noticeable, and even alarming, shortly before the locomotive left the rails. While this may indicate that the roadbed, for at least that section of the track, is not in the excellent condition usual with English railroads, it is doubtful whether this was really the cause of the accident. More probably the high speed, in conjunction with the sharp curvature of the track at Salisbury, gave rise to the ensuing accident.

It is said that the section of the line in the neighborhood of Salisbury has been known to be dangerous, and that the engine drivers have had orders not to exceed a speed of 30 miles an hour at that point. It is to be hoped that this disobedience of orders is not an indication that the English railroads are beginning to resemble certain of our American lines in the desire for speed almost irrespective of the attendant risks. Within recent months there has been a series of accidents on British railroads which would tend to show that such is the case, and we trust that the terrible lesson which these disasters are adapted to teach will not be neglected in establishing a new record for safe travel in England such as that which British railroads have deservedly possessed heretofore.

Official Meteorological Summary, New York, N. Y., June, 1906.

Atmospheric pressure: Highest, 30.34; date, 13th; lowest, 29.71; date, 6th; mean, 29.94. Temperature: Highest, 93; date, 30th; lowest, 52; date, 12th; mean of warmest day, 82; date, 30th; coldest day, 62; date, 12th; mean of maximum for the month, 79.5; mean of minimum, 63.5; absolute mean, 71.5; normal, 69; average daily excess compared with mean of 36 years, +2.5. *Warmest mean temperature for June, 72, in 1888, 1892, and 1899; coldest mean for June, 64, in 1903. Absolute maximum and minimum for this month for 36 years, 97, and 47. Precipitation: 1.70; greatest in 24 hours, 0.48; date, 29th; average for this month for 36 years, 3.25; deficiency, —1.55; greatest precipitation, 7.70, in 1887, least, 0.86, in 1894. Wind: Prevailing direction, south; total movement, 6,855 miles; average hourly velocity, 9.5 miles; maximum velocity, 54 miles per hour. Weather: Clear days, 5; partly cloudy, 17; cloudy, 8. Thunderstorms, date, 2d, 6th, 9th, 10th, 21st, 23d, 29th, 30th. Frost: Light.

* Mean temperature of June for the three years named is given in round numbers.

A CITY OF SALT.

BY WILLIAM G. FITZ GERALD.

If there is any more surprising monument of human labor than Wieliczka's underground city, hewn in the course of ages in glistening rock-salt in the bowels of the earth, one would like to know what it is, and where it may be found. An out-of-the-world place this, in the quiet Carpathian valley of the Vistula, some miles off the Cracow-Lemberg Railroad in Austrian Poland. For ever since railroads came into the world, these peasants refused to permit them near, fearing lest the vibration should cause the upper earth to fall in upon and bury the teeming inhabitants of those strange, crystal, sparkling streets a thousand feet down in the earth, with their little horse-railroads, drawn by congenitally blind animals, who may be said never to have been "in the world" at all, as we know it.

The origin of the rock-salt mines of Bochnia and Wieliczka is lost in the mists of antiquity. They are certainly known as early as the reign of Bela IV., of Hungary, in 1252. During the Tartar invasions they were somewhat neglected, but they were restored to fresh activity by immigrant Hungarians from across the border in the time of St. Klinga.

One thousand years of patient human toil have honeycombed out of the solid salt crust of the earth an entire city at various levels. It consists of an intricate congeries of winding streets and dim scintillating alleys; of pillared churches; diamond and ruby staircases, restaurants, railroad stations, shrines, statues, monuments, and a thousand other wonders—all rough-hewn in the hard, sparkling rock-salt crystals which, lit by electric lights, pine torches, magnesium flashes, or thousands of candles, fairly blaze like a world of precious stones.

The Salt City is not only difficult of access, but the Austro-Hungarian government (it is state property) most jealously guards it; and all workmen are searched several times a day, lest they should be tempted to conceal fragments of rock-salt upon their persons. It is not clear why mere salt should be considered so precious, but the fact remains that all workers are searched as jealously as the Kaffirs in the diamond mines of Kimberley.

The entrance is a long, low, ordinary-looking building, containing the Administration Offices of the mines, and also a small museum of palæontological curiosities, found deep down in remote recesses. Elevators descend the abysses leading to this wondrous city, though many visitors prefer to go down by the long, massive staircase, hewn in the solid salt, which flashes emerald and ruby rays at every step.

One naturally asks why an entire "city" was hewn in the salt, more especially the pillared cathedrals, the altars, statues, and the like. And one learns, naturally enough, that all this patient work chiseled out during centuries, is in the nature of votive offerings from grateful men, whom the salt has yielded what will seem to us a mere abject pittance, ranging from five cents to twenty-five cents a day!

The salt-hewn cathedral of St. Anthony dates from the seventeenth century, and was projected by a pious foreman. Galician miners are deeply religious people. They have their own minister of religion in the depths, and touching prayer services with weird music are held in their rock-salt churches. Also they have their own band for festive occasions.

The high altar in the salt "cathedral" is cunningly adorned with twisted pillars, and it is flanked by salt-hewn statues of St. Stanislaus and St. Clement. On the altar steps are carved in ruby-red rock-salt effigies of two kneeling monks; and in the background of the altar is a huge salt crucifix, before which stands the Virgin placing the infant Jesus in St. Anthony's arms. This, the most extraordinary church in all the world, contains a salt-hewn pulpit, supported by salt statues of St. Peter and St. Paul, and in a niche below stands a glistening statue of the good king Augustus II.

Emulation must have been the secret of all this gigantic work. It seems that no sooner was the first shrine chiseled in salt, the first statue carved, than succeeding generations of miners, fired with zeal, resolved to see what they also could do in this strange sculpture. Some three hundred feet away from the cathedral is a most wonderful rock-hewn salt cavern in this weirdest of cities. This is the vast "Salle de Danse," the wonderful Lentow ballroom, lit with enormous lusters or chandeliers of wire-hung rock-salt crystals of opalescent hues. These last were added in honor of a visit from the Russian Czar, Alexander I., who (like many other royal and imperial dignitaries) visited the City of Salt with the Palatine of Hungary.

This great ballroom is over three hundred feet in length, and towers dimly to a height of one hundred and ninety feet. Its walls of salt-rock glisten and flash with exquisitely-hued crystals, and there are symbolical statues here and there, representing "Knowledge," "Labor," "Vulcan," and "Neptune"; as well as a special Throne of State at one end, of course hewn in the rock-salt, and kept for the use of the aged Emperor Franz Joseph or the Imperial Archdukes.

There is a triumphal archway in salt over the entrance to the great ballroom, surmounted by a miner saluting, and at his feet is carved in salt-crystals the Polish greeting "Szcze sc Boze!"—the equivalent of the German "Glückauf." Whenever an old working is exhausted and closed, or a new "street" opened in the subterranean city, the event is celebrated by a great ball in the Lentow Saloon. Then it is that hundreds of Galician peasant women, wives and friends of the workers below, quaintly clad as a comic opera chorus, take their partners in the vast, rough-hewn salt cavern, while shrill pipes, quaint-sounding flutes, and sweet violins make merry music as the couples whirl in wild Slavonic dance. Another vast chamber, about three hundred and fifty feet from the surface, is the Michalowice Hall on the second tier of the city. Rock-salt was dug out of this for forty-four years. It is about a hundred feet long, sixty-five feet wide, and one hundred and seventeen feet high. The sides and roof are secured by hundreds of tree-trunks, placed one above the other as pillars and strutted together. This reminds one of the terrible accidents that have happened in the City of Salt. More than once fires have broken out in the workings, and have burned for years, until the wooden props have given out. Or again, the strange, sullen-looking saline lakes, navigated by boats in these dark depths, may rise suddenly, probably fed by subterranean springs, and drown scores of these patient, hard-working men.

Worst of all, great masses of the rock-salt, often weighing hundreds of tons, may fall in avalanches from the domed roofs of the streets or the ceilings of new chambers. One notices that the immense saloons, restaurants, churches, and other public buildings hewn in salt, are lighted by great chandeliers of salt crystals. There is one in the Michalowice Chamber ten feet in diameter, twenty feet high, and containing about two hundred and forty candles.

The Kaiser Franz Chamber, named after the present ruler of the dual monarchy, contains two immense pyramids with ornamental bases, commemorating a visit of the Emperor and Empress many years ago. This hall is nearly two hundred feet long and about one hundred and five feet high. Leaving this chamber, one crosses a wooden bridge over a subterranean river filled with blind fish, and in the dim light of torches one beholds another public monument—an obelisk thirty feet high, carved in rock-salt, and recording a visit of the late Crown Prince Rudolph and Princess Stephanie in 1887.

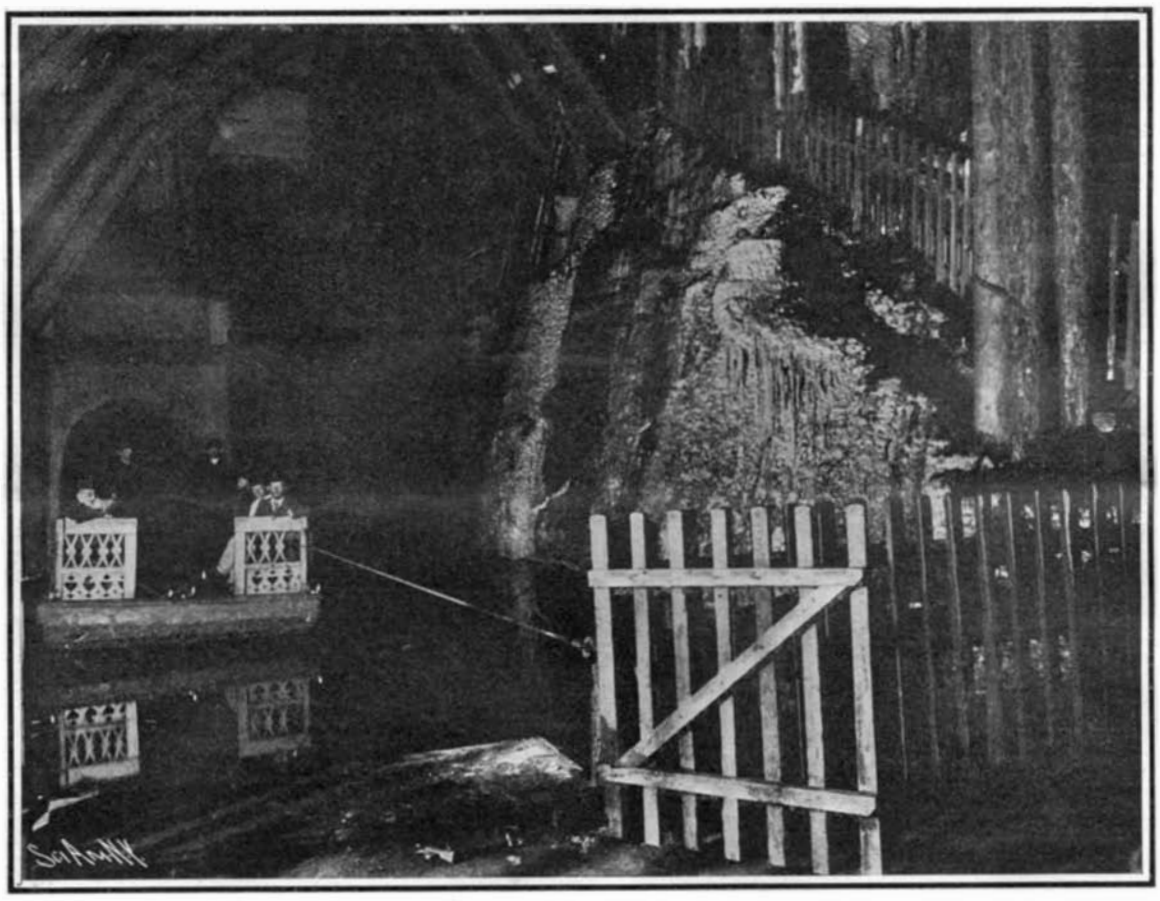
One may but mention in passing the Drozdowice and Archduke Frederick chambers, on the way to the Central Railroad Station, which is named after Count Coluchowski. Here meet all the little trolley lines of the underground city, and it was made a kind of central "Broadway" three centuries ago. Here converge many of the principal streets or galleries of the East Field. The lines are narrow-gage; and the little cars are drawn by Polish ponies, most of whom have never been on earth at all, and are born blind.

The platform of this "Grand Central Depot" has seating accommodations for four hundred persons, and on holidays its cafés and restaurants are crowded with visitors from the upper world, who eat and drink and enjoy the wild music of the miners' orchestra, which echoes and reverberates strangely through the dim yet sparkling streets.

Nor must we forget to mention the salt lakes of the city, in many places twenty or thirty feet deep, and navigated by ferryboats containing twenty-five persons. These lakes give access to remote and very ancient parts of the city, such, for example, as the Stephanie Grotto, where salt-hewn statues of medieval saints rise strangely out of the dense salt water, girt and enshrined, as it were, by most beautiful salt stalactites and stalagmites. But while admiring these wonders, this patient work of ages, let us not lose sight of the hard life which the poor mining inhabitants of the Salt City are compelled to live. There are some two thousand men at work day and night down here, in eight-hour shifts, and as a rule the men get little more than twenty cents a day. Like the monks of the Great St. Bernard, their allotted span of life is short. The men have a peculiar livid look. They are hollow-cheeked and bloodless—a condition probably due to the action of the salt on the system after years of insidious contact.

Besides floods, falls of salt-masses, and fires—all of which catastrophes take on additional horror down in these depths—another serious danger is the violent explosions of carbureted hydrogen, which may accumulate in newly-excavated galleries. All holidays, political and religious, are celebrated in the City of Salt with a careless *élan* that blots out all thought of sorrow. There are imposing services in the unique cathedral, dances, picnics, boating parties, and even marriages down in this strange underworld, hollowed out of the rock-salt.

Children are born here, too, and christened. When these grow up, of course they take naturally to the work of their fathers, and help to hew out the hundreds of thousands of tons of rock-salt which is a government monopoly. The men seem perfectly happy; and to see them on a festive day, when the streets are half an inch deep in ruby and diamond-flashing salt-pebbles and dust; when the Emperor may be on his throne in the great Lentow Saloon, and two hundred and fifty Slav musicians directing a perfect orgie of delights—then indeed one would say the citizens of the salt domain need no sympathy from outsiders.

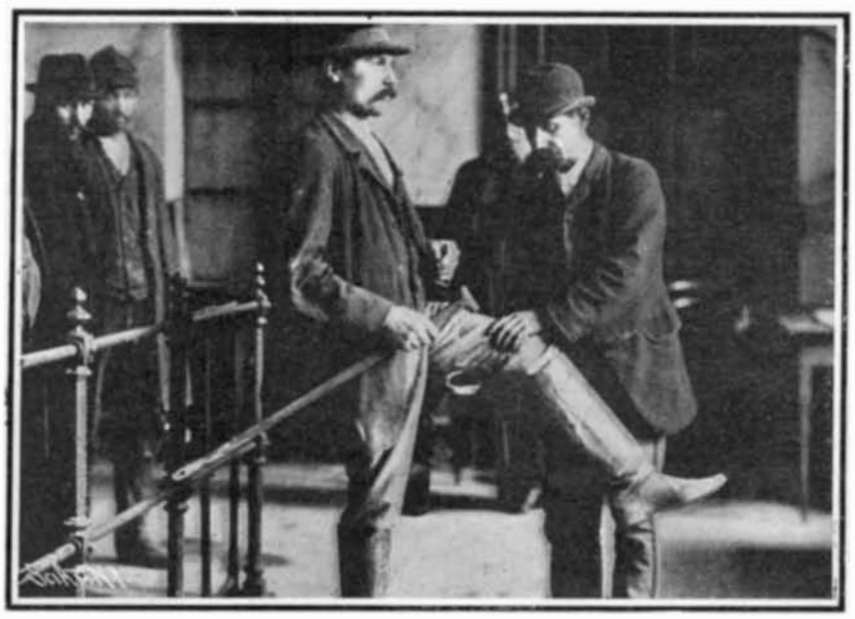


The Subterranean River in the City of Salt.

