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AMERICAN INDUSTRIES.—No. 7.

THE MANUFACTURE OF HORSESHOE NAILS.

The manufacture of horseshoe nails by machinery is not new, but during the past few years so many improvements have been made, and so much ingenuity shown in perfecting the machinery used, that the illustration of the largest nail manufacturing establishment in this country must prove of interest to our readers. Every one is familiar with the musical ringing of the anvil of the village smith as he rounds up his time to the full by skillfully drawing horseshoe nails from rods of tough iron; and many of us have seen the nail maker, who tramped from shop to shop, making at each stop a quantity of nails; but now "his occupation is gone." Machinery, more nimble and accurate than he, turns out by the million nails that are better finished, more uniform, and of better quality than the article made by hand.

The first nail machine we can find record of was one patented in 1606, by Sir Davis Blumer, in England, and twelve years later an improvement was patented by one Clement Danbury, but neither of these machines ever seems to have been put to a practical test.

Cut nails were first made in this country by Jeremiah Wilkinson, of Cumberland, R. I., in 1775, who built a rough machine with which he cut tacks from sheet metal, and later he so improved his machine as to enable him to make nails and spikes in a similar manner, finishing the heads in a vise.

A Mr. Perkins took out letters patent in this country in 1795, for a machine which it was said had a capacity of turning out 200,000 nails a day. This machine eventually found its way to England, where it created great excitement, especially among the manufacturers of hand-made nails.

The Perkins machine was the first one put in practical use, and did its work well in a small way; but what would Mr. Perkins say if he could enter a large manufactory like the Globe Nail Company's works, and witness the turning out of ten tons of finished nails a day, as this concern does?

We have chosen as the subject of our industrial illustration this week the manufactory of the Globe Nail Works, of Boston, Mass., whose extensive establishments are devoted entirely to the manufacture of horseshoe nails.

The works, which are situated at Boston Highlands, Mass., include a large main building, an extensive ell in which the several steps of nail making are carried on, a rolling mill—a model of its kind—in which the iron is prepared for the punching presses, and a machine shop, where all the rolls are made and where the repairs are carried on. The buildings are divided by brick partitions and passage ways, which almost completely isolate one department from

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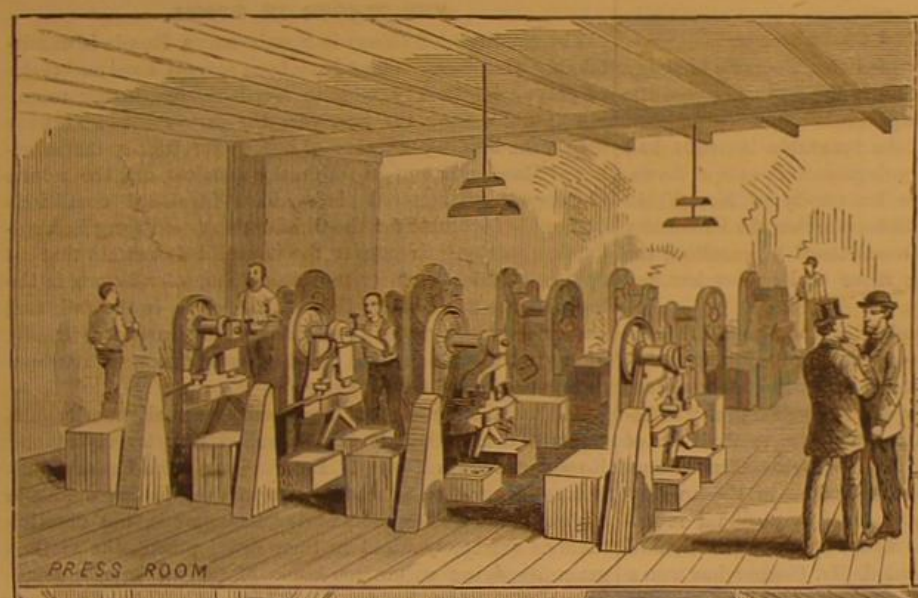