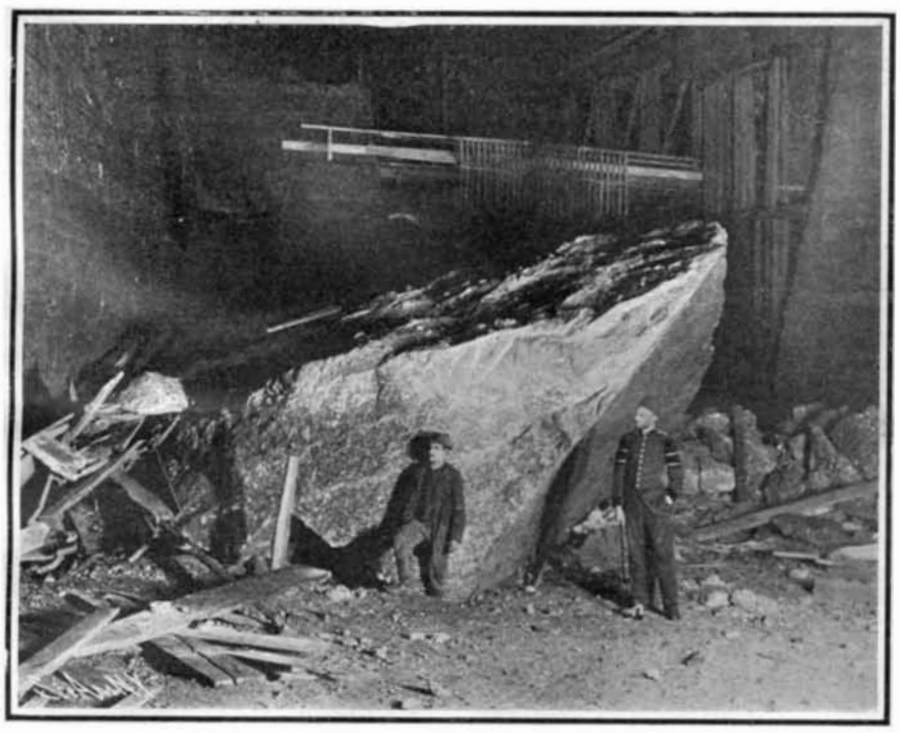
A CITY OF SALT.

The Interborough Rapid Transit Company, of New York, has just placed an order for fifteen miles of cables insulated with voltax, the new potential insulating compound which has just been placed on the market. This compound, which for the past eight years has been given severe tests, offers so many advantages over rubber insulation that it is rapidly coming into prominence. Recent tests made by the electrical testing laboratories of New York show that this material can withstand a voltage 100 per cent greater than rubber insulation, and has withstood high potential insulation, resistance, and melting point tests that no other compound yet discovered has withstood. The cost of this material is about twenty per cent less than rubber insulation.

A Railroad Station and Its Restaurant in the City of Salt.

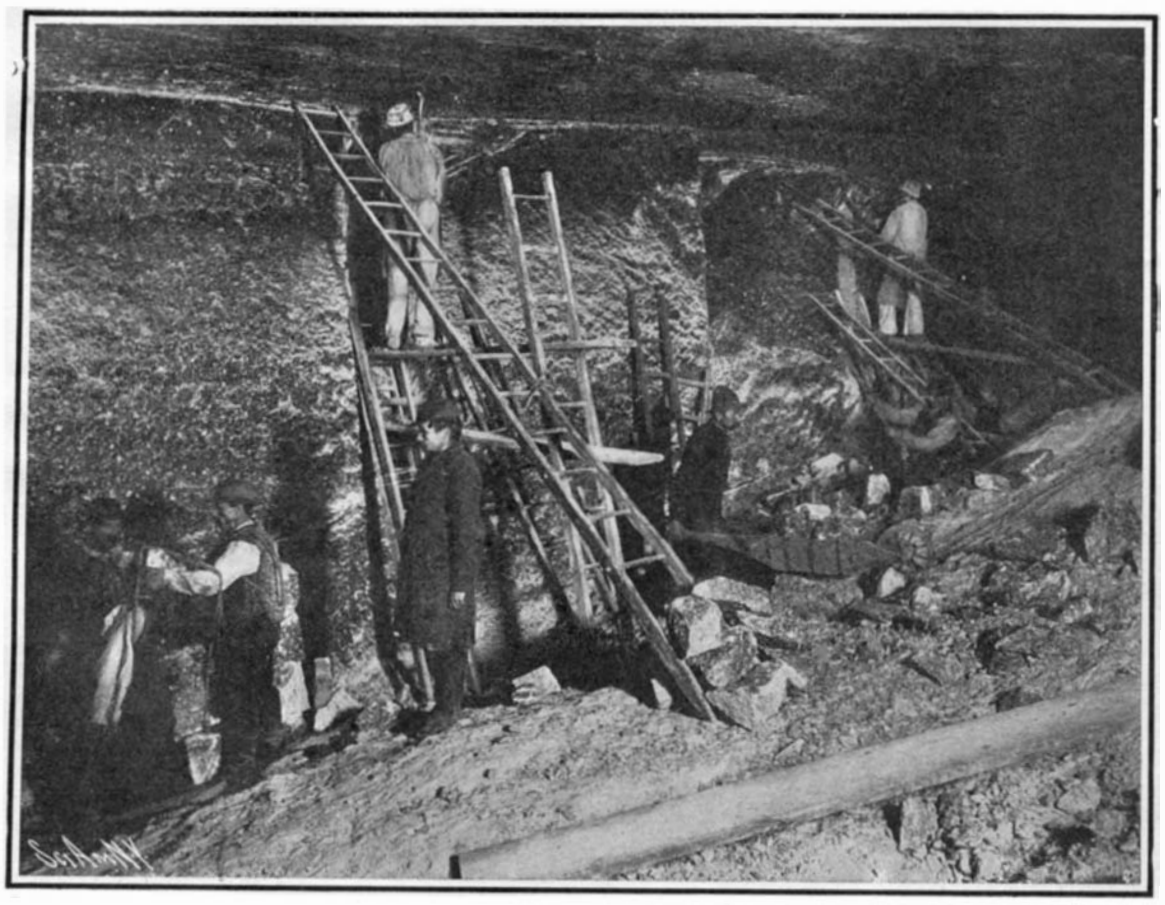


The Workmen Are Searched Daily.

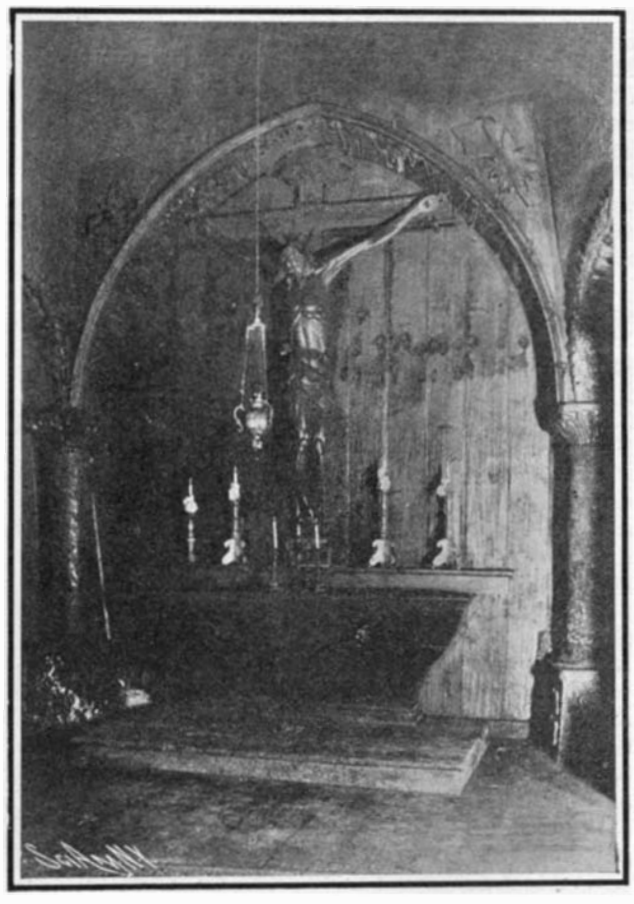


This Great Mass Weighing Several Hundred Tons Fell from the Roof. Salt Mining is not Without Its Dangers.

One of the Great Salt Chandeliers in the Salt Church Hewn Out of the Solid Salt Rock.



Workers Deep Down in the Salt City Driving a New Street.



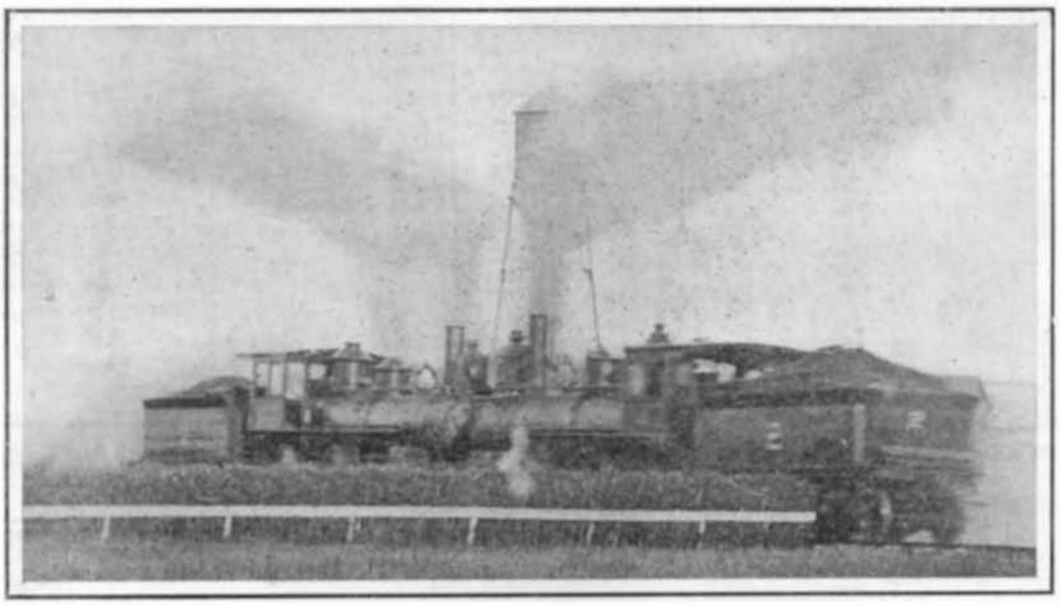
A Side Chapel in a Church Hewn in Salt.

A CITY OF SALT.

A RAILROAD COLLISION AS A FORM OF AMUSEMENT.

The search for sensational spectacles wherewith to attract the attention and open the purse strings of the amusement-seeking public has led to some curious and fantastic results. Some years ago it was reported through the West that an enterprising promoter had organized a railroad wreck in which a pair of engines approaching each other at a rapid rate of speed upon a section of temporary track collided with tremendous realism. A similar spectacle was recently planned and brought to a successful termination on the Fourth of July at Brighton Beach, where it was viewed by nearly 30,000 excited visitors. Unfortunately, the arrangements for the great show were very poor, to say the least; for not only was the actual collision delayed until nearly six o'clock, but the locomotives themselves, as can be imagined, were not of the largest and most expensive kind, nor were they able to attain even a respectable speed.

Nevertheless, the sight was a thrilling one. A temporary track about half a mile long had been laid within the oval of the Brighton Beach racetrack. Here, too, a mistake was made, as this length was hardly adequate to permit the locomotives to approach any degree of speed before they came in contact. All the afternoon they had chortled up and down this bit of track, simulating youthful energy under the bright coat of new paint which disguised their ancient plates and members. At last, after the great crowd had almost lost hope of seeing the much-advertised collision, the signal was given, and the two locomotives started toward each other from opposite ends of the track, the rails of which had been generously sanded to insure good traction. After the engines had advanced some 50 feet and had started to pick up speed, the engine drivers jumped from their respective cabs and landed safely—in about a foot and a half of water which covered the grassy inclosure. With whistles shrieking and clouds of black smoke mounting from the stacks the locomotives lumbered toward each other, gradually gathering speed as they neared the point of collision. It was intended that this take place near the middle point of the temporary roadway, but as one of the locomotives managed to move at a somewhat higher speed than the other, the point of contact was somewhat to one side of the originally intended position. It made little difference, however, as the entire track was visible to the spectators. Those in charge of the show had declared that the engines weighed 80 tons apiece, but we must ascribe this statement to the heated imagination of an ambitious press agent, for it is doubtful if either piece of mechanism exceeded 50 tons in weight. Notwithstanding, the spectacle as the locomotives crashed into one another was sufficiently impressive. As they struck it was seen that the force of the impact lifted the interlocked forward ends high in the air, while the rear ends of the tenders were likewise raised by the force of the concussion. This phenomenon, which has been noted in prior collisions, both accidental and premeditated, is clearly visible in one of the accompanying photographs. It could be seen, however, for but an instant, as great volumes of steam and smoke at once burst forth from the riven shells and hid everything from sight. Fragments of metal, coal from the tenders, and water from the tanks were scattered for yards around the wreckage.

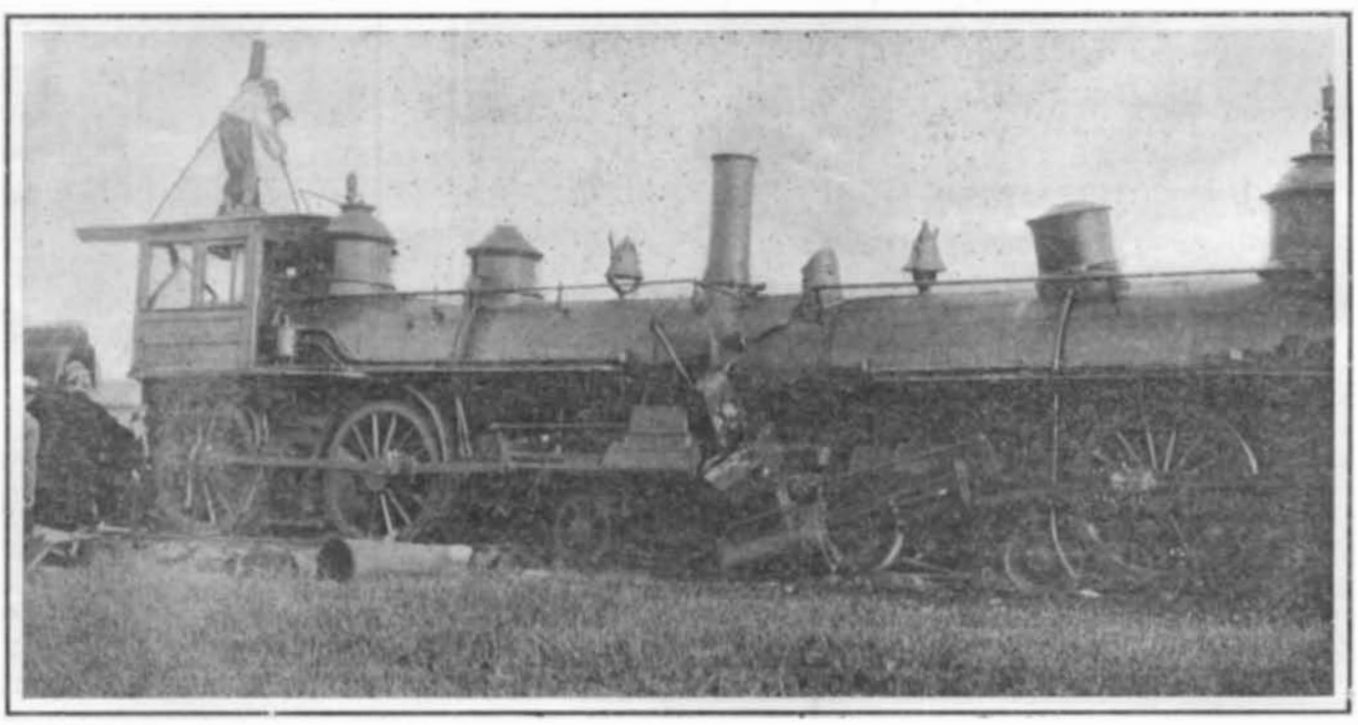


Just Before the Locomotives Crashed Together.

The Moment of Collision.

After the shattered boilers had emptied themselves of their scalding contents, it was seen that the damage was apparently not as great as indicated from the actual collision, as shown in the above-mentioned photograph. Nevertheless, the damage was such that both engines are, of course, useless for anything but the scrap heap. One engine suffered more severely than the other, though it is difficult to estimate to what this fact is due. The forward ends of the boilers telescoped almost exactly and rather neatly, the upper rim of the shell of engine No. 1 shearing off the smokestack of engine No. 2. The steam dome of engine No. 2 is also badly battered. The greatest apparent damage is that to the forward trucks and the cylinders with their valves and other gearing, particularly in the case of locomotive No. 2. In both engines the forward trucks were torn loose from the body and smashed backward into the mechanism of the driving gear, tearing, bending, and crumpling everything underneath the boiler. The cylinders of locomotive No. 2 were torn from the yoke and forced outward and downward, while the cylinders of locomotive No. 1 suffered less severely. The tenders and cabs were also badly bent and shattered. It was unfortunate that the speed of the engines was not greater—it is doubtful if either attained a velocity of 20 miles an hour—though as far as the sight for the curious spectators was concerned, it could hardly have been more impressive.

In another of the accompanying photographs, the engines are shown just at the moment of collision but before the effect of the blow had affected either machine. But a puff of steam from the boiler of No. 2 indicates that the force of the blow had already started an outlet for the contents. Had the picture been taken a fractional part of a second later, the view would have approximated the second photograph, showing the great masses of iron reeling and buckling under the impact of the collision. Before the steam and smoke cleared away thousands of people swarmed across the water-sodden inclosure, and proceeded to snatch mementos in the shape of bits of iron, splintered woodwork, or anything which was not too hot to handle, from the engines, and so enthusiastic were these relic hunters that it was with the greatest difficulty that the attendant police guard prevented the carrying away of the major part of the twisted metal, and thereby saved the promoters an additional profit to add to their already huge receipts.



After the Impact.

A RAILROAD COLLISION AS A FORM OF AMUSEMENT.

Attention has been drawn by Prof. Thurston to the effect of water dropping on the wheel from the casing. The energy absorbed by a single drop of water falling on the periphery of a turbine wheel, 10 feet diameter, running at 500 revolutions a minute, amounts to 67.7 foot-pounds. When it is considered that of the steam passing through the turbine some 20 per cent is condensed, we see that the loss from this cause may be important.

THE MEREDITH CIGAR-VENDING MACHINE.

In the accompanying illustrations a new cigar-vending machine is shown, which possesses novel and distinctive features, and covers an unusual range of work. It practically forms an automatic retail store, in which a customer waits on himself, but is enabled to visually

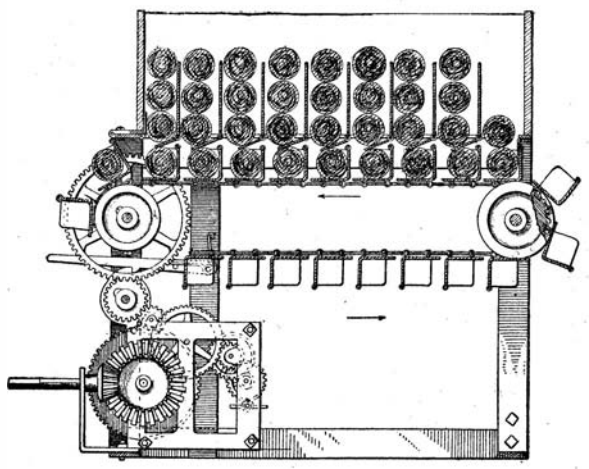


Fig. 2.—MECHANISM OF THE CIGAR-VENDING MACHINE.

inspect and select out of the original boxes any kind or quality of cigar for a single coin, or any number of cigars for a single coin; as three for ten cents, six for a quarter, etc. It is especially intended for hotels, club rooms, barber shops, etc., and while dispensing entirely with the aid of a clerk, insures to the customer the receipt of any kind, price, or quality of cigar that he may select. For the purposes of visual inspection and selection, all the cigars in their original boxes are displayed in full view beneath an extended glass showcase. The customer after making a selection drops his coin in the proper slot, and by special delivery mechanism, under the control of the customer by means of a push button, one or more cigars of the kind selected and paid for is automatically discharged into one of the side troughs within reach of the customer.

The delivery mechanism is unique and ingenious in preventing skinning or abrasion of the cigars. The bottom is cut out of the box in which the cigars come, and the box is placed above the vending unit as seen in Fig. 2, and the cigars are then put back in the box. Stationary vertical partitions in the vending unit extend up into the cigars, dividing them into vertical tiers. An endless carrier belt with cells, each receiving a cigar, is given a regulated movement through a clock spring gear set into action by the push button and coin. The carrier belt causes the lower horizontal layer of cigars to be carried forward under the superposed cigars, and discharges them at one end. A hinged leaf or false bottom separates the lower cigars of each vertical tier from the upper ones, and prevents skinning. After the rear vertical tier of cigars is received

Fig. 1.—CIGAR-VENDING MACHINE.

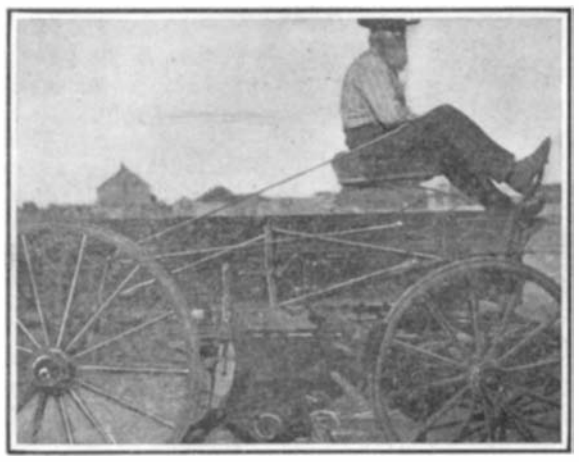
into the cells of the belt, the next vertical tier is similarly fed into the cells by the dropping of the hinged leaf or false bottom. Each box of cigars has a delivery unit similar to that seen in Fig. 2.

Although primarily intended for cigars, the device is equally adapted for vending any kind of articles or packages of uniform size.

This invention has been protected in three patents to Mr. G. W. Meredith, who has assigned his rights to Milo R. Meredith, of Wabash, Ind.

BRAKE MECHANISM FOR VEHICLES.

Pictured in the accompanying illustrations is an improved brake mechanism, which provides means for applying brakes to the front wheels of a vehicle, as well as to the rear wheels. The invention also includes supplementary operating mechanism, adapting it for use either with or without the wagon body. One of the illustrations shows diagrammatically the mechanism used, the wheels and body of the vehicle being indicated by broken lines. The front brake lever is shown at *A* and the rear lever at *B*, while fulcrumed to the vehicle body is a short lever *C*. The upper arm of the lever *C* is connected with the lever *B* and with the foot lever *D*, by means of a pair of rods, while another rod connects the lower arm of lever *C* with the lever *A*. Thus, when the foot lever is moved forward, both the front and the rear brakes are operated. The upper end of the lever *B* carries a pulley block. Around this block a rope is passed, one end of the rope being fastened to the upper end of the lever *A*. By drawing on the other end of the rope the levers *A* and *B* will be moved toward each other, setting the front and rear brakes. The rope and pulley gear provides a two-to-one leverage, and this is further increased by the length of the levers *A* and *B*, thus affording a very powerful brakeage. The great advantage of this arrangement is that the brakes can be controlled either from the wagon or by a person on foot. In the case of long teams the brakes may be operated from the back of a saddle-horse. The rope gear permits coupling out of a wagon to any desired length. The front brake lever is fulcrumed to the bolster, and one would suppose that with the body of the vehicle removed,



BRAKE MECHANISM FOR VEHICLES.

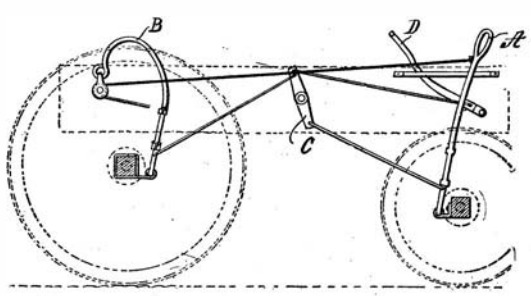
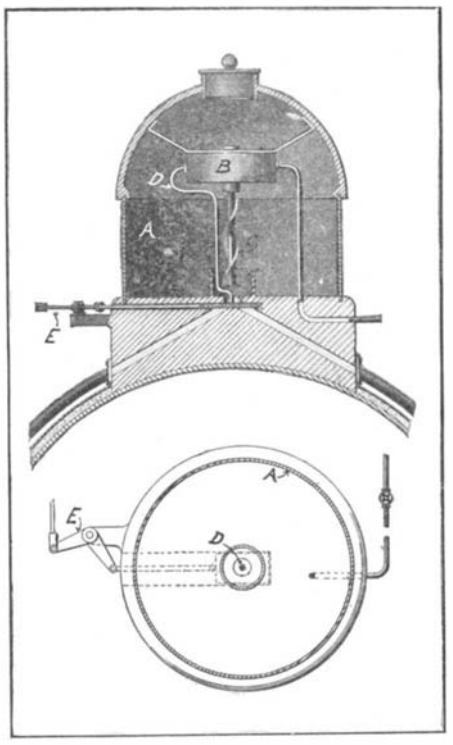


DIAGRAM OF BRAKE MECHANISM FOR VEHICLES.

the bolster would turn on the pin bolt when the brake rope was pulled. But to prevent this the inventor has provided a bracket which holds the bolster always at right angles to the coupling pole, that is, parallel with the rear bolster. The inventor of this brake mechanism is Mr. Gilbert D. Buchanan, Saratoga, Wyoming.

AN IMPROVED TRACK-SANDING DEVICE.

A recent invention provides means for loosening the sand in the sand box of a locomotive whenever desired, so as to insure a proper flow to the rails of the track. Briefly stated, the invention comprises an air motor, which operates an agitator within the sand box. The motor is operated under control of the engineer or fireman, and the exhaust from the motor is utilized to drive the sand down the tubes leading to the track. In the accompanying illustration the sand box is indicated at *A*. Suspended within the box *A*, by means of brackets, is the air motor *B*. The agitator, which is shown at *C*, consists of a rod provided with spiral ribs or fins. This stands vertically over mouth of the ducts leading to the rails. The exhaust air from the motor is led to the ducts through the tube *D*. The valve which closes the mouth of the tube is operated by the usual gear *E*, from the cab of the locomotive. Ordinarily, it may not be necessary to agitate the sand; for unless it be caked it will flow down by gravity to the rails, whenever the valve is withdrawn. But in emergency cases or whenever the engineer finds that the sand is not flowing properly, he needs merely to open the air supply pipe, when not only will the sand be agitated and loosened, but it will be positively forced down the tubes leading to the rails. A patent on this



IMPROVED TRACK-SANDING DEVICE.

sanding device has been secured by Mr. Albert G. Zamel, of 560 West Twelfth Street, Chicago, Ill.

FOLDING CRIB.

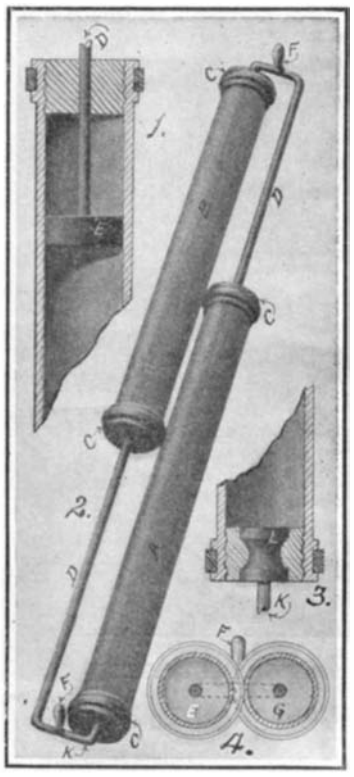
In the accompanying engraving we illustrate a crib which is so constructed that it may be folded up to make a compact parcel for transportation or storage. The device should be found useful when moving from one place to another, or to persons living in limited quarters, who can take down the crib and store it away during the daytime, and readily erect it at nightfall. The construction of the crib will be clearly understood by reference to the engraving. The frame comprises two pairs of crossed legs, one pair at each end, which are connected by four side rails. The latter are reduced at their ends to pass through holes in the legs, and are held in place by cotter pins or pegs. To make the frame perfectly rigid, brace rods are extended from the side rails to the pivot of each pair of legs. These rods are each hinged at the center, so that they will collapse when the crib is folded up. To hold the legs properly spread, a cross-bar is used on each pair near the top. The body of the crib is made of canvas, and is provided with pockets on the upper edge at each side, through which the side rails are passed before being fitted to the legs. The hood of the crib is stretched over a collapsible frame, which fits in sockets in the side rails. In our engraving we illustrate the crib as partly torn away, to show the slats sewed into the bottom of the crib body. These slats give the required stability, but do not interfere with its folding.

A FOLDING CRIB.

The small compass into which the crib can be folded is pictured in the foreground of our illustration. The inventor of this improved crib is Mr. Louis Dejonge, Jr., 139 St. Paul's Avenue, Stapleton, Staten Island, New York.

AN IMPROVED PARALLEL RULER.

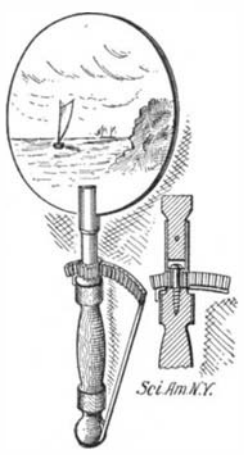
In the accompanying engraving we illustrate an improved drafting instrument, consisting of a ruler adapted for parallel movement over the paper, thus facilitating the drawing of parallel lines. Mariners will also find the ruler useful when laying out a course on a chart, for comparing directions with the compass. The instrument is of the roller type, but is an improvement on previous inventions along this line, in that it may be extended to any desired length within wide limits, and in that it is made of transparent material, so that the lines of the map or drawing directly under the ruler will be visible. The instrument consists of two glass tubes, *A* and *B*, each provided with rubber bands *C* at opposite ends, adapted to bear against the chart when in use, to prevent slipping of the ruler. A rod *D* is secured to the outer end of the tube *A*, and enters the tube *B*, terminating in a piston *E*. Another rod *D*, secured to the tube *B*, enters the tube *A*, and terminates in a piston *G*. In this way the two tubes are connected, and yet are free to move axially so as to extend the ruler, and at the same time maintain the parallelism of the tubes. Two handles *F* are secured to the rods *D* to assist in moving the ruler over the paper and in extending it to the desired length. The method of securing the rod to the tubes is shown in Fig. 3. The end *K* of the rod is formed with a head that fits into a block, which is screwed into the end of the tube. The glass tubes are preferably graduated to indicate miles, kilometers, etc., and the scale can be read through the tube when the latter is rolled to position on the chart. The inventor of this improved ruler is I. Myhre Hofstad, of Ketchikan Avenue, Wrangell, Alaska.



IMPROVED PARALLEL RULER.