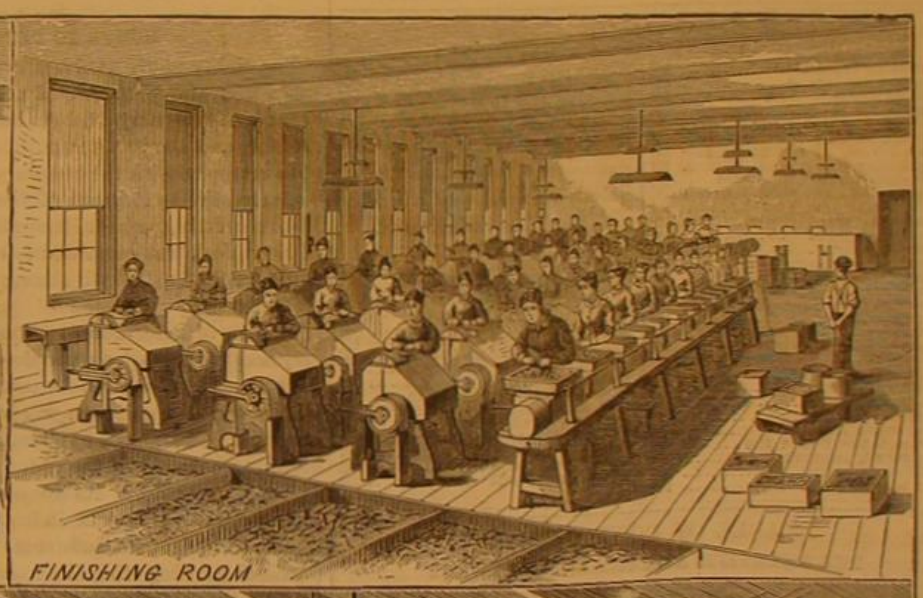

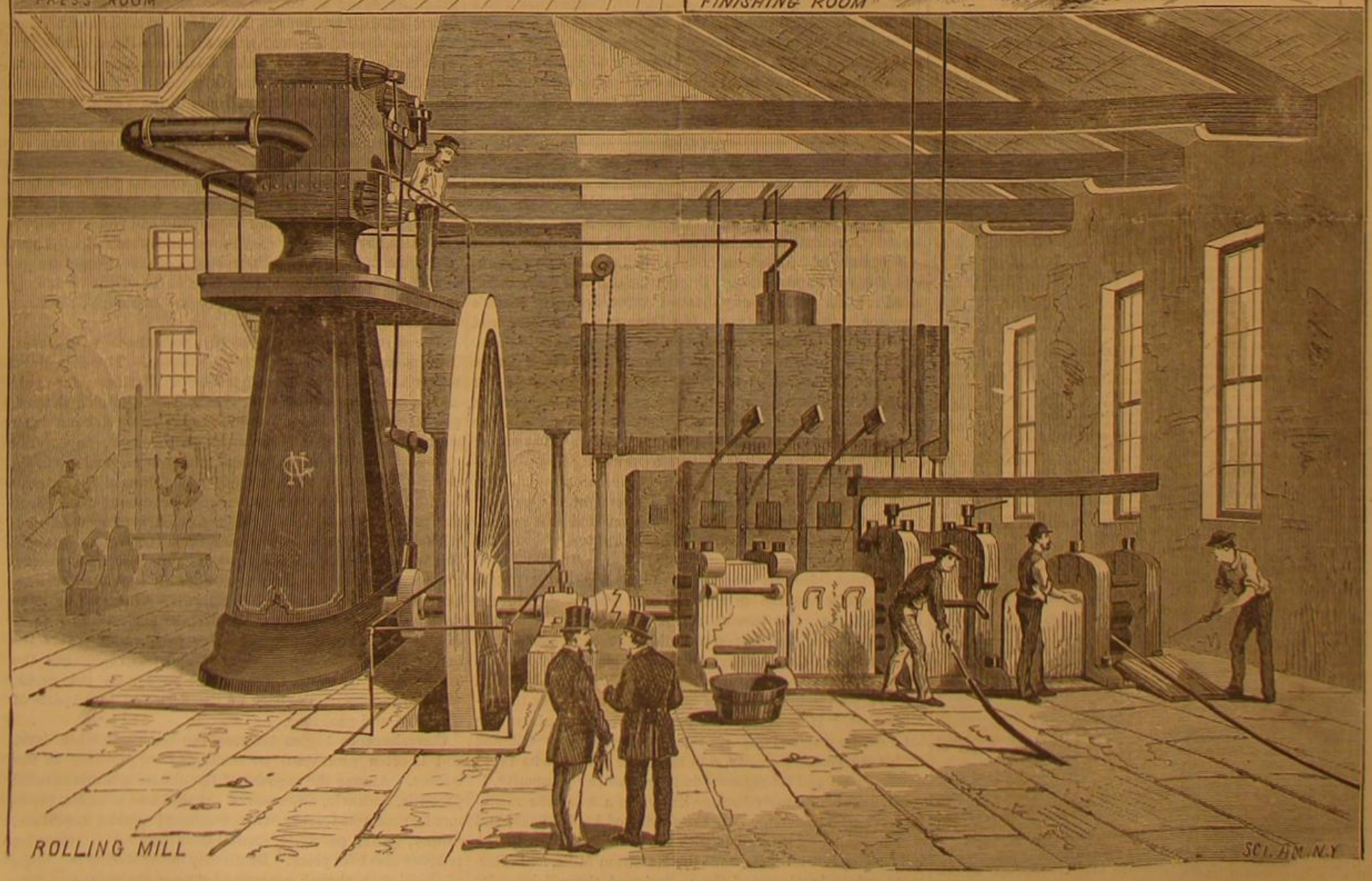

THE MANUFACTURE OF HORSESHOE NAILS.

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VOL. XL., No. 9. [NEW SERIES.] *Thirty-fourth Year.*

NEW YORK, SATURDAY, MARCH 1, 1879.

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II. ON THE MINUTE MEASUREMENTS OF MODERN SCIENCE.—By ALFRED M. MAYER. No XVII. On the Application of Rotating Mirrors to the Measurements of Minute Lengths, Angles, and Times. On Wheatstone's Experiments to Measure the Velocity of Electricity and the Duration of the Electric Discharge. With ten figures. On the Determination of the Velocity of Electricity through Conducting Bodies. The above is a most interesting and valuable paper.
On Atwood's Machine. A communication from POWHATAN CLARKE, M. D., Professor of Natural Sciences, Baltimore City College.

III. CHEMISTRY AND METALLURGY.—Notes on the Microscopical Examination of Iron. From a Report to the Society of German Engineers. By A. MARTENS. With 11 figures.—An important and valuable paper, showing the ease and certainty whereby, by the use of the microscope, the comparative value of iron, of different kinds or specimens, may be accurately determined. The paper is accompanied by drawings showing the form and appearance of the crystals of iron, of graphite as it appears in the cells and cavities of iron, the appearances of good and bad iron, rough and polished tin, etc.
Meeting of the New York Academy of Sciences. A paper by Dr. HENRY WURTZ on some new and interesting minerals discovered by him in the Silver Islet Mine. Huntilite and animikite, with their chemical compositions.
Spongy Iron Filters and Silicated Carbon Filters. A series of comparative experiments therewith, with a valuable table of results. By G. W. WIGNER, F.C.S.
The Artificial Syntheses of Organic Compounds. By JOHN M. STILLMAN, of the University of California. Showing the chemical processes and formulæ for the artificial production of Formic Acid; Alcohol; Glycerin; Oil of Bitter Almonds; Oil of Cinnamon; Wintergreen Oil; Carbolic Acid; Indigo Blue.
Preservative Gases for preserving Meats and Other Foods. How produced. By Dr. B. W. RICHARDSON.