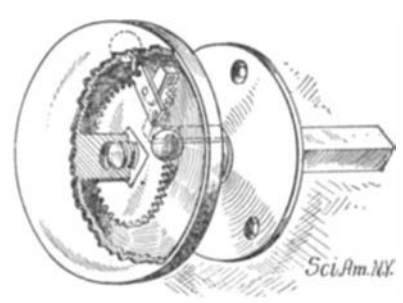
ODDITIES IN INVENTIONS.

A Novel Fan.—In the accompanying illustration we show an improved fan, which may be operated by hand to rotate alternately in opposite directions. The fan is supported on a spindle carrying a pinion, which meshes with a toothed segment. The latter is secured to the end of a spring attached to the handle of the fan. When the spring is depressed the fan will be rotated in one direction, and as soon as it is released the tension of the spring will withdraw the rack, causing the fan to turn in the opposite direction. Thus a person may fan himself without the tiresome movement of his arm or hand by periodically depressing the spring with his thumb.



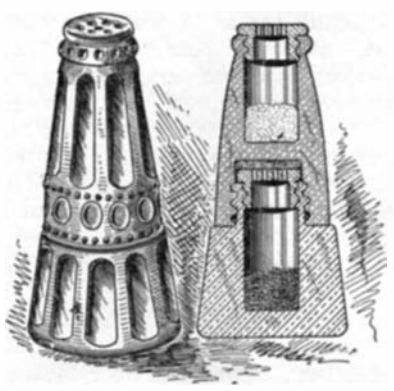
A NOVEL FAN.

Combined Door Knob and Bell.—A Western inventor has recently introduced a combination door knob and door bell, which serves to give warning of the entrance of any one, and thus minimizes the danger from sneak thieves. The door knob is hollow and is made in two parts, the outer part forming a gong. Within this gong are a couple of balls, which are operated by means of gearing connected with the spindle to sound the gong whenever the spindle is turned, thus giving the alarm. The main advantages of the invention are that it does not detract from the appearance of the door as would a bell connected up in the usual manner, and that it is in a measure concealed, so that it will act as a trap for any one bent on mischief.



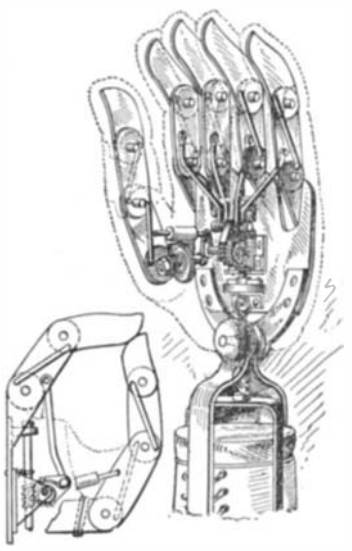
COMBINED DOOR KNOB AND BELL.

A Combined Pepper and Salt Shaker.—In the salt shaker here illustrated, the salt is prevented from caking and is kept loosened without having to be dried or heated and without requiring the addition of foreign materials, such, for example, as corn starch. This result is obtained by using a combination pepper and salt holder, the former being provided with a socket or recess, into which the upper part of the salt shaker fits. In this manner the perforated top of the salt shaker is kept closed, and moisture is prevented from entering. When it is desired to use salt the pepper holder must be removed, but when it is desired to use pepper the pepper and salt holders may be used together. A washer is fitted into the socket of the pepper shaker, and this fits snugly over the mouth of the salt shaker, to prevent the salt from shaking out when the two shakers are used together.



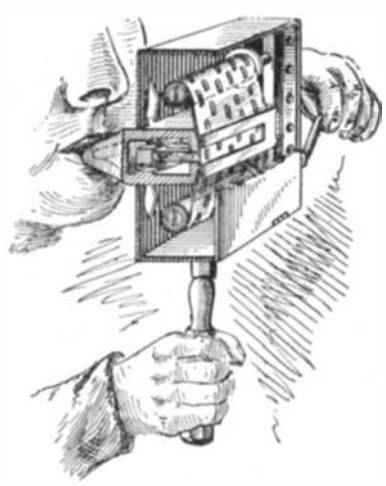
COMBINED PEPPER AND SALT SHAKER.

An Artificial Hand.—A recent invention provides a hand fitted with jointed fingers and thumbs, which are connected by rods to a mechanism in the center of the hand. This mechanism may be operated by turning the forearm, to draw the fingers into closed position. The mechanism is carried in a bracket supported by a sleeve laced to the arm above the elbow, while the operating shaft of the mechanism is connected with a sleeve laced to the forearm, so that by moving the forearm relative to the upper part of the arm the mechanism is operated. The object of the inventor is to provide a mechanical hand that will be able to hold an ax or other implement as tightly as would the natural hand, so that it can be used for chopping wood or for other manual labor. The fingers are made of aluminium or wood, so that they will be light and yet very strong. The mechanism is simple, and yet provides a powerful grip.



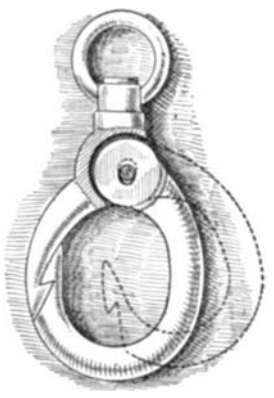
AN ARTIFICIAL HAND.

Novel Reed Instrument.—By a recent improvement, an inventor of Newark, N. J., provides a reed instrument of the mouth-harmonica type, which is easily worked by a little wind power and a slight call on manual effort. It is operated on the same principle as a hand organ using a music roll to select the notes, but wind power is furnished by the mouth instead of by bellows. This musical instrument is mounted in a box, and held in playing position before the lips by means of a vertical handle, while a crank handle on the left side turns the drums, or rollers, upon which the music sheets are wound. During the turning, the player blows into and draws from a wind chest, the latter being fitted with valves which provide a continuous exhaust. As the note sheet having the usual perforations passes over the tracker-board, whenever a perforation of this sheet registers with an opening of the board, then a corresponding note is sounded, whether the operator is blowing or sucking air. When the piece has been played, the operator can rewind the note sheet on one of the rollers.



NOVEL REED INSTRUMENT.

A Self-locking Hook.—The device shown by the accompanying illustration is particularly capable of lifting and hoisting heavy loads under conditions where quick and easy handling is required for fastening and unclasping a self-locking hook. It comprises two pivoted members, one having a swivel; the other, or hook proper, has an eye larger than the pivot on which the member swings, so that the latter may be lightly shifted on the pivot in addition to the swinging. The swinging hook and the relatively fixed member have lugs at their meeting ends for interlocking with each other, the necessary relative movements of these parts being permitted by the enlarged eye in the hook proper. To disengage the lugs the hook proper is slightly lifted, and it may then swing on its pivot. The hook presents a perfectly smooth exterior surface, so that the parts offer no projections to catch anything that would cause a load to lose its balance.



A SELF-LOCKING HOOK.

Brief Notes Concerning Patents.

David O. Paige, an inventor who has left a very efficient mark especially on the safe industry of this country, recently died in the city of Detroit. He was very active as an organizer and manufacturer, and while his enterprises called him to widely separated fields, the main body of his work was confined to Michigan. Besides manufacturing safes and vaults, he was interested in the production of glass-lined steel tanks, and designed the machinery for their construction. This inventor, a native of New Hampshire, was born at Weare in 1833. He was the holder of scores of patents, many of enduring importance. One alone, the celebrated "steel flange" fireproof and burglar-proof safe, placed him in the class that has made the best improvements in the safeguarding of personal property.

A cornet with two bells has been recently invented by Z. Albert Meredith, of Tahlequah, Indian Territory. This innovation is said to improve the quality of the tone and overcome the difficulty of playing instruments of this class. In the usual construction of cornets and similar valved instruments, such as, for instance, tenor, alto, and baritone horns, it is common to provide what is known as a second slide in connection with the second valve casing, which second slide is introduced when the second valve is depressed for the purpose of providing the additional length of tubing required to secure the lowering of the tone. The second slide is necessarily short and involves sharp bends, which increase the difficulty of playing and affect the quality of the tone. In Mr. Meredith's instrument all open tones, and tones produced by the depression of the first and third valves either singly or jointly, are emitted through the first bell. On the other hand, all tones produced when the second valve is depressed, whether alone or in conjunction with the first and third valves, are emitted through the second valve. This permits of a design which dispenses with all sharp or abrupt turns in the tubing of the instrument.

An amusement apparatus creates a great additional interest, where a means of exercising skill is introduced. This combination may be found in an invention made by Mr. E. F. Porter, of Boston, by which a baseball is mechanically pitched for a batter to strike. The player stands upon a platform, and in striking the ball causes it to hit a target, and through the mechanism connected with the latter, a dummy figure, preferably of a man, is caused to travel around the four bases of a base-ball diamond represented on the face of an indicator plate. The dummy speeds to a greater or less extent in conformity to the impact of the ball against the target, moving from the home base to the first, to the second, to the third, or making a home run. The element of skill enters largely into the game, as it is difficult for the batter to hit the ball, pitched in a constantly changed position. Again, if the sphere is not struck in a manner to make a drive directly to the target's center, the distance to which the dummy will move will vary according to the distance from the center at which the ball strikes. Failure to reach the target through striking the side walls of the chamber of this base-ball batting and registering device, constitutes a "foul." Aside from providing amusement for base-ball players, this invention should prove of service in training batters during those seasons of the year when weather conditions do not permit of outdoor practice.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

FOLDING CLOTHES-RACK.—A. F. PETERS, Cortland, N. Y. The object of the invention is to produce a device which may be folded together, so as to be carried conveniently in a traveling bag or satchel, but readily opened out and set up when desired for use. While it operates in one capacity as a hanger for clothes, it presents a horizontal rest upon which clothes may be placed in a folded position, thereby preventing the formation of wrinkles.

UNDERWAIST.—E. H. HORWOOD, Hoboken, N. J. The invention relates to the manufacture of underwaists for children, youths, and misses of that class wherein the armhole-section is rendered double and likewise that portion immediately beneath the armhole. The purpose is to improve upon the construction of the underwaist for which Letters Patent were formerly granted to Mr. Horwood.

Electrical Devices.

PRONG-INSULATOR.—L. STEINBERGER, New York, N. Y. The invention relates to insulators, Mr. Steinberger's more particular object being to produce a type of so-called "prong-insulator" which may be used upon either the upper side or the lower side of a cross-arm, or mounted horizontally on a support and which offers certain constructional and insulating advantages. He prefers to make the insulating portion out of the substance known as "electrose," the metallic member being made of iron, bronze, or any other metal.

Of Interest to Farmers.

LOADING APPARATUS.—H. T. WASHBURN and S. G. WASHBURN, Goodwin, S. D. The invention relates to loading apparatus, and has reference more especially to apparatus for loading manure and like materials in the field; and one of the principal objects thereof is to provide an apparatus of this kind which is simple and comparatively inexpensive to manufacture, besides being portable or readily removed from one place in the field to another.

FRUIT-RECEPTACLE.—V. E. STINE, Clearfield, Pa. This invention is an improvement in that class of fruit-receptacles adapted to be supported and carried on the person by means of straps or equivalent means. In broad terms the improved receptacle is a flexible bag having a rigid mouth at the upper end and a flexible mouth at the lower end. The bag or receptacle is preferably formed of stout canvas; but any other thin and pliant material of due strength may be substituted.

PLOW-FRAME AND ATTACHMENT.—J. G. EVANS, Calhoun, S. C. The object of this inventor is to provide a cheap, but light, strong, and durable, form of plow-frame, the same including the beam and foot or stock proper, the latter having an attachment adapted for securing different forms and sizes of plow or cultivator shares or teeth whereby the latter may be easily changed as occasion requires.

CULTIVATOR ATTACHMENT. — A. M. POTTS, Cedar Point, Kan. The improvement refers to a novel knife and means for attaching it to cultivators, so that as the ground is cultivated the knife or knives precede the cultivating-tools and cut down the weeds growing on the part of the field being acted upon. It provides means for attaching the knives which will permit the easy and universal adjustment of their position whereby to adapt them to various classes of work without injuring the plants under cultivation.

CORN-HARVESTER.—W. E. KOCH, Duvall, Ohio. When a leaning stalk is encountered it is engaged by conveyor-chains which have a tendency to lift it to erect position. When severed by cutters, the butt of the stalk slips back into the check, which retains it until the chains lift the upper end thereof into a position where it may be engaged by upper star-wheels. These wheels engage the stalk at its upper and its lower end, forcing the butt thereof past a stop-plate, the spring of which yields to allow its passage. The present is an improvement on Mr. Koch's prior patent.

COMBINED COTTON SCRAPER, BLOCKER, AND CULTIVATOR.—W. R. COX, Waldron, Ark. There is a combination of three implements in a single unitary machine, in this invention, and the inventor's object is to produce a machine which will scrape both sides of a cotton-row at the same time, thin the cotton by leaving it in blocks, and hill it up at the same time. By means of the device any other crops planted in the drill can be cultivated in the same manner.

Of General Interest.

SHIPPING-CRATE.—F. W. BENDER, Crystallake, N. J. The object of this improvement is to provide a crate extremely rigid and strong, and, furthermore, to provide an arrangement which will prevent the contents of the crates from being subjected to pressure when set up in piles as arranged in cars for shipment. The invention relates to crates such as used in handling, storing, or shipping fruits and vegetables.

FOLDING DISPLAY-BOX.—C. E. ISACKE, New York, N. Y. This device relates particularly to a device for advertising cigars, and it comprises a peculiarly-constructed dummy box, which is formed of paper, cardboard, or equivalent material, and arranged so that it can be shipped flat, thus effecting great economy in space, so that when assembled into proper form and painted or covered with painted or printed sheets it will closely resemble an open box containing cigars.

COPYING DEVICE.—H. H. HARRISON, New York, N. Y. This device is for use in connection with the so-called "hectograph copying composition." Particularly designed as a hand-operated device, still it may be made of a large size and arranged to operate on and having a geared connection with a permanent platen. The invention particularly resides in the manner of applying the hectograph composition to a fabric or other flexible holder and to certain devices for adjustably securing this holder to the body of the copying device.

SURGICAL IMPLEMENT.—A. C. KELLOGG, Portage, Wis. The implement is designed to facilitate the application of a compressive rubber ring to the stump of the funis or umbilical cord of a new-born infant after cutting off the same, so as to prevent hemorrhage, and to which the inventor applies the name of "Funis ring applicator." The implement dilates and applies the ring and at the same time forms a storage-holder for the rings.

PORTABLE BURIAL-VAULT.—W. PARRY, Crown Point, Ind. The design is to secure a thoroughly dry receptacle for a body buried in wet ground or quicksands. The object is to take care of the percolation by providing means whereby any accumulation of water may be allowed to escape by suitable drainage and ingress of such accumulations prevented from rising to the casket by a pneumatic cushion of gas maintained in the vault and around the casket and which serves to resist the entrance of water into the casket in case water should gain access to the interior of the vault.

BOX.—J. SUTHERLAND, Springer, New Mex. This invention pertains particularly to improvements in boxes for holding granulated tobacco, the object being to provide a box approximating the size of the original package or bag, so that the tobacco may be transferred from the bag to the box and maintain practically its original shape without danger of being pulverized as it does when carried in a bag.

PIPE-FLANGE.—E. L. MAXWELL, Mulberry, Fla. One of the purposes of the improvement is to provide a flange constructed in two sections—a male and a female section—and in such manner that they may be expeditiously and conveniently firmly keyed together and wherein the parts will not separate until purposely disconnected, which operation can be as conveniently accomplished as the act of connecting them. It is adapted for connecting the ends of opposing pipes—as, water, steam, or gas pipes—but for use wherever a flange is needed.

BOTTLE-CLOSURE.—L. LAWTON, Carrollton, N. Y. This bottle is provided with means for preventing the refilling after its original contents have been removed, and the inventor's object is to provide details of construction which are simple and adapted for effectively sealing the bottle from receiving liquid, but that permit the free removal of the liquid contents as occasion may require. To prevent the loss of liquid goods and insure the safe transportation of filled bottles having the improved closure, a small cork may be inserted into an upper chamber, thus closing the upper angular passages. A metal-foil cap bearing a label or trade-mark is placed over the top of the bottle-neck to identify a particular brand of liquor or other liquid goods.

BRUSH.—R. E. WILLIAMS, Dallas, Texas. In the present patent the invention has reference particularly to improvements in bath-brushes, the object being the provision of a brush having in its combined construction a plurality of devices for acting variously on a person when the brush is in use.

MEASURING INSTRUMENT.—B. F. SASSAMAN, Gibbstown, N. J. In this instance the improvement relates to measuring instruments, the more particular object of the invention being the production of a square containing movable parts and which may be used for a very great variety of purposes. If desired, the instrument may be employed as a square arranged for general use, as a so-called T-square, or with an ordinary depth-gage, or with an ordinary steel square and used for purposes of a "fence"; in fact, to those skilled in the art the device will be found applicable for many uses and combination of uses.

DISPLAY-FRAME.—G. E. LEIGH and J. A. COLEMAN, Mount Carroll, Ill. The purpose of the inventor is to provide a frame especially adapted to be slipped over the lid or cover of a cigar-box when opened to frame the picture usually displayed upon the inside of the cover and to so construct the frame that when placed in position upon the box cover or lid the cover will be prevented from accidentally closing and whereby also the cover will be held in a position best adapted for display of the frame and picture framed thereby.

BLAST-FURNACE.—W. KEMP, Tucson, Arizona Ter. Especially ores of copper and iron are smelted by this invention. It economizes use of fuel; rids ore of sulfur if any is contained therein; provides an effective fuel-chamber in which the fuel is fed directly to smelting zones of furnace before being heated; provides special air-blasts for preventing coal from being heated while in transit to fuel-chamber; provides furnace with special twyers for burning out sulfurous compounds of ores; distributes fuel uniformly in the fuel-chamber throughout the entire length of the furnace; and provides certain constructional improvements.

GATE.—G. A. MOCK and J. MENDENHALL, Granada, Col. The improvement is in gates for roadways, lanes, or the like, the object being to provide means for releasing the gate and raising it to swing open or closed, the said means being under control of a person in a vehicle at either side of the gate, the gate swinging to open position in the direction opposite to the side on which the vehicle may be when a person therein manipulates the mechanism.

DIRECTORY DEVICE. — C. A. JOHNSON, Malden, Mass. One purpose of this improvement is to provide a directory particularly adapted for use in elevators and so constructed that the names of tenants are produced upon slats, any one or more of which slats may be turned to present a blank surface or any one or more may be removed and others substituted without removing the adjoining slats from the front of the device or disarranging them.

REGENERATING AND PURIFYING OF AMMONIA.—L. WERLIIN, Elsmere, Del. The invention relates to ice-making and refrigerating machines using liquid anhydrous ammonia. The process can be carried on in an exceedingly small apparatus. The invention consists mainly in a method whereby the warm gases from the high-pressure side of the compression-machine are used for evaporating the liquid anhydrous ammonia and the condensed gases are returned to the receiver or to the expansion-coil.

APPARATUS FOR THE GENERATION OF ACETYLENE GAS.—A. ROSENBERG, 259 High Holborn, London, England. The invention refers to apparatus employed in the production of gases by the reaction occurring progressively between a solid and a liquid reagent which are permitted to gradually come into contact with one another. The object is to provide a tubulure attachment for a vessel (which forms the subject of another application for Letters Patent, formerly filed) which is adapted to serve not only for the transport and storage of the solid reagent, but also in combination with said tubulure attachment as a generator for the gas when the vessel is immersed in the liquid reagent.

WALL CONSTRUCTION.—J. N. SMYTHE and W. S. AYRES, Newark, Ohio. The principal objects of the invention are to provide means for readily securing the blocks to the studding of a building, to provide for the construction of doors, windows, and all other features present in the walls, to break joints in the blocks, as is usually done, and to leave the interior of the veneering in such form that a symmetrical inside surface is provided which is adapted to use of woodwork. The invention relates to a wall construction and veneering-block by means of which walls in or after construction can be covered with a veneering of blocks of artificial stone or other plastic material.

ADVERTISING DEVICE. — A. SUESSKIND, New York, N. Y. The invention pertains to an advertising novelty, which is adapted for application to a napkin, clothes, and the like designed to be used in various places, especially in restaurants, for advertising purposes in general. The principal object is to provide a readily-removable plate upon which advertisements may be placed and to mount it in a removable manner upon a support adapted to be applied and secured to clothing or to be connected with other articles of ordinary use.

Hardware.

CUTTING AND PUNCHING TOOL.—A. J. LEVIS, Houghton, Mich. In this case the object is to provide a cutting and punching tool more especially designed for the use of tinners, plumbers, and other mechanics and arranged to permit of forming tongues and slots in the ends of stovepipe-sections to allow convenient interlocking of adjacent stovepipe-sections.

SHEARS.—W. P. SPRAGG, Moberly, Mo. The shears comprise handles or levers having co-operating movable fulcra together with connection at such fulcra for maintaining the relation therebetween. Blades are employed, having the inner ends thereof in movable relation with the corresponding ends of the handles, the opposite edges of the blades being parallel and beveled or sharpened for a suitable proportion of length of the blades from their outer ends, special means being employed for maintaining the cutting portions of the blades in movable relation with each other.

Heating and Lighting.

GAS-BURNER.—H. SUESSMANN 144 Alte Jacobstrasse, Berlin, Germany. The regulating device which forms the subject of this application differs from nozzles with adjustable outlet-apertures for Bunsen burners consisting of certain parts, owing to the fact that the adjustment of the outlet-slit in the divided cap is produced by its adjustability relatively to a restriction in the nozzle-casing which receives it. This adjustment may be effected by means of a set-screw, for example.

INVERTED INCANDESCENT GAS-BURNER.—H. SUESSMANN, 144 Alte Jacobstrasse, Berlin, Germany. Attempts have been made to obviate defects by preventing the heating of the Bunsen burner as much as possible by the use of insulating substances of various kinds. Mr. Suessmann's object is different, the effect aimed at being only to prevent the influence prejudicial to the efficiency of the burner attendant upon the heating of the mixing-tube, while at the same time utilizing the heat of the waste gases for effecting a preliminary heating of the mixture of gas and air in the Bunsen burner.

Household Utilities.

APPARATUS FOR DISTILLING WATER.—C. R. DUDLEY, Sykesville, Md. The invention has reference to improvements in apparatus for distilling water, its object being to produce a still designed more particularly for domestic use whereby water may be distilled quickly, efficiently, and economically, and to produce a device which shall be cheap, simple, and adapted for use in connection with an ordinary stove or the like.

GAS-BROILER.—H. GANDAR, New York, N. Y. The object of the inventor is to provide a new and improved broiler adapted for convenient attachment to ordinary gas-stoves and arranged to permit of proper broiling of the meat or other food product and without danger of losing any of the juice or causing undesirable smoke.

FLY-TRAP. — W. E. THOMPSON, Tecumseh, Neb. This trap is adapted for use below or above a window-sash. Mr. Thompson by his invention seeks to provide a novel form of trap adapted to be placed in an opening or openings in the wall of a house or room and having a tapering inlet through which flies may pass to the interior of the trap and from which they cannot escape.

IRONING-BOARD.—G. H. AIGIN, Delaware, Ohio. The invention is an improved attachment applicable to ironing-boards in general, but particularly adapted for shirt-bosom and collar and cuff boards. Mr. Aigin has devised attachments for the board proper, whereby one or more cloths used for covering or dressing the face of the board may be quickly and easily attached and are held securely.

BATH-TUB.—J. A. LEFFERTS, Elizabeth, N. J. The invention relates to a novel construction of bath-tubs, and the principal purpose thereof is to provide means whereby they can be enameled in different colors upon their outside and inside surfaces. In order to provide for giving tubs two colors, both of them being applied by the ordinary process of enameling, the inventor constructs the tub in two parts and enamels them separately by the dry process.

PORTABLE WARDROBE.—ANNA M. SCHERFF, Wells, Nev. In this instance the invention relates to improvements in folding wardrobes particularly adapted for the use of travelers, the object being to provide a device of this character in which clothing will be protected from dust and so constructed that it may be folded for packing in a trunk.

BED-CLAMP.—F. W. MERRIWEATHER, Kansas City, Mo. The object of this inventor is to provide a cheap and convenient device by means of which the head and foot members of iron bedsteads may be connected closely together for the purpose of exhibition in salesrooms, and which device may be readily adjusted to beds of various forms. The clamp may be universally applied to all styles of metal bedsteads.

Machines and Mechanical Devices.

GIN.—M. REYNOLDS, Clarksdale, Miss. Mr. Reynolds's invention refers to cotton-gins and more particularly to that type usually termed "linters." Its principal object is to provide an efficient apparatus of this character by which mixed seeds of different sizes may be satisfactorily operated upon to produce lint of different grades.

EMBROIDERING ATTACHMENT FOR SEWING-MACHINES.—R. L. RODMAN, Lott, Texas. In the present patent the invention has reference to attachments for sewing-machines, and more particularly for those doing embroidery while the machine is operated by hand. The attachment is mounted upon the needle-bar of the machine upon which it is to be used.

MACHINE FOR TURNING PIPES AND OTHER ARTICLES.—C. H. MCCREADY, Neodesha, Kan. The aim of the present invention is to provide a machine for turning pipes, screw-rods, and other articles in a simple and convenient manner and allowing compensation for the longitudinal movement of the article unscrewed or screwed up. The invention relates to a machine, as shown and described in the Letters Patent of the United States, formerly granted to Mr. McCready.

SAW-SHARPENING MACHINE. — J. M. WADDELL, Alexandria, La. This improvement pertains to machines for sharpening saws, and is especially applicable to such gangs of saws as are employed in cotton-gins and the like. The principal objects of the invention are to provide an apparatus by which each tooth will be of proper form and in which after the machine has been set the entire gang may be automatically operated upon.

FRICTION-SET.—M. B. MINER, Sampson, Ore. The object of the invention is to reduce friction incident to operation of "setting" or moving the friction-pin, especially in apparatus for setting the friction-pin of hoisting-engine drums. This is attained by an arrangement of the head and box with certain anti-friction devices and the adaptation of other friction de-

vices to coact between the actuating-screw, head, box, and pin so as to practically absorb friction between the moving parts, rendering the device more durable and easier of operation and increasing the mechanical efficiency of the hoisting-engine.

COIN-CONTROLLED VENDING DEVICE.—G. W. Meredith, Wichita, Kan. In the present patent the invention is a division of a prior application for a patent for a cigar-vending machine, which was formerly filed by Mr. Meredith; and it consists in the novel mechanical features whereby a deposited coin is made the intermediary through which one or more cigars held in the cells of a carrier-belt are discharged into range of possession by the purchaser.

CIGAR-VENDING MACHINE.—G. W. Meredith, Wichita, Kan. The invention relates to vending-machines, in which individual articles of merchandise are discharged from a stock held for sale by means of a manually-operated handle. Although applicable to sale of other merchandise in packages of nearly uniform size, it is especially intended for the sale of cigars. The machine is constructed in its entirety as a cigar-case in which cigars are arranged in their original boxes, with quality, brand, and price exposed to view for selection. It is for use in hotels, clubrooms, barber shops, and other places. Mr. Meredith has invented another cigar-vending machine in which articles of merchandise are discharged from a stock held for sale by working and manipulating an operating-handle, and although applicable for the sale of any kind of package articles of somewhat uniform size, it is especially intended for the sale of cigars. His machine provides for an extension of the function of the machine for the sale of one for five cents, two for five cents, three for five cents, one for ten cents, three for ten cents, one for a quarter, or any number for a single coin value up to one dollar.

UNIVERSAL EXCAVATING AND GRADING MACHINE.—W. Gilmore, Meridian, Miss. The principal object in this case is to provide for universal adjustment of the parts to permit working under various conditions, and especially to provide for excavating under a railroad-track without removing the track, so as to cut down grades without discontinuing the trains for any length of time and to do the work at greatly-reduced cost on account of the rapidity of the machine in handling large amounts of earth.

SAWING-MACHINE.—S. J. Gray and J. Horning, Oakland, Cal. The object of the improvement is to provide a novel machine of the endless-saw type adapted for cutting in any position—either vertically, horizontally, or at any desired angle. A further object is to provide means for cutting at any height desired, whereby trees may be cut near or far from the ground and large or small logs sawed with equal facility.

APPARATUS FOR SORTING CHIPS. — H. Powers, Lincoln, N. H. The tank or receptacle is filled with water, into which the screened-out knots and large chips are discharged and in which the knots by their greater specific gravity sink, while the lighter chips float, in combination with a series of perforated pipes arranged close to the water-level, the issue-orifices all being faced in one direction, whereby the floating chips are continuously carried away by a surface current produced by a series of impinging jets of water or air and under the influence of which the floating chips are carried over a spillway and delivered to an elevator to be carried up to the rechipper.

ELEVATOR DRIVING MECHANISM. — V. W. Mason, Providence, R. I. The invention is especially applicable in mechanism of the elevator driving class which is driven by an electric motor. It relates especially to reversing mechanism, and concerns itself also with the connection from the motor to the mechanism. The object is to provide a reversing mechanism which will operate to apply a brake automatically immediately upon the arresting of the forward motion and prior to the reversal of the motion.

MEASURING ATTACHMENT FOR PAPER-BOX MACHINES.—A. Bell, New York, N. Y. The invention refers to improvements in attachments for machines employed in placing the paper covering on the sides and ends of pasteboard boxes and covers, the object being to provide a simple means whereby the desired length of material may be accurately measured, thus resulting in a considerable saving of paper at the overlap.

CLOCK.—A. D. Gary, Lavonia, Ga. The invention comprises the combination with the clock-train having an escapement shaft and wheel, of a plate having a laterally-extending arm, a pallet for engaging the escapement-wheel mounted on the arm, a pendulum mounted to swing upon the plate, and a connection between the pallet and pendulum. The plate is provided with a bearing for engaging the escapement-shaft and a slot leading therefrom to permit removal and attachment of the plate, and a rod secured to the plate and extending therebelow to swing the plate.

BEATING-IN DEVICE FOR LOOMS.—J. K. Dalkranian, New York, N. Y. The object of this invention is to provide a device arranged to insure a proper beating in of the weft and the pile-warp-thread loops, to hold the beaten-in parts in position during the formation of the following row of pile-warp-thread loops, and to keep the pairs of ground-warp threads properly separated for the pile warp-thread needles to pass between adjacent pairs of ground-warp threads. This is a division of the application for Letters Patent of the United States for a pile-fabric loom, formerly filed by Mr. Dalkranian.

JIG OR ORE-CONCENTRATOR. — A. C. Campbell, Asheville, N. C. The device comprises an inclined riffle upon which the ore is deposited and along which it is driven by an intermittent air-blast. The dense stuff settles upon the riffles and is blown through them, while the less dense matter is carried to a dam at the lower end of the river whence it flows off through a pipe.

MOTOR-TOOL HOLDER.—C. B. Hastings, New York, N. Y. The invention pertains to motor-tools such as are adapted to be held in the hand when applied to the work. The object is to produce a holder having means for guiding the tool in a vertical plane and having a construction enabling the tool-holder to be readily adjusted, so as to change the elevation at which the tool operates.

AUTOMATIC STOP FOR HOISTS.—F. H. Kohlbraker, Nanticoke, Pa. The object here is not only to provide a throttle-valve cut-off mechanism that may be operated by the cage should it rise too high in its shaft by overwinding of the hoisting-engine drum, but to provide means whereby the valve or valves may be closed and the brake set to instantly stop the engine should any of the parts become deranged, such manual operation taking place without disturbing the automatic device, thus saving time and trouble of resetting said device, as is necessary with the construction shown in a former patent granted to Mr. Kohlbraker.

Prime Movers and Their Accessories.