IV. NATURAL HISTORY, GEOLOGY, ETC.—The Heat of the Comstock Mines. By Prof. JOHN A. CHURCH, E.M. A very interesting paper, containing details of the temperatures of the rocks of the Comstock Mines at the different depths, the heat of the waters therein, the probable sources of the heat, the rate of transmission of heat through the rocks, with appliances for cooling and ventilation.—Origin of the Metallic Iron of Greenland.—The Florida Alligator.

V. AGRICULTURE, HORTICULTURE, ETC.—The Latest Advances in Fruit Culture. From the Proceedings of the Western New York Horticultural Society. Apples, and how to dry them in a fine white condition. The latest new fruits. Peach growing, training, thinning and cutting back. The secret of success in peach growing. The peach and apple tree borers and their remedy. Grapes; how to cure mildew. The codling moth. Strawberries; new varieties, etc. Best plums.—Sowing Seeds.—Indian Nut Parties in Nevada.
The War with Insects. By Dr. JABEZ FISHER.

VI. MISCELLANEOUS.—Chicago claims the next International Exhibition.—A Co-operative Manufacturing City.—Postal Items.—Fisheries on the Canary Islands.—New Discoveries at Ancient Troy.—Ancient Glazed Pottery.—The Dignity of Labor.

STRIKES IN LIVERPOOL AND LONDON.

The strike in Liverpool now (February 13) includes not only the sailors and dock hands, but laborers generally, carters, and carpenters. The entire trade of the city is paralyzed. Thirty-five grain laden ships destined to Liverpool have stopped at Queenstown, and their owners do not know where to send them. Meanwhile there is danger that the grain will heat and spoil. Few, if any, ships are leaving the port; and steamers arriving can be discharged only by men brought from other ports and protected by the police and military.

The fleet chartered at Liverpool to convey troops and supplies to South Africa will have to be fitted out at other ports. The shipowners' committee and a deputation from the strikers met on the 12th, the former proposing to pay the old wages, provided the day's work shall be one hour longer. This proposition was rejected by the delegation. The shipowners' committee then, on their own responsibility, suggested that the question be referred to arbitration. This suggestion was also rejected.

The threatened strike of the Amalgamated Society of Engineers has begun at London, involving the engineers, boiler makers, steam engine makers, iron moulders, and other iron workers in all the great establishments which ordered a reduction in wages. It is said that the pattern makers and a hundred other trades intend to follow.

In view of the fact that strikes are invariably failures on a falling market, this action of the workingmen of Liverpool and London—both cities being overcrowded with laboring people—would seem to be anything but prudent. Every day's delay of manufacturing and commercial industry only hastens the decline of England from the commercial and industrial supremacy she has so long enjoyed; and the laboring part of the community must be the first to suffer from the loss of trade which England's rivals are only too ready to take up and keep.

HONOR TO PETER COOPER.

The eighty-ninth anniversary of Peter Cooper's birthday was appropriately celebrated at his house in this city on the evening of February 12, by a large gathering of prominent citizens, and the investment of the venerable inventor and philanthropist with the honorary degree of Doctor of Laws, conferred by the Regents of the University of New York. More correctly, perhaps, it might be said that the University of New York was permitted to honor itself by enrolling the name of Peter Cooper among those of its most honored alumni.

The life of Peter Cooper is typical of the nineteenth century and the American people—a time and country which have done so much to make possible the experience which, to use Mr. Cooper's own words, has compelled him "to believe that it is to the application of science to the laws of life that we must look for all future improvements in the condition of mankind." As one of the leaders in the application of science to human industry, both by personal invention and through the influence of the noble institution of practical learning which he founded, Mr. Cooper has won a place in the esteem of his countrymen excelled by few. To those who have to make their way in life by unaided effort and personal worth, the successful career of Peter Cooper is a perpetual encouragement and model. May he long enjoy the satisfaction of seeing the beneficent fruits of his industrial, scientific, and philanthropic efforts.

SAMUEL BATCHELDER.

Massachusetts has lately lost two notable sons, both aged men—Richard H. Dana and Samuel Batchelder. The first was a man of letters, and famous. No New Englander would dare admit that he had not heard of the author of the "Buccaneers." American encyclopædias give full particulars of his life and writings, though the one was uneventful, and the other without any marked effect upon the world's progress, even in literature. Mr. Dana was a dreamer, and his intensely practical countrymen rewarded him with fame. Mr. Batchelder was a doer, one of the pioneers in the cotton industry which has given New England so much of her wealth and influence; a brain worker of singular power; a man of science and invention. Look for his name in the American Cyclopædia, and you will not find it. The purely literary standard of culture hitherto prevailing leads invariably to the exaggeration of the importance of essayists and verse writers, and the almost total oversight of practical thinkers. By-and-by the value of science and practical energy and useful invention will be more justly esteemed among men.

Mr. Batchelder was born in Jaffrey, N. H., June 8, 1784—five years before the first cotton mill was erected in the United States. His parents removed to Ipswich, where, in 1808, the young man helped to build the second cotton mill in New Hampshire. Afterward he took charge of it, becoming so closely associated with the establishment and growth of the cotton industry in this country, as to justify the remark that, "If he did not create this great manufacturing interest, he watched over it in its infancy, and contributed by his enterprise, sagacity, and inventive genius to its rapid development and its vigorous and far-reaching prosperity."