BOILER-FLUE.—A. Van Walters, Galion, Ohio. The invention refers to flues or tubes as constructed in modern tubular boilers, and is especially useful in connection with steam-boilers of the locomotive or marine type. The object is to provide a boiler-tube which effects a lasting and hermetically-tight joint between the tube and the flue-sheets, which can be easily removed and replaced when worn out, and which tends to decrease the troublesome incrustation encountered in steam-boilers.

PYROMOTOR. — W. W. French, Fort Branch, Ind. In this patent the improvement refers to motors, the more particular object being to produce a motor controlled directly by heat upon the principle of the expansion and contraction of one or more metallic members. It further relates to means whereby the expansion and contraction of the metallic members or member is caused to produce an appreciable degree of motion.

EXPLOSION-ENGINE.—H. D. Dibble, Mystic, S. D. The object of the invention is to provide a gas or explosion engine arranged to utilize the motive agent to the fullest advantage and to use a small portion of the hot residue from a previous explosion to compress the same to the igniting-point with a view to ignite the incoming new charge.

Railways and Their Accessories.

AUTOMATIC AIR-BRAKE AND STEAM COUPLING.—O. E. Leib and E. B. Witte, Trenton, N. J. The principal objects of the improvement are to provide means for effectively making an air-tight joint between two air-brake-system cars when the latter are coupled together and for automatically allowing an escape of air from each car when the cars are uncoupled or when one is released from the other; furthermore, to prevent the escape of all the air from the air-brake system in an uncoupled car, only allowing enough to escape to set the brakes, and to apply the device to both freight and passenger cars.

GRAIN-DOOR.—W. S. Gilleland, Newkirk, Oklahoma. The invention comprises the combination with a car having a door-opening provided with a sill, of doors hinged to the sides of the opening, a plurality of catches on one of the doors and a plurality of rock-levers pivoted to the other. The levers have their outer ends provided with flanges for engaging the catches, the inner end of levers being extended to form a handle. A bar connects the inner end of said levers to constrain them to move in unison, one being provided with an integral lug for directly engaging the sill when the flanges are engaged with the catches. This prevents movement of the doors with respect to the sill.

CAR-UNLOADING APPARATUS.—A. Buquet and A. Crochet, Minerva, La. The invention relates to apparatus for unloading sugar-cane from cars into the feeder for cane-mills. It is an improvement upon that form of device in which a large rake is attached to and carried by a horizontally-reciprocating frame, which frame is hinged to swing vertically about a horizontal axis at one end, so as to be raised and lowered to permit the rake to operate in any horizontal plane.

CAR-FENDER.—M. Wick, New York, N. Y. The principal objects of the inventor are to provide means for automatically releasing a series of movable elements when a portion of the fender comes in contact with an obstacle so as to lift the obstacle upon a platform and hold it thereon without stopping the car or running any danger of throwing the obstacle under the wheels, provided it is approximately the size of a human body.

CAR-FENDER.—C. Hager and T. D. Finizie, New York, N. Y. In the present patent the invention is an improvement in side fenders for street-railway cars, the same being attached to and pendent from the body of a car and hanging outside of and parallel to the wheels, so as to practically inclose and prevent access to the space between the ends or platforms of the car. Messrs. Hager and Finizie have invented another improvement in the class of car-fenders which are detachably connected with the fronts or platforms of street-cars and adapted to be lowered from normal position in case of emergency.

Pertaining to Recreation.

GAME DEVICE.—R. D. Martin, Tampa, Fla. The object of the game is to completely wrap a string around a mast with the intention of making the ball strike the mast at a chosen point. The ball having a flexible connection with the mast, any impulse given to the ball will cause the string constituting such connection to wind around the mast and likewise unwind of its own accord. The purpose is to provide a portable game requiring the exercise of considerable skill.

Pertaining to Vehicles.

COOLER.—D Mc Ra Livingston, New York, N. Y. The invention is more particularly intended for the coolers of motor-vehicles propelled by explosive-engines. It consists in a cooler having lapped joints at the side edges formed by means of return-bent or inwardly projecting portions formed along the opposite edges of one plate or wall and outwardly-projecting plain portions on the two side edges of the companion plate or wall of the conduit through which the fluid to be cooled passes. In order that the hooked edge portions may be formed, slits at the angles are produced. Mr. Livingston has invented another cooler and the improvement is intended principally for embodiment in the coolers of motor-vehicles propelled by explosive-engines, and the present relates especially to that form of cooler in which conduits are so bent as to present a diamond figure, the bends of the conduits being diagonal to the vertical and horizontal.

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Inquiry No. 8214.—Wanted, information as to the manufacture of paper from the pith and other parts of the corn stalk.

Wanted.—Physical Culture Appliances. Because of my great success in the sale of appliances for the improvement of the health and strength, I have found it necessary to open another store at 1 West 42d St., New York City. I would like to hear from owners of special appliances such as vibrators, braces, or anything in that line that would pay to push.
Prof. Anthony Barker, 1164 Broadway, N. Y. City.

Inquiry No. 8215.—Wanted, manufacturers of oil burners.

Inquiry No. 8216.—Wanted, makers of invalid rolling chairs with power attached.

Inquiry No. 8217.—Wanted, the address of the manufacturers of the "Rapid" boiler tube cleaner.

Inquiry No. 8218.—Wanted, flexible cloth, air-tight, capable of holding a pressure of three inches of water; or factory which treats cloth with paraffine or other chemicals.

Inquiry No. 8219.—Wanted, the address of the manufacturer of the machines making flower pots from 5 centimeters and upward, and sewer piping 60 centimeters long and 15 to 25 centimeters in diameter.

Inquiry No. 8220.—For manufacturers of "cotton-flock" for the wall-paper printing trade.

Inquiry No. 8221.—For makers of styptic pencils in quantities.

Inquiry No. 8222.—Wanted, the address of the Crown Cap Co., manufacturers of the metal cap for bottles; also for makers of similar bottle caps.

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.

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(10036) H. M. writes: The Scientific American, of May 19, 1906, contains an answer to some queries from A. X. (9976) that is, to say the least, different from the information that is generally to be found in the Notes and Queries column. Your paper has the reputation of being a conservative scientific journal, reasonably accurate, and one that never stoops to persiflage. But this time the bounds were overstepped, with the usual result—the ridicule of the editor acted as a boomerang. In attempting to make sport of a letter from a schoolboy, he made some mistakes that are more mirth-provoking than the errors of the student. Among other things he says: "This letter claims to come from a high school, from a *scholar*, we assume." Now in the El Paso high school we are taught that the term scholar is applied only to a learned man, or one having great knowledge of literature or philology. Of course, etymologically considered the word scholar means "one who learns from a teacher," but good usage does not countenance its use with that meaning. Again he says: "A body weighs more on the top of a mountain than it does at sea level, at any time, since it is farther from the center of the earth on the mountain top." Our physics teacher taught us that the *maximum weight of a body is at the surface of the earth* (*at the sea level*). Of course, a body weighs more at the poles than it would at the equator, because in the former position it is nearer to the center of the earth. But, "if a body is removed above the sea level, as on the top of a mountain or in a balloon, the distance d between it and the center of the earth is increased and by reference to formula $Fg = \frac{MM'}{d^2}a$ we see that its *weight is diminished*" (Hoadley's "Physics," p. 62). Fair play demands, Mr. Editor, that you publish an answer to your explanation in as prominent a place as was the original article. I am going to watch with interest to see if you dare publish this letter. In conclusion, give the next boy a chance, for he will get over his carelessness, and please do not publish any more erroneous answers to questions dealing with elementary physics. A. Thank you, my lad, we are much under obligation to you for setting us right. Over forty years' experience as a professor has taught us to welcome correction, even from a high school scholar, and even on a point where the error was one of the types simply, or at most one of inadvertence. It was so evident that "more" had been printed, where "less" should have been printed, that we had not supposed even the most captious and hypercritical would waste a postage stamp in telling us the mistake, which we saw as soon as the paper came from the press. It was so plain a slip that any one would be stupid not to see it. Oh, yes, we do *dare*, we are *bold* and *bad* enough to dare to print your letter, impertinence to an older person and all, and to say that we do not believe the teachers of the El Paso high school teach their students and scholars—we hope there are scholars there—any such manners as are found in your letter. As to your limitation of the use of the word "scholar," we doubt if El Paso will be able to make this use of the word universal, especially as both Webster and the Century do not give it first place. The Standard says, "When used without qualification, the word is understood in this latter sense"—that is, "one who is thoroughly schooled, an erudite person." We agree with this usage, and wish it might become general. Our use of the word was in connection with the qualifying phrase, "from a high school," and, as we understand English authorities, was correct. Of course, one is quite at liberty to restrict the sense of a word in his own use of it as he pleases, but one has no right whatever to find fault with another as you do for using that word in any sense authorized by any good authority. In this you overstep the bounds of good taste, as among gentlemen. We note with pleasure that you bear witness to the general and "reasonable" accuracy of the Scientific American, and that it does not stoop to persiflage. Persiflage is a very fine word for a high-school scholar to use. It means literally to whistle. And most high school boys do considerable of that. We shall be glad to hear from you again at any time, but will not publish another letter from you of the sort you have sent us this time.

(10037) C. D. asks: 1. What point below the freezing point do air, hydrogen, nitrogen, oxygen, become liquid? A. These temperature points are very nearly as follows in Fahr. degrees, below zero: Air, 312; hydrogen, 422; nitrogen, 317; oxygen, 297. 2. Please give me the address of a reliable company that sells chemicals and chemical apparatus. A. You would better deal with a firm in the city near your home than to buy at a distance and pay transportation charges. Our advertising columns very often contain the advertisements of these dealers. We do not advertise dealers in the Notes and Queries column. 3. Where can I get some books on argon, helium, neon, krypton and xenon, and give me the prices of them? A. We can send you many valuable papers on the rare gases of the atmosphere which have appeared in the SUPPLEMENT. Among them are argon, Nos. 1000, 1001, 1002, and others, price ten cents each; helium, Nos. 1056, 1057, price ten cents each. 4. What kind of chemical books, as organic chemistry, etc., so I can find liquid formene? What is formene? A. Formene is a tetrachloride of carbon CCl_4. Its preparation can be found in the Dispensatory. Its properties are those of an anæsthetic, similar to those of chloroform, soothing the pain of neuralgia and even causing insensibility. As it has been the cause of death also, it is not used by physicians. It is not a substance for an amateur to meddle with. 5. What are the uses of liquid air? A. At present liquid air is not put to any commercial use.

(10038) C. J. K. asks: I beg to inquire if you can suggest anything that I can use for a reflector in place of plate glass where the size required, 10 feet x 12 feet, makes plate glass impracticable to handle? A. Glass is the best material for a reflector, since it does not tarnish with exposure to moisture and can be easily cleaned. It would not seem to be necessary to have a single piece of glass for a reflector 10 x 12 feet. The difference could not be told if there were a large number of pieces of glass set edge to edge in the frame, making a total area as great as desired. This has been done in the various solar engines which have been built. We do not think any artificial glass would answer your purpose.

(10039) J. E. N. writes: I have been a reader of your paper for many years, and several times I have noticed where you have given receipts for, and published articles on, ice-cream making. In every case you claim that to make a good ice cream it is necessary to use pure cream. Now I am telling you that you are mistaken there. There are trade secrets and trade secrets, but the following is a Simon pure one; it has never been published to my knowledge, and the ice cream is as good from every point of view as that made from pure cream. It is used by several large dealers, the whites of the eggs being used for making icing for cakes and for cake making. Well, to proceed. To every quart of unskimmed milk use one pound of granulated sugar and the yolks of five eggs and any flavor desired. Place the milk in an enameled dish, and heat slowly, stirring continually until it just comes to a boil, then skim and add the sugar and remove from the fire, stir with a wooden stick until the sugar is dissolved, have the yolks of eggs in a dish well beaten up with a few quarts of warm (not hot) milk, and now add these, stirring the milk all the time. Place the milk can in a tub with broken ice around it, and stir milk until it is cool, add your flavor, and it is ready to freeze. It costs far less than pure cream, and makes, if anything, a far nicer article.

(10040) J. T. R writes: I have a primary battery of eighteen cells; two series of nine connected in multiple, i.e., two positive and two negative wires connected. These are used to charge a secondary battery of three cells of chloride accumulator. The voltmeter indicates 6.6 volts at storage battery and 6.5 volts at terminals of primary battery. Is my primary battery large enough, and what should be the potential of the charging plant described above? A. A storage battery should have a charging current with a pressure of 2½ volts per cell. Three cells require 7½ volts. The maximum charging rate should be 6½ amperes per square foot of surface of positive plate, reckoning both sides. You probably fall short in both pressure and current.

(10041) C. J. H. asks: What is the most desirable formula for making soap bubbles? I am in doubt in regard to the amount of glycerine and soft soap to use and as to whether there were any other ingredients that could be added to advantage. A. A good soap bubble solution is not to be obtained by simply mixing soft soap and glycerine. It is very difficult to secure a good solution. Only the purest oleate of soda, or the best white soap, white Castile for example, can be used. Only the best glycerine can be used. Price's glycerine is reliable. The manipulation is tedious. If, however, you wish to undertake it, proceed as follows: Take the purest caustic soda 1 part, and dissolve in distilled water 40 to 50 parts. All parts by weight, of course. Take pure oleic acid. Set it for a few days in a refrigerator and decant the clear fluid, if a separation takes place. Of this take 7 parts, and mix with the soda solution. Shake till the reaction is complete. Now add water up to 350 parts with the previous water. To two measures of the oleate of soda add one measure of Price's glycerine. Run no risk with poor glycerine. Let this stand a few days in a cool place, and siphon off the clear solution, which is to be used for soap bubbles. Some add a little ammonia to this, but it works well as we have given it.

(10042) A. P. B. says: I wish to pump the air out of a glass fruit jar, and then seal it so well that air cannot get back in the jar for at least one year. Please tell me what pump to use and how to seal. A. A glass fruit jar is a poor style of bottle to use for this purpose. Better get a ground-glass stoppered bottle with another opening near the neck, to which a small glass tube is sealed. Coat the stopper with petroleum, and after having introduced the contents put in stopper, and seal with hot sealing wax. The air is to be drawn out through the other opening and glass tube, which is then sealed with a blowpipe and gas or alcohol flame. Any maker of scientific apparatus can furnish a small pump as well as bottle for this purpose. An ordinary mechanical air pump used in the school laboratory will give a vacuum having not over 2 ounces pressure absolute, or more than 14 pounds pressure less than the air. J. W. Queen & Co., Philadelphia, Pa., can furnish what you want.

(10043) F. H. B. writes: Please explain what metals, minerals or ores draw lightning the most. We have a piece of about 20 acres on which lightning always strikes during a thunder shower. Land slopes to the west with higher land farther east, on which lightning seldom strikes, that is, comparatively seldom. Rock near surface, sometimes cropping out, of a light gray color, looks like bastard slate, but will seldom split. Land covered with young timber, hemlock, pine, white oak, red oak, maple, and hickory. I think full 90 per cent of the hemlocks have been struck by lightning, while a large per cent of the other trees have also been struck. Out of 116 hemlocks which measured 6 inches 20 feet above the ground, 112 showed lightning marks. Near one end of the tract is a depression, at the bottom of which almost every tree has been struck by lightning. Live stock and game shun the tract, but not the land around it. The surface rock overlies a soft slate, which, judging from the dip, must be 300 feet below the surface. Near the upper edge of the slate is a spring, where, when the water is low, an oil collects, which, when collected on a woolen cloth, burns. I have never been able to collect enough to send you for a test, as it flows off with the water, and being transparent, is hard to find. Only when the spring is so low that no water runs away have I collected it on woolen cloth. A. It is a fact that some kinds of trees are struck more frequently by lightning than others. The Weather Bureau has investigated this matter and its brochure on the subject states that 54 per cent (the highest) of all trees struck are oak and one per cent (the lowest) beech. We do not think any ores or metals under the ground would *draw* the lightning any more readily than water would do it. Nor would the mineral oil seem to account for the phenomena.

(10044) M. E. P. asks: 1. I am operating a single-phase light plant with about 800 lights. My transformer and liner are nearly all overloaded. Could I raise the voltage from 1,000 to 2,000 volts and use 200-volt lamps in place of 100-volt, or would it be better to parallel the secondary coils in the transformer and still run 100-volt lamps and change the generator to 2,000 volts? A. An additional generator to relieve the overload is a more natural solution of your difficulty than to change all your lamps and transformers, since 2,000 volts is a much greater strain on the insulation everywhere than 1,000 volts is. 2. What voltage is required to make a 15-inch spark, such as is given by a static machine? A. We have not exact data at hand for the voltage required to force a spark through 15 inches of dry air under all circumstances. A paper read before the American Institute of Electrical Engineers showed that 150,000 volts were required to force a discharge between points, and that a different pressure was necessary if spheres, disks, etc., were employed. We have from time to time published valuable papers concerning the work of Prof. Trowbridge, of Harvard University, in this direction. These can be had for ten cents each. 3. Is the current or discharge from a static machine giving 15-inch spark, such as is used in X-ray work, dangerous? Will it produce death? A. A discharge through 15 inches of air is a very dangerous current to encounter. Any discharge from a coil capable of giving such a spark should be avoided. The only safe rule is not to touch the secondary while the coil is active; and if necessary to touch any part of the apparatus, to place the hand not in use behind the back. No circuit can then be made through the body from arm to arm. 4. Will the 200-volt lamp last as long as the 100-volt? A. One of the largest lamp makers says of 200-volt lamps: "Owing to the increased strain to which the carbons or filaments are subjected by the high voltage, these lamps are uncommercial except in the lower efficiencies. The efficiency of our regular product is 4 watts per candle, and in its average life and maintenance of candle power it corresponds to our standard 100 to 125-volt 3.1 watt lamp." This shows that it will cost more to run a 200-volt lamp than a 100-volt lamp for the same candle power.

(10045) T. D. asks: In a perfect compound dynamo, would the neutral points vary with the load? A. Yes.

(10046) H. E. T. asks: 1. Is there an alloy approximately as soft as lead, and as tenacious, malleable, and ductile as copper? If so, what are the properties of the alloy? A. There is no alloy known to us that is as soft as lead and as tenacious as copper. The alloys of lead and copper have no commercial value as a metal and are not in use. We do not know the properties of such alloys. 2. Is there any need (commercially speaking) now of a telephone repeater, since Dr. Pupin's invention? In other words, could a telephone repeater have any other use than to increase the distance at which speech may be transmitted? A. There is the same need that there has always been. If such an instrument can be invented, it will enable speech to be transmitted not only to greater distances, but at a much less cost than the system to which you refer.

(10047) J. M. S. writes: I have a small electric mouth lamp that when connected up with an alternating 104-volt current, by means of a rheostat, requires from 3½ to 4 volts to light it. Now what I want is to make a rheostat by covering either a piece of wood or iron with asbestos, and then placing same in a lathe and winding it with German silver wire, so as to be able to cut the 104 volts down and not burn out my lamp. Can you inform me what gage wire and how much of it will it take to accomplish the desired results? A. We cannot give exact data for a coil such as you require, since we do not know what the current is which you use. But you can proceed as follows: Take 24 B. & S. German silver wire, which has 3 feet to the ohm. Provide 375 feet, and wind into the coil as you propose. You can arrange a switch so that the current may be adjusted; that is, make a variable rheostat; or you can by testing find what amount will be needed to have the light burn properly. You are probably aware that the more economical way is to have a small transformer for your lamps. Such lamps can be run with a battery also.

(10048) M. McC. writes: A positive remedy for carbon brushes sparking is to soak the brushes for twenty-four hours in ordinary machine oil. Complaints I have read in columns of the SCIENTIFIC AMERICAN prompts the above and should be generally known. I had the same trouble and it occurred to me to try above remedy, and I find it does avoid sparking positively. A. We are not able to indorse this as a sovereign remedy for all diseases of dynamos which show themselves by the symptom called sparking. Machine oil can only act as a lubricator, and sparking may be due to a cause deeper than the surface of the armature.

(10049) F. H. asks: Will you please tell me what kind of metal to use on contact points on a gasoline engine electric igniter, and where to purchase the same? A. Always use platinum at the contact points for breaking a circuit where there will be a strong spark. Any dealer in gasoline engines who advertises in our columns can furnish the article. So also can dealers in electric materials.

(10050) A. S. asks: 1. Would ten cells be sufficient to run a six-candle lamp (10 volts, 1.5 amperes)? If not, how many would be required? A. No. Your lamp requires 1.5 amperes. This battery furnishes 30-1000 of an ampere, or about one-fiftieth as much current as is needed for the lamp. 3. How shall I prepare the pastes used in the upper and lower spirals? A. This battery is useful for testing purposes only, as the description states. The paste is prepared by mixing the solid minium or litharge into a paste with dilute sulphuric acid. This is the method in all storage batteries using such pastes. 3. What is used as the electrolyte, and how is it made? A. Dilute sulphuric acid. You will have to buy the acid. You cannot very well make it. 4. Where could I get the battery charged? A. Charge the battery with a primary battery. A gravity battery is as good as any for the purpose.

(10051) N. D. writes: In your issue of April 13 you mention sulphides of barium and calcium, and state "when properly prepared." Are there any special directions for preparation, and how? A. To prepare a phosphorescent calcium sulphide, calcine clean oyster shells in order to burn out all but the calcium carbonate. Then reduce the shells to a fine powder by pounding or grinding. Place this powder in layers in a crucible with flowers of sulphur. Cover the crucible to shut out the air, and heat to dull redness for half an hour. Let the whole cool while still covered, and transfer the calcium sulphide formed to a glass bottle, which cork tight to prevent the accession of moisture. Barium sulphide should be formed from witherite and sulphur by heating in a crucible in the same manner.

(10052) W. M. R. writes: I made some little time back the eight-light dynamo described in your valuable paper, designed by Hopkins some twelve years ago or so. Having studied electricity at University College, London, I made some alterations in the design of armature which I think have made material improvement in dynamo. The alterations were these: Instead of using washers as suggested, I cut washers out of 20-gage charcoal iron, using varnish for insulation. These I fastened on to the armature by thick-end washers engaging a screw on armature shaft. After getting all firmly screwed up, I put into lathe and slotted out 24 grooves the breadth of 4 wires and 8 wires deep, and in these I wound the wires very carefully. By this arrangement I was enabled to run the armature with iron 1-16 inch distant from cheeks of field magnet. I turned the field magnet upside down, with yokes firmly bolted to base plate, from which rose two pedestals (hollow) forming bearings for the ends of armature. I arranged the bearings with an endless chain dipping six inches into oil chamber, with the result that I can light up 50-volt lamps to full brilliancy at a speed of 1,660, instead of 2,200, the speed mentioned in your article. I have had the machine lighting up my house, driven by a Pelton wheel, for several months, and the bearings have not an atom of shake and have only been filled up with oil once, as it circulates and runs back again. I thought possibly some of your readers would like to hear of my results. I would advise anyone attempting to make the machine to get the segments for commutator cast separate. I tried both ways and found the latter preferable. I made the commutator much larger than the design. A. Of course, the iron-clad armature is an improvement over the old form of a dozen years ago. The results of the alterations are very satisfactory.

(10053) J. M. S. asks: 1. What size German silver wire and how long a piece should I use to wind a rheostat to reduce an alternating current 7,200 amperes, 104 volts, down to 2 volts? Also size and amount of iron wire for above results? A. The use of a choke coil is not the most economical way to reduce from 104 volts to 2. A simple mode of getting the result would be to put a wire in series with an incandescent lamp, and take a shunt from the wire at two points which have a resistance between them equal to about one-fiftieth of the resistance of the lamp. The best way, however, is to obtain a transformer from the company supplying the current, which will give you this rate of transformation. If your current should happen to be transformed from 2,000 volts to 104 a second transformer like the first would carry it down to about 5 volts, which perhaps is near enough to your limit for your use. 2. How shall I proceed to construct an appliance for heating say a glass of water, using same current, amount, size and kind of wire? A. This you can do by means of a small coil of wire in series with a lamp. An arc lamp would give a quicker result. With an arc lamp use 12 or 14 B. & S. German silver wire. With an incandescent lamp use 18 or 20 wire.

(10054) B. P. asks: Will you kindly furnish me with information regarding liquid air, its process of manufacture, cost, properties, etc., and what developments have been made regarding its uses and its dangers? A. We can send you ten good articles upon liquid air at ten cents each, or else the book upon the subject by Sloane, for $2.50 by mail. Liquid air has no commercial uses at present, and there are no dangers from it, if handled by one having knowledge of the usual properties of gases.

(10055) C. M. L.—The principal source of graphite in the United States is the mines at Ticonderoga, N. Y., which furnish about 200 tons per annum. It is also mined near Raleigh, N. C., and in Virginia, Georgia, New Hampshire, Rhode Island, and California; also in Nova Scotia. The best graphite comes from Colombo, Ceylon, and costs from 2 to 4 cents per pound, according to quality. Prices depend much upon the regularity of the supply.

(10056) W. E. asks: Will you tell me how the voltage and internal resistance of a Bunsen cell can be calculated mathematically, or refer me to a good book on the subject? A. The voltage and internal resistance of a battery are not calculated by mathematics. They are measured by instruments. The processes employed are to be found in Kempe's "Handbook of Electrical Testing," price $7.50. This work is complete. A special book upon batteries is Carhart's "Primary Batteries," price $1.50, both prices by mail.

(10057) X. writes: I wish to obtain some information which would be very acceptable to me, and in fact to a great many at this time, when the question of using gasoline engines on automobiles of different kinds is very popular; and that is, the dimensions and drawings, if possible, of a jump spark or induction coil that would be oblong in shape, without vibrator, light as possible, and to work on low voltage giving a one-quarter inch spark. A. The details for making an induction coil to give a spark one-quarter inch in length can be found in Bonney's "Induction Coils," price $1 by mail. You can omit the vibrator and arrange the break in the combustion chamber or cylinder without special instructions. The shape may also be changed to adapt it to the space allotted to it. The important thing is the insulation and the windings. All else is secondary. Only a low voltage can be used upon so small a coil.

(10058) F. P. asks: 1. Is the efficiency of an electric motor affected if the body frame of the automobile is iron, or if motor is clad with wrought iron or other metal instead of cast iron? A. The efficiency of an

The Index of Patented Inventions, Registered Trade Marks, Designs, Labels and Prints which usually appears on this page is this week omitted, the United States Patent Office being unable to supply it in time because of new arrangements which it is about to make for the printing of the Official Gazette. The index will be published in next week's issue.

electric motor is not affected by the material of the frame of the carriage to which it is attached. Nor does it make any difference to the motor by what metal it is inclosed. The reason for using ironclad motors on street cars is chiefly to prevent the escape of magnetic lines into the space around the motor. No metal but iron can do this, and cast iron is cheaper than wrought iron. 2. Will wrought iron field magnets, instead of cast iron, in SUPPLEMENT 1195, double the efficiency of the motors? If not, what winding will do it? A. Wrought iron will transmit about twice as many lines of force as cast iron; hence a saturated magnet core of wrought iron will give twice the effect of one of cast iron. 3. If pinion wheel is placed on top of gear wheel, is it as efficient as if placed on the side? A. The position of the driving gear does not affect the amount of power it transmits. 4. If not too small, how should motors in SUPPLEMENT 1195 be wound so as to act as dynamos also? A. The winding of a motor does not need to be changed to make it generate as a dynamo. 5. Is there any special danger on an electric automobile, whether still or moving, in a thunderstorm? A. An electric automobile is not exposed to any more danger in a thunder-storm than any other. We do not recall ever hearing of any person being struck by lightning upon a railway train. 6. In the inclosed sketch, if *U* is a one-horse-power motor, with 3-inch pinion meshing into 30-inch gearwheel, connected to 18-inch rod, *J H*, and this joined to 6-foot lever *H F*, working on fulcrum *G*, five feet from power end, what horse-power will be obtained at *A* on the bent axle, *D C A B E*, which is connected to lever, *H F*, by 18-inch rod, *A F*? A. With the arrangement you describe you will have at the end of the train of wheels and levers one horse-power less whatever has been lost in friction at the several bearings. No one can calculate this. It must be found by experiment, and will depend upon the condition of the machine. A horse-power is 33,000 foot-pounds of work done in a minute. It is not affected by the speed of motion nor by the weight lifted. If the speed is great a less weight will be lifted by a horse-power; and if the weight is great, the less will be the speed. Your arrangement reduces speed and increases pressure, or weight lifted, but the amount of power remains the same. The 30-inch gear moves one-tenth as fast as the gear which drives it, and the end, *F*, of the lever moves one-fifth as fast as the end, *H*. Hence *F* moves one-fiftieth as fast as the small gear on the motor.

(10059) J. F. C. asks: What is the fraction of power lost in the current produced by a generator which runs a motor, the connecting wires being not longer than 10 yards? That is, what is the relative power of motor and generator? Both are the same size. What size of a booster would be required to have both equal? A. A motor only thirty feet from the dynamo which furnishes the current for running it has little or no drop of potential from that of the dynamo, and needs no booster. The only loss is due to the heating of the coils by the current.

(10060) F. S. L. writes: I would like to know how to make a sparker or a spark coil, and in what way it differs from an induction coil. I want to make a spark coil to use to ignite an acetylene gas jet. A. Spark coils are made about ten inches long. The center is a core of iron wire as in an induction coil. It may be ⅞ inch in diameter. Insulate the core by wrapping it with paper which may be soaked in paraffine. Fit heads upon the ends of the core to hold the winding and wind four to six layers of about No. 12 B. & S. double cotton-covered wire upon the core. Insulate the layers with paper. This coil is put in series with a battery, and upon breaking the circuit a spark is produced at the break which lights the gas. There is no secondary coil. In this is the difference between a spark and an induction coil.

NEW BOOKS, ETC.

PRACTICAL PAINTERS' WORK. Edited by Paul N. Hasluck. Philadelphia: David McKay, 1906. 8vo.; pp. 160. Price, $1.

The reader will find that this book contains a fairly comprehensive digest of information which will be of considerable value to the painter and the workman in allied arts. It is based upon a series of contributions by experienced craftsmen to the various publications and supplies many valuable hints on the general principles and processes of the art of which it treats.

MODERN POLYPHASE MACHINERY. By Andrew Stewart, A.M.I.E.E. London: S. Rentell & Co., Ltd., 1906. 12mo.; pp. 296. Price, $2.

The use of the alternating current is daily becoming a factor of greater importance in the general subject of electricity. Mr. Stewart's book on polyphase machinery, dealing exclusively with the principles, design and construction of modern mechanism of this character, will doubtless be found of assistance by the electrical engineer. Mathematical methods of investigation and explanation have been largely dispensed with and, although this may appear to be *contra* to general practice in writings of this class, it will be found that the discussion has been considerably simplified by this method without, however, materially limiting the information which the author gives about the chief characteristics of such machinery. The book is hardly intended for the use of students, but was written for the practising engineer.

GLASS WRITING, EMBOSSING AND FASCIA WORK. Edited by Paul N. Hasluck. Philadelphia: David McKay, 1906. 32mo.; pp. 160. Price, 50 cents.

The information detailed in this handy little volume is edited by a writer who has contributed largely to the literature of practical handicrafts and it is in the convenient form of a comprehensive series of short articles. It will be found of value for the artisan engaged in work of this character, as well as for the practical man in general.

NOTES ON ELECTROCHEMISTRY. By F. G. Wiechmann, Ph.D. New York: McGraw Publishing Company, 1906. 12mo.; pp. 145. Price, $2.