Mr. Batchelder early became known as a scientific manufacturer who understood all the details of his business, and was intrusted by capitalists with the founding of the cotton industry at Lowell. He built the Hamilton Mills, and afterward, while in charge of them, designed those fabrics for which Lowell has been famous and which have been staple articles of commerce ever since. In 1831, when the success of Lowell's manufacturing enterprise had become acknowledged such as had never before been known in New England, Mr. Batchelder united with parties in Boston in purchasing the site of a factory in Saco, Me., then recently burnt, and took charge of the erection of the York Mills, becoming their superintendent. He soon saw and appreciated the capabilities of the place, and with his associates secured the whole water power at what was then called the Saco Falls, and laid the foundation of another great manufacturing city.

Having made the York Mills one of the most successful corporations in New England, and secured a competency, Mr. Batchelder, in 1846, resigned his trust and removed to Cambridge, intending to devote himself to his library, which was large and choice, to his grounds, and to the gratification of his tastes generally. But when the great manufacturing enterprise at Lawrence was projected he again was swept in as one of the proprietors, and soon after he became actively engaged once more in manufacturing enterprises, holding the office of director in many corporations, and that of treasurer in the Portsmouth Mills, until 1855, when he took charge of the York Mills, which had declined during his absence, put them in running order, and has since been treasurer and manager of them, as well as of the Everett Mills at Lawrence.

An account of Mr. Batchelder's success as an inventor was given in the SCIENTIFIC AMERICAN last summer, in connection with an illustrated description of his ingenious, simple, and efficient dynamometer. Mr. Batchelder also invented the steam cylinders and connections so universally used for drying yarns. About the year 1833 or 1834 he invented and applied the first stop motion to the drawing frame, which he patented in England; and it has since been in general use in that country as well as this.

THE PLAGUE IN RUSSIA.

The condition of things in Southeastern Russia is unmistakably alarming. There have been several local outbreaks of plague in Turkey and in North Africa during recent years; and during the past year the movement of Turkish levies, the herding together of homeless refugees, the massing of Russian troops in unhealthy districts, and the return of troops from infected places, have furnished conditions extremely favorable for the development and spread of epidemic diseases. Whatever the cause, it is certain that an epidemic of a peculiarly malignant character began in the low country north of the Caspian Sea early in the fall, and has since steadily spread northward and eastward in spite of the unfavorable season and the most energetic attempts to isolate the infected regions.

At first the disease was described as a malignant typhus fever, a disease which has prevailed very largely among Russian troops in Turkey. Later reports from Russian physicians give as the characteristics of the existing epidemic the well known symptoms of the true plague, but describe them as extremely rapid in their development, the victims generally dying within ten hours of the first attack, sometimes within four hours. Ninety per cent of those taken with the disease die, and naturally the wildest alarm prevails in the districts menaced. A large number of Cossacks who fled from one of the first infected villages were lately found frozen to death on the banks of the Volga. The dead lie unburied in the streets, and as soon as warmer weather returns the festering corpses must materially aggravate the pestilence.

Leibermeister describes the true oriental plague—whose excursions into Europe during former centuries proved so terribly fatal—as a fever of a most acute and violent type, accompanied by buboes or carbuncles, and often followed by a long train of disorders. Four stages of the disease are recognized: 1. The stage of invasion; 2, the stage of intense fever; 3, the stage of fully developed buboes; 4, the stage of convalescence.

The first stage begins suddenly, sometimes with fever. The general health is seriously disturbed. There is great bodily and mental weakness, headache, dizziness; face pale and flabby, features distorted, eyes languid, speech awkward, gait staggering; nausea, vomiting, and diarrhea occur. This stage lasts from a few hours to one or more days. The change from this to the second stage is marked by fever, usually beginning with a chill, and followed by extreme lassitude and fever, with its attendant consequences. Soon the patient passes into a well formed typhus condition, with delirium, passing on to stupor. The tongue becomes dry, cracked, hard; the tongue, teeth, lips, and nostrils, are covered with a dark mucus or with soot black crusts; cardiac weakness or paralysis follows. After two or three days buboes appear and the third stage begins. The fever diminishes, and a sticky, offensive perspiration covers the body. The pulse becomes fuller and less rapid, and the mind grows clearer. Buboes now appear on the groin, with carbuncles on the back of the neck and other parts of the body, and gangrene.

Convalescence begins between the sixth and tenth days, and is often protracted by continued suppuration of the buboes. Among the sequelæ of the disease are enumerated parotitis, furuncle, abscesses of the skin and muscles, pneumonia, protracted fever with continued typhus condition, dropsy, partial paralysis, mental disturbance, etc. Genuine relapses also take place. Death may occur during any stage of the disease, though generally between the third and fifth days. The mortality is greater than that of any other

epidemic disease. At first almost all of the sick die; and for long periods the mortality may range between 70 and 90 per cent.

The manner in which the disease spreads is not clear. It is certain, however, that no efficient protection is known for those who cannot isolate themselves absolutely from infected districts. The only successful treatment hitherto found has been rigid quarantine, with the most pitiless isolation of the sick or exposed. The disease must be stamped out as soon as it begins, if need be with the utter extermination of infected communities and the burning of their villages and effects. Leibermeister, writing when there was no probability of a recurrence of the plague in Europe, said, after describing the murderous measures which had been successfully employed to prevent the spread of the disease: "If we should ever again be threatened with an outbreak of the plague in Europe, we should know exactly what measures to adopt to ward off the danger. . . . It is scarcely necessary to mention, that owing to our imperfect knowledge of the nature of the plague and the mode of its development, as well as of the manner in which the contagion is carried, etc., it would be advisable rather to do too much than too little; and when there is any doubt it is better to follow the same way."

The black death which carried off so large a portion of the human race about the middle of the 14th century presented all the essential characteristics of the ordinary bubo plague, to which was added lung complications with expectoration of blood. Some have thought it a distinct disease; it is more probable, however, that it was the same pest, aggravated by other maladies—the natural result of so vast an accumulation of unburied corpses. Most of the recent epidemics of the plagues in the East and in North Africa have occurred during the warm damp weather of spring and early summer.

FOOD ADULTERATION.

We had occasion, not long since, to criticise somewhat sharply the management of the Social Science Association, in allowing a member to secure a quasi-sanction for a tissue of sensational assertions with regard to food adulteration in this country—assertions which we had the best of reasons for believing to be as groundless as they were sensational.

Indirectly, however, Mr. Angell's extravagances have been beneficial in calling out from public analysts a summary denial—not only of his assertions, but all others like them. The Boston *Evening Transcript* prints a three column report of an interview, touching this matter, with Professor James F. Babcock, State Assayer of Liquors and Professor of Chemistry in the Boston University.

While in hearty sympathy with the efforts making to prevent or diminish the adulteration of food, Professor Babcock is obliged to contradict emphatically Mr. Angell's sweeping statements. With regard to the use of poisonous adulterants, he said that in a large experience he had rarely found in foods or drinks substances which would be likely to be injurious to health.

As State Assayer of Liquors, he has had to examine a large number of samples sent to him by selectmen and other public officers. About one third of the samples were found to be "extended" by artificial colors and flavors; but almost without exception these adulterants were not injurious to health.

Those liquors most adulterated or likely to be adulterated with really injurious substances are ports and clarets, which are said sometimes to contain logwood or aniline colors, though he never met with any in the samples submitted to him as assayer.

For several years Professor Babcock was the official analyst of Boston, and made analyses of milk for the milk inspector. About a quarter of the milk sold was found to be diluted with water and the color restored by the use of burnt sugar. He had never found any other adulterations in milk. He said:

"All the stories of sheep's brains, starch, flour, chalk, etc., as adulterants of milk are idle fancies. Records of the milk inspector of the city of Boston, Mr. Henry Faxon, whom I believe to be a faithful and efficient officer, contain sworn statements of the results of analyses of milk, the first in 1859 by Dr. A. A. Hayes, and followed in succeeding years by others, from the late Charles T. Carney, Dr. Charles T. Jackson, Dr. J. C. White, and Professor J. M. Merrick, including about one hundred by myself, a record of twenty years, and comprising nearly five hundred analyses, and in no instances is anything other than water and caramel reported."

The average amount of water found in Boston milk was about 10 per cent; but that amount is decreasing. He knew of no adulteration of butter, except possibly by the addition of oleomargarine, which if properly prepared is worth even more than butter as a food. He never found granular or block sugar adulterated. In exceptional cases glucose has been worked up with cheap sugar; but glucose is not injurious. It is less sweet than cane sugar, but has almost the same food value.

Glucose comprises about 80 per cent of honey, about 60 per cent of dried figs. It is the substance into which in the body all starchy or saccharine food must be first converted before it can be assimilated. Bread and cane sugar when taken into the body are very rapidly changed into glucose.

In molasses the absence of foreign substances is almost the universal rule. The cheaper grades of sirups are sometimes mixed with glucose, but not in any of the refineries in the vicinity of Boston. Alum and tin are sometimes used in bleaching sirup, but their use is not countenanced by the better class of refiners.

When tin and alum are used, the object is the saving of time and labor. Their use is very limited.

Candy, though a good deal mixed with glucose, is rarely adulterated with anything injurious to health. "There are some candy toys, not intended, but of course liable, to be eaten by children, which are sometimes painted or colored with poisons—metallic pigments—but I think the attention which has been called to this matter by the published reports of the State and city boards of health and the prosecution of one or two manufacturers last year has had a very beneficial effect, and I think it would be difficult to find in Boston at the present time candy adulterated or colored with any substance likely to be injurious. Starch is used to a considerable extent in making lozenges, and gum arabic in some kinds of confectionery, also gelatine, but these can hardly be called adulterations, as they are well-known articles of food."

The adulterations of ground mustard, pepper, spices, etc., are of a nature to affect the pocket rather than the health. The same may be said of teas and coffees. Of the general purity of drugs, Professor Babcock said: "I think of all classes of merchants, retail druggists are less guilty of adulterating their goods than any other"

THE FARMER'S BEST FRIEND.

The inventor helps the farmer, not merely in devising time saving and labor saving means for getting in and harvesting his crops; not merely in perfecting means of communication by which the most distant markets are made accessible, and the cost of transportation so reduced as to give value to the surplus products of the most secluded farm; not merely in multiplying and cheapening the comforts and luxuries of the farmer's home, but still more in making home markets for the farm's productions, and thus preventing the steady drain upon the resources of the soil incident to the exportation of raw products.

As the Chicago *Inter-Ocean* observes:

"Nature is a bountiful giver, but she requires that what is taken from the ground by the processes of vegetation shall be repaid with equivalents in the shape of manures. For lack of paying that debt, she punishes the farmer with increasing sterility of the soil. We, therefore, have seen the richest wheat fields retire from the State of New York and take position in Ohio, Illinois, Indiana, and Michigan, then leave these localities for Wisconsin, Iowa, and Minnesota, whence they are making ready to take their flight to Nebraska, Kansas, and Colorado. In many places of the West the yield of wheat has permanently fallen from 35, 30, or 25 bushels an acre down to 12, 10, or 7 bushels. This is the penalty which the agriculturist pays for exporting the vegetative constituents of his land. Only where the produce of the fields is consumed in their neighborhood can the waste of consumption be applied to maintain fertility, otherwise the loss is constant and sure. The waste of consumption is always in proximity to the fields when manufacturing industry, widely diversified and developed, is in proximity also. It is for this reason that the thorough establishment of manufactures always precedes a scientific agriculture and a highly prosperous condition of the farming classes. Poor lands will make farmers poor. Manufactures help to keep the lands rich, and to improve those which are less fertile."