The latest contribution to the literature of electrical chemistry—to-day a subject which is rapidly coming to occupy a place as one of the most important practical arts—is this book by Dr. Wiechmann. While the compass of the work is limited, it gives an excellent general summary of the present state of the art. The subject is treated in a practical manner without the elaboration of abstruse theories. Unfortunately no descriptions of the actual apparatus used are given, the author contenting himself with elaboration of the principles underlying the process.

ELECTRIC WIRING, DIAGRAMS, AND SWITCHBOARDS. By Newton Harrison, E.E. New York: The Norman W. Henley Publishing Company, 1906. 12mo.; pp. 272. Price, $1.50.

This excellent little book was written especially for the electrical artisan, the object being to give a practical treatise on electric wiring, the construction of switchboards, and other related subjects. Not only is the subject of building wiring discussed, but brief explanations of the principles of transmission and the types of electrical machinery employed are added to the text. The discussions are usually concise, though, unfortunately, the text contains a number of mistakes which it is hoped a second edition will correct.

PRACTICAL PATTERN MAKING. By F. W. Barrows. New York: Norman W. Henley Publishing Company, 1906. 12mo.; pp. 326. Price, $2.

The author is thoroughly conversant with his subject. While the literature of pattern making is voluminous, still there always seems to be ample room for an acceptable work. The work describes in lucid language the principles which underlie pattern making, as well as the more practical side. It is very well illustrated.

BOSSISM AND MONOPOLY. By Thomas Carl Spelling. New York: D. Appleton & Co., 1906. 16mo.; pp. 358. Price, $1.50.

The author states that: "The purpose of this book is not to humiliate Americans by pointing out their lack of public spirit and need for a moral awakening in all that pertains to government, but is rather to state boldly and without an attempt at concealment true conditions as the author sees them. It is better to know the worst and to apply the remedy than to go straight to destruction under a delusion." The author's Preface is dated November, 1905. Since that date there has been much "muckraking," productive of great good. The work is a valuable one dealing with important economic questions.

TRANSMISSION OF HEAT THROUGH COLD STORAGE INSTITUTION. By Charles F. Paulding, M.E. New York: D. Van Nostrand Company, 1905. 18mo.; pp. 41. Price, $1.

A special book on a special subject. The literature of ice making and refrigeration is quite extensive already, but there always seems to be a field for a book which deals with one corner of a large industry. The refrigerating engineer will find this book invaluable.

PRACTICAL HANDRAILING. Edited by Paul N. Hasluck. Philadelphia: David McKay, 1905. 18mo.; pp. 160. Price, $1.

The art and craft of handrailing is justly considered the highest branch of carpentry. The present work begins at the very foundation of the subject, and works through the more difficult problems until the most complicated handrails are reached. The practice is English, but it will prove of value to the American artisan.

PHYSICAL OPTICS. By Robert W. Wood. New York: The Macmillan Company, 1905. 8vo.; pp. 546. Price, $3.50.

An advanced text-book for students who wish to obtain a special knowledge of a very important branch of physics. The author is

a well-known authority on the subject. The author takes up in turn: "The Nature of Light," "Reflection of Light," "Refraction of Light," "Dispersion," "Diffraction," "Double Refraction," "Circular and Elliptical Polarization," "Absorption of Light," "Optical Properties of Metals," "Rotatory Polarization," "Magneto Optics," "Fluorescence and Phosphorescence," "Laws of Radiation," "Nature of White Light," and "Relative Motion of Ether and Matter." The book shows great erudition and a wonderful grasp of the subject.

PRACTICAL BRICKWORK. Edited by Paul N. Hasluck. Philadelphia: David McKay, 1906. 18mo.; pp. 160. Price, $1.

English practice is described. The book can be read with profit by all those who are engaged in or are interested in masonry. The work is well illustrated.

REFERENCE BOOK FOR STATICAL CALCULATIONS. By Francis Ruff. New York: Spon & Chamberlain, 1905. 16mo.; pp. 136.

This work gives force diagrams for frameworks, instructions for statical calculations, etc., for all classes of engineering work. With its aid practical men can carry out any desired statical calculation with ease and rapidity. It is filled with illustrations and tables.

NEW METHODS OF TESTING EXPLOSIVES. By C. E. Bichel. Translated and Edited by Axel Larsen, M.I.M.E. London: Charles Griffin & Co., Ltd., Philadelphia, 1905. 8vo.; pp. 62. Price, $2.

The literature on the subject is limited, owing to the fact that until fifteen years ago black powder and dynamite were almost the only explosives used in practical mining. New explosives require new research to test their safety and practical efficiency. The author has produced a most practical book for the mine engineer.

EXPERIMENTAL RESEARCHES ON THE CONSTITUTION OF HYDRAULIC MORTARS. By Henri le Chatelier. Translated by J. L. Mack. New York: McGraw Publishing Company, 1905. 16mo.; pp. 132. Price, $7.

The author started his researches many years ago, and his thesis on the subject was the starting point of the studies of a number of writers. This classic is the most complete and beautiful piece of work done upon the chemistry of Portland cement. The translator has changed some of the chemical formulæ.

EDUCATIONAL WOODWORK. By A. C. Horth. New York: Spon & Chamberlain, 1905. 18mo.; pp. 159. Price, $1.

Of books on manual training there are no end, but there always seems to be a field for another work. The author has succeeded in illustrating his book with a number of very helpful photographs, showing the proper position of the hands. Manual training has certain elements in common, whether the instruction is given in England or the United States. Therefore, the book is not rendered useless by the difference in practice. The exercises are carefully chosen and are well illustrated.

MANNHEIM AND MULTIPLEX SLIDE RULES. By L. W. Rosenthal, E.E., A.A.I.E.E. Chicago: Eugene Dietzgen Company, 1905. 18mo.; pp. 59.

Slide rules are coming more and more into use among draftsmen, and the pamphlet before us describes two excellent slide rules.

INJECTORS: THEIR THEORY, CONSTRUCTION, AND WORKING. By W. W. F. Pullen. New York: D. Van Nostrand Company, 1906. 12mo.; pp. 208. Price, $1.50.

The third edition of this excellent book needs little recommendation, as it has been before the engineering public for over a dozen years. The injector is described and illustrated in practice and theory, and its possible advantages and failings are discussed clearly and concisely. The author develops theoretical calculations on the subject of water injection to a limited extent, but not to such a degree that the book will prove of no value to the non-technical man.

MECHANICS FOR ENGINEERS. By Arthur Morley. New York: Longmans, Green & Co., 1905. 12mo.; pp. 282. Price, $1.20.

Engineering students require a thorough knowledge of the principles of mechanics in a far more general manner than the students of the usual scientific courses. The present volume has been written for the use of engineering students, and with this object in view the gravitational system of units has been adopted in English measures. Graphical vector methods for the solution of problems have been inserted in certain of the chapters, and while such exercises often take up more time than the easy arithmetical ones, their solution will undoubtedly be found excellent practice by the student in leading up to more difficult problems. Calculus has not been used, although the author advises that the student should not try to avoid it.

WATER SOFTENING AND TREATMENT. By William H. Booth. New York: D. Van Nostrand Company, 1906. 8vo.; pp. 308. Price, $2.50.

There are very few problems concerning steam generation which are of greater im-

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portance than that concerning the treatment of water for boiler and manufacturing purposes. No steam user who thoroughly understands the magnitude of this question will neglect to institute at least an attempt to reduce the amount of hard scale deposited in the boiler or, for instance, in fabrics. The question of water softening has been treated at great length in numberless publications and books. The present volume is one of the latest contributions to the literature of the subject, and will doubtless prove of value to the practical man as well as the expert. The author has supplemented his own experiences by drawing information from many sources, such as manufacturing plant managements, consulting experts, and technical institutions. The book is well illustrated.

KURZES REPETITORIUM DER ORGANISCHEN CHEMIE. Von Dr. Kurt Dammann. Freiburg im Breisgau: Herdersche Verlagshandlung, 1906. 14mo.; pp. 256. Price, $1.25.

Dr. Dammann's excellent work is in nowise intended for a textbook, but is designed to be used in connection with the regular course of instruction in organic chemistry. The work is exceedingly thorough, and includes the very latest phases of the science on which it treats. It will be found of great value in instances where time is lacking for extended investigations of standard text or reference books, and the student will find it splendid for purposes of review. The arrangement into divisions and subdivisions with a great number of formulas is good.

SCIENCE AND THE MANUFACTURER. By Keith Quinton. London: Guilbert Pitman, 1906. 14mo.; pp. 86. Price, 80 cents.

The close relation and intimate association of science and industry to-day is so universally admitted, that the statement of the fact needs little proof. In "Science and the Manufacturer" is given an interesting account in a brief manner of how science is necessary in certain industries, and in fact, how to-day it is indispensable for the proper development of manufacturing or other work. The book is interestingly illustrated from photographs, and while rather limited in scope, will undoubtedly be found interesting by the reader.

OCEAN AND INLAND TRANSPORTATION. By Emory R. Johnson, Ph.D. New York: D. Appleton & Co., 1906. 12mo.; pp. 395. Price, $1.50.

The reader will find this discussion an interesting treatise on the economics of transportation by water and an excellent complement to "American Railway Transportation," by the same author. The book is based largely on information secured from government and other official sources, as well as from private individuals in commercial and transportation enterprises. As the volume of water transportation is greatly in excess of the inland water commerce, about four-fifths of the book is taken up with a discussion of the former. The historic development of the various lines of transportation and communication, as well as the growth of the commerce between the various countries, is interestingly discussed.

ENGINEERING MATHEMATICS SIMPLY EXPLAINED. By H. H. Harrison. London: Percival Marshall & Co., 1906. 12mo.; pp. 165. Price, 75 cents.

This book is designed for the use of the young engineer apprentice who is beginning the study of mathematics, or for the artisan whose knowledge of the subject is limited. It is intended to take the place of the orthodox textbooks, which are usually crammed with academic exercises which are difficult of comprehension, and merely tend to give the student a certain amount of dexterity in the manipulation of symbols, while a clear comprehension of the principles is seldom imparted thereby. The instruction given by the author in this book has at least one excellent quality—it accustoms the student to think for himself.

TURNING FOR BEGINNERS. By J. Lukin, B.A. London: Guilbert Pitman, 1906. 16mo.; pp. 128. Price, 60 cents.

During the author's long life he has given to the world a number of books on amateur mechanics. This book will undoubtedly prove of interest to any amateur, although the practice and designs are English.

AN INTRODUCTION TO THE STUDY OF COLOR PHENOMENA. By Joseph W. Lovibond. New York: Spon & Chamberlain, 1905. 8vo.; pp. 48. Price, $2.

The theory is illustrated by a series of geometrical figures, bringing the salient points into one harmonious whole, and has been awarded the silver medal by the International Jury of Awards of the St. Louis Exposition. The new system of color nomenclature need not, of course, displace any arbitrary or popular color terms, but may be used to define the limits within which such terms may be permissible. Our color nomenclature certainly needs reformation.

THE BATTLES OF LABOR. By Carroll D. Wright, Ph.D., LL.D. Philadelphia: George W. Jacobs & Co., 1906. 12mo.; pp. 220.

This very interesting volume is based upon four lectures, each of which is well worth reading. The last of the four, however, is of special value, as therein the author expounds his personal views and opinions based on long

HOW TO MAKE AN ELECTRICAL Furnace for Amateur's Use.—The utilization of 110 volt electric circuits for small furnace work. By N. Monroe Hopkins. This valuable article is accompanied by detailed working drawings on a large scale, and the furnace can be made by any amateur who is versed in the use of tools. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1182. Price 10 cents. For sale by MUNN & Co., 361 Broadway, New York City, or by any bookseller or newsdealer.

and intimate acquaintance with the labor problems of the country. The labor troubles, defeats, and victories of ancient times are interestingly recounted in the first and second of these lectures. The third reviews great modern labor battles, beginning about 1877 with the B. & O. and Pennsylvania strikes, and including the anthracite strikes of 1900 and 1902.

METALLURGICAL CALCULATIONS. By Joseph W. Richards, A.C., Ph.D. Part I. New York: McGraw Publishing Company, 1906. 8vo.; pp. 208. Price, $2.

Prof. Richards' book forms one of the most important steps in the application of science to metallurgy. It is a reprint of the serial running in "Electrochemical and Metallurgical Industries," which, however, has been largely elaborated and brought up to date. A serial which is now appearing will be published as Part II. and a later serial as Part III., thus completing the work. The treatment of the subject is logical and clear, though, unfortunately, the book is lacking in reference to other literature on the subject.

STEAM TURBINE ENGINEERING. By T. Stevens and H. M. Hobart. New York: The Macmillan Company, 1906. 8vo.; pp. 814; 516 illustrations. Price, $6.50.

Messrs. Stevens and Hobart's book is undoubtedly the outcome of a vast amount of patient and extensive research and investigation. It contains a remarkable collection of data with reference to steam turbines gathered from all sources in Europe and America. A large part of this information, in addition to being tabulated, has been plotted in curves. Besides the extraordinarily complete collection of statistics given, the authors have also provided many illustrations showing the destructive characteristics of the different leading types of turbines. The whole is elaborated by clearly-written and comprehensive text.

A SCHEME FOR THE PROMOTION OF SCIENTIFIC RESEARCH. By Walter B. Priest. London: Stevens & Sons, Ltd., 1905. 8vo.; pp. 62.

It is the object of the author to submit for consideration proposed legislative provisions, incorporating means whereby incentives means to scientific research may be made operative by the agency of law in those directions wherein the prosecution of such research may lead to results of general utility. The plan is quite an elaborate one.

MODERN LOCOMOTIVE ENGINEERING WITH QUESTIONS AND ANSWERS. By Calvin F. Swingle, M.E. Chicago: Frederick J. Drake & Co., 1905. 16mo.; pp. 630. Price, $3.

This handsomely gotten-up pocket-book is a plain, practical treatise on the construction, care, and management of modern locomotives. Boiler construction as applied to locomotives is dealt with in detail. All the leading types of valves and valve gear are fully described. Valve setting is illustrated in all its details. An entire chapter is devoted to the study of the indicator and its application to the locomotive. Compound locomotives receive special attention. Locomotive equipments, including electric headlights and mechanical stokers, are not forgotten. Particular attention is given to the important subject of breakdowns and what to do in case of emergency. The air brake is fully described. The book is admirably illustrated, and is a distinct contribution to the subject.

PRACTICAL GILDING, BRONZING, AND LACQUERING. By Frederick Scott-Mitchell. London: The Trade Papers Publishing Company, Ltd., 1905. 12mo.; pp. 175.

While there is a number of works in which the subject of gilding, bronzing, and lacquering is treated, there has up to the present time been no convenient and concise book treating this branch of the decorative art exclusively. The book here discussed is largely based on writings in various publications, and is excellently edited by an expert on the subject, Frederick Scott-Mitchell, who has been associated with the painting and decorating trades for over a quarter of a century.

THE PHANTOM OF THE POLES. By William Reed. New York: Walter S. Rockey Company, 1906. 12mo.; pp. 283. Price, $1.50.

NAVAL POCKETBOOK. Founded by Sir W. Laird Clowes. Edited by Geoffrey S. Laird Clowes. London: W. Thacker & Co., 1907. Pocket edition. Pp. 965. Price, $3.

LES TREMBLEMENTS DE TERRE. Leur Origine Electrique Possible. Les Tremblements de Terre au Pérou. Par Emile Guarini. Paris: H. Dunod et E. Pinat, 1906. Pp. 26. Price, 50 cents.

POOR'S RAILROAD MANUAL APPENDIX AND DIARY. Special Edition, 1906. 12mo.; pp. 284.

THE INFINITY OF THE STARRY UNIVERSE. By John Lowry Adams. Sydney: Turner & Henderson, 1906. 8vo.; pp. 39, 4 plates, 2 diagrams.

THE MILKY WAY. The Solution of the Problem of the Milky Way, Showing it to be a Special Shadow Effect. By John Lowry Adams. Sydney: Turner & Henderson, 1906. 8vo.; pp. 44, 12 figures.