The inference is that, as tariff protection multiplies all branches of manufactures, that policy must be conducive to the welfare of farmers, and should receive their energetic and unwavering support. But this is not the only inference that is warranted by the facts of the case.

During the past twenty years the farmers of the West have been enormously benefited by the increase of home markets due to the rapid extension of manufactures throughout the great agricultural States. By far the larger part of the manufacturing industry of those States is based on and made possible by recent inventions. Without such inventions the West could do little manufacturing. Without them the millions of consumers lately added to the non-agricultural portion of Western communities would have remained at the East, or in Europe, whither the Western farmer's crops would have had to go to find a market, his profits diminished by the cost of transportation, and the strength of his land decreased by the elements carried away. Yet, strange to say, the representatives in Congress of communities which inventors have made possible, professedly acting in accordance with the wishes of their constituents, have directly and strenuously assailed the system which, more than anything else—more, probably, than all things else together—has been the mainspring of recent invention. It has made the American people—those by adoption as well as those of native birth—a race of inventors, and the farmers of the West have been benefited thereby more than any other part of the community, yet their representatives say that the patent system is injurious!

A CABLE JUBILEE.

Invitations have been sent out by Mr. Cyrus W. Field, of this city, for a grand dinner party, on the 10th of March, in celebration of the twenty-fifth anniversary of the formation by merchants of New York of the company to establish telegraphic communication across the Atlantic.

Now that the world is covered by a network of ocean cables, it is hard to realize how recent is the innovation, or how much the originators of the movement had to contend against. Only one of the five gentlemen who met at the house of Mr. Field twenty-five years ago to organize the first ocean telegraph company has since died, namely, Mr. Chandler White. His successor, Mr. Wilson G. Hunt, with the other four founders—Peter Cooper, Moses Taylor, Cyrus W. Field, Marshall O. Roberts, and their legal adviser, David Dudley Field—are still alive to see the wonderful extension of electrical intercourse that has grown out of the enterprise they inaugurated a quarter of a century ago.

TRADE ARBITRATION IN ENGLAND.

Some months ago Governor Hartranft, of Pennsylvania, sent Mr. J. D. Weeks, of Pittsburg, as special agent to England, to inquire into the practical workings of arbitration in the adjustment of labor disputes. A meeting of the Congressional Labor Committee was held, January 22, for the special purpose of listening to a statement of the results arrived at by Mr. Weeks, a full report of which, with statistical proofs and much collateral information, having been already submitted to the Governor.

Mr. Weeks said that the practice of arbitration began in the iron trade in England in 1870. The trade in the North of England was then new, and the workmen, gathered from all parts, had nothing in common. The strike of 1865–66 lasted four months, and there were constant troubles until 1869, when a board of arbitration was formed. Since that time there has not been a strike. Wages were raised under the operations of the board from $2 to $3.30 a ton for puddling, and they have since declined to $1.75 a ton, the present rate.

The best evidence of the popularity of the system was found in the fact that at the close of the year 1875, 35 works, 13,000 ironworkers, and 1,900 puddling furnaces were its supporters. In the English Northumberland coal regions, from 1873 to 1877, all disputes were settled by arbitration, during which time troubles between the employers and employed ceased. In the Durham region, in which 50,000 miners are at work, the same system is in operation, and the men are now working on a sliding scale of wages. In South Wales the strikes, after causing a loss of nearly $15,000,000, ended in the formation of a board of arbitration and the adoption of a sliding scale of wages, now in operation. The scale provides for a minimum figure below which prices cannot fall, and twice the men themselves agreed to a lower figure. Two years ago the people interested in this industry in Wales took a vote whether to continue or abandon arbitration. The vote stood 19,000 for it, and 9,000 against continuation. The hosiery and pottery arbitrations were not successful. Arbitration is resorted to in the nut and bolt, nail, iron stone, miners, quarrying, iron moulding, chemical manufactures, boot and shoe makers, and in the manufacturing of textile fabrics, the only system of arbitration made legal in Wolverhampton. Here the awards of the board were accepted as a set of working rules, and the contract of hiring between the employers and employed was as binding as any other.

Mr. Weeks expressed the opinion that there could not be a successful system of arbitration without trade unions. He believed that the system would be beneficial in this country. It is to be hoped that in his official report Mr. Weeks will be able to explain the failure of arbitration in several recent cases of strikes in England. In regard to wages and living, Mr. Weeks said that while puddlers received $5 a ton in Pittsburg, the same work brings in England less than $2. Rents are cheaper, but living is higher in England. American competition in iron, he said, was due to the fact that common American iron is equal to their best, and they cannot approach the former in quality.

AN IMPROVED CANE MILL WANTED.

Our Louisiana sugar growers are calling loudly for an invention which some of our ingenious readers ought to supply, namely, a cane mill which will largely increase the yield of juice obtainable by current methods of pressing. At present but little over half the juice is extracted, even in the best managed mills, the majority of planters failing to realize so much as 50 per cent of the possible yield of their cane. The Mason process, in which the pressed cane, or bagasse, is saturated and subjected to a second pressing, is said to increase the yield from 15 to 20 per cent, but the cost of evaporating the greater volume of water must considerably reduce the gain. The Mallon process, in which the cane is subjected to the action of steam direct from the boilers, while the cane is passing through the mill, is said to demonstrate the possibility of getting 72 per cent of the juice from old stubble cane, and 74 per cent from plant cane; though whether it will do this in average working we are not informed. The problem is no doubt a difficult one to solve, but it is well worth attempting. A process that would economically save any considerable portion of the juice now wasted would not only largely increase the profits of sugar growing, and enable our American industry to compete successfully with that of the countries most favored by nature for this work, but would certainly remunerate the inventor. In the words of a planter, who begs us to lay this matter before our active-minded readers, the planters will pay as well as bless the man that can say Eureka!

Mr. C. O. Gregory, in a communication in the *English Mechanic*, states that he has successfully used the gas and water pipes in his dwelling as a source of electricity for a microphone. He connects one of his microphone wires with the gas pipe, the other with the water pipe, and finds the current ample and of course constant.

THE MANUFACTURE OF HORSESHOE NAILS.

[*Continued from first page.*]

another. The beams, girders, and stairways are entirely of iron. It is, as a whole, an example of the most approved fireproof construction.

The machinery is driven by two Corliss engines of 150 horse power each, one of which appears in the rolling mill in the lower portion of the front page view, the other is employed in driving the nail machinery shown in the other views. Only the best Swedish iron is used in the manufacture of these nails. It is reduced to the required form in the rolling mill, being first heated in the furnaces shown in the background, and afterward passed between a succession of rolls, which reduce it in thickness, elongate, and shape it for the operation of punching. On finally leaving the rolls the iron is conveyed to the press room, shown in the upper left hand view on the title page, and is automatically fed to power presses, which cut the nails from the strip with uniformity and accuracy. Being worked in oil through the several processes of manufacture and finishing, the iron is not liable to rust while in store or in transit.

Fig. 2.—ASSORTING ROOM.

From the presses the nails go to the tumbling cylinders where they are smoothed by attrition, after which they are pointed, and stamped with the Globe Nail Company's trade mark in the finishing room shown in the upper right hand view in the title page engraving. The machines here employed are attended by girls. After this operation the nails are again tumbled, and are finally conveyed to the assorting room, where each nail receives individual attention. Those having the least imperfection are rejected, and only the absolutely perfect ones are packed for shipment.

These nails are far more perfect than hand-made nails, and as they cost but very little more than the iron from which they are made, it is obvious economy for every horseshoer to use them.

The nails made by this company not only find their way into all parts of this country, but are sent to Europe in large quantities, where they successfully compete with those of English manufacture. Millions of horses are constantly wearing out and destroying what this establishment is trying to supply. In all times and seasons horseshoe nails, like staple articles of food, are in constant demand.

The nails made by the Globe Nail Company have been steadily growing in favor since their introduction ten years ago so that it has been necessary to enlarge their works and increase their facilities from time to time, having now attained such proportions as to entitle it to the highest place in the front rank among the similar industries of the world.

As an evidence of the public appreciation of their goods the company point with commendable pride to the fact that at every World's, National, State, County, and Industrial Fair, where their horseshoe nails have been exhibited, they have received the highest awards. At the recent Exhibition at Paris, this company received two gold medals, being the only gold medals *ever* awarded for horseshoe nails.

The marked success of this concern is due to a careful selection of material, scrupulous care in manufacturing and assorting, and the adoption of improved labor-saving machinery, by which the product is not only cheapened, but made better.

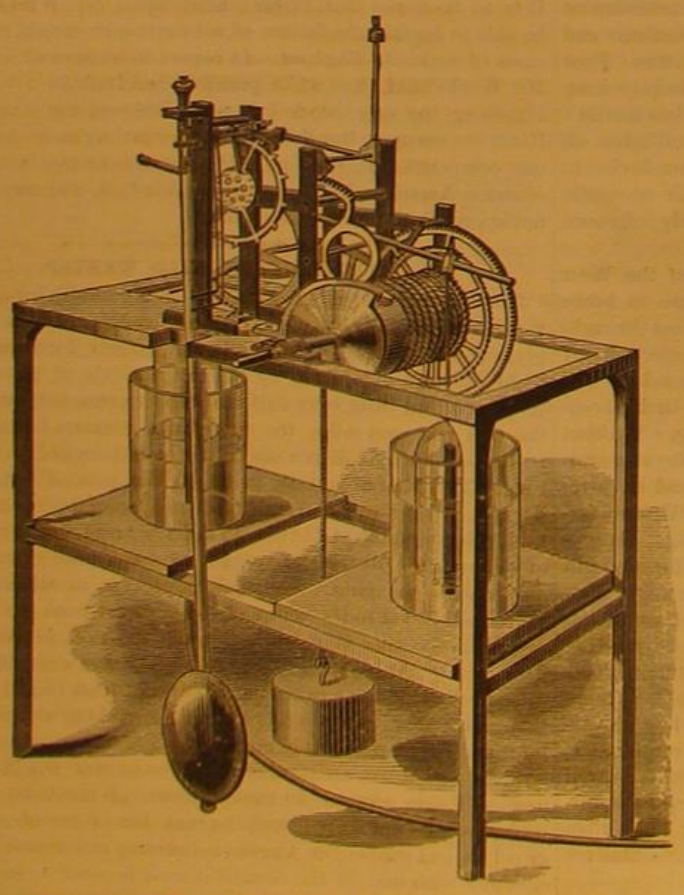


Fig. 1.—PNEUMATIC REGULATOR FOR CLOCKS.

PNEUMATIC REGULATOR FOR CLOCKS.

The pneumatic clock regulator represented by the accompanying engravings is the invention of Mr. E. J. Muybridge, of San Francisco. It is intended to regulate with accuracy a certain number of clocks located in different parts of large cities.

The pneumatic regulator may be applied to any ordinary clock operated by weights, springs, or other motive power. It consists of a series of hollow bells, plunging into and emerging alternately from vessels filled with a liquid; by this means the air within the bells is compressed and forced through tubes into a second vessel filled with the same liquid, where the tubes end just below a second series of bells corresponding in number to the clocks to be regulated. From here the air acts directly on the gearing of the second and minute hands of the clocks. The further details are easily understood from the engravings. Fig. 1 represents the clock combined with the regulator, which acts on the clock, represented by Fig. 2, which may be situated at any distant point.—*La Nature*

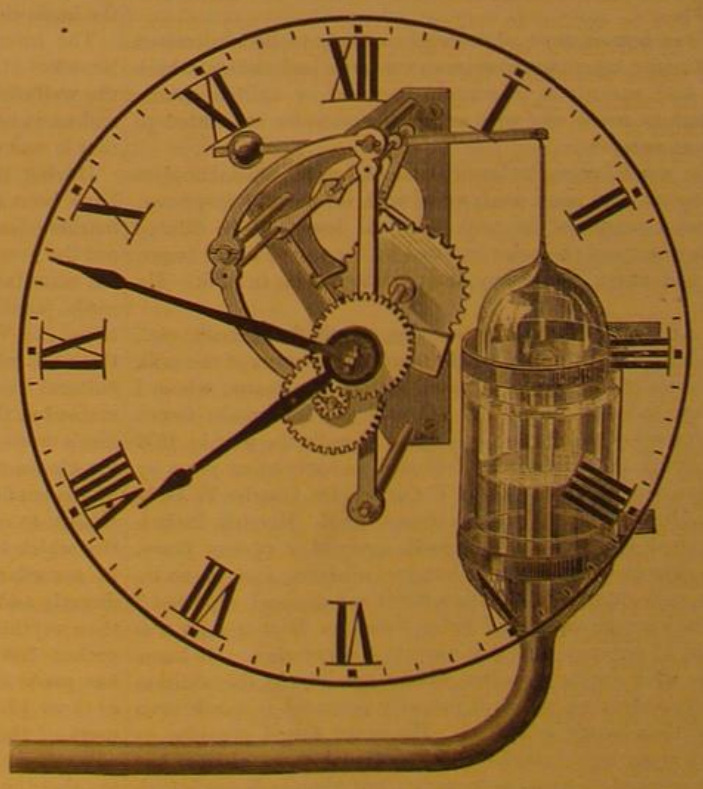


Fig. 2.—PNEUMATIC CLOCK.

A FAST FIRE ENGINE.—Switzerland exhibited at Paris a self-propelling fire engine, which traveled to the Exhibition, a distance of 250 miles, in eighteen hours. This was a very good performance, being over 14 miles an hour.

Dangers of Arsenic.

In a series of samples of glazed and plated papers examined for the Massachusetts State Board of Health, and intended to be used largely by children, Professor E. S. Wood has found arsenic present in dangerous amount in all but one of the greens, one scarlet, and one red, and a small quantity in one blue and one chocolate brown.

The Denver (Col.) *News* publishes the following: "For some weeks past a local physician has been attending a young lady who has exhibited every possible indication of arsenic poison. Her appetite failed her, and her face became of a ghastly pallor, while the features were bloated and her eyes watery, with swelling of the lower limbs. Day by day her body was racked with intense pain, and finally her condition became so unendurable that she almost longed for death to put an end to her sufferings. The physician was satisfied from the beginning that she was afflicted with some disease produced by arsenic poison. But the most rigid investigation failed to reveal in what possible way it could have been administered to her. Her food was inspected, the water she drank was most carefully selected from the wells, where no impurity by any means could find its way into it. By the merest accident in the world the cause of this remarkable condition was discovered. The doctor happened to be present when the young lady's clothes were brought home from the wash. The singular luster of the linen struck him as remarkable. He inquired who did that washing, and was told that an old negro woman whose great skill in polishing linen made her very popular with the girls. The doctor thought he was now on the road to the discovery, and concluded for the nonce to play an amateur detective. He visited the old woman, and soon learned that her "polish" was produced by the use of arsenic in the starch. Then the whole case was plain. The girl was afflicted by arsenic poison produced by absorption. Being of a peculiar temperament and organization, she incurred a danger which others might have escaped. Respiration aided it, and her bodily susceptibility to the fatal drug conspired to produce the dangerous condition which has just been detailed.

A RICH growth of sponge has been found in the harbor of Key West, Fla. One man with a few small boats lately secured $10,000 worth in two days.

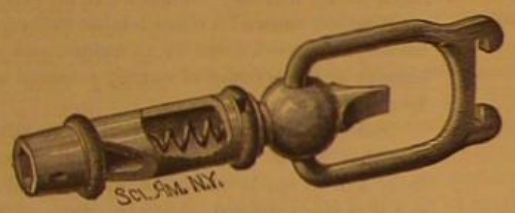
Starvation in the Nursery.

The London *Lancet* asserts as a fact of daily experience by physicians in that city, that large numbers of persons occupying decent positions in society, systematically starve their children in respect to that article of food which is most essential to their nutrition. We have reason to fear that the practice is not unknown in the nurseries of well-to-do people here. So far as our observation goes, however, the practice is attributable wholly to popular ignorance of the needs of growing children, or children that ought to be growing, but are not. The *Lancet* is of opinion that the stint is a simple meanness, a pitiful economy in respect to matters not open to the observation of observant friends. Instead of giving children their unstinted fill of milk, even though the dairyman's bill should come to nearly as much as the wine merchant's, such persons give their children cocoa with water, and not always a suspicion of milk; corn flour with water just clouded with milk; tea, oatmeal, baked flour, all sorts of materials, indeed, as vehicles of milk, but so very lightly laden with it that the term is a sham. The consequence of this misplaced economy is that there are thousands of households in which the children are pale, slight, unwholesome looking, and, as their parents say in something like a tone of remonstrance, "always delicate." Probably in nine cases out of every ten the "delicate" child is simply a child that is or has been starved.

A NEW GUN TOOL.

The novel little tool shown in the accompanying engraving comprises a whistle, screwdriver, socket wrench, shell extractor, and corkscrew combined in compact and usable form.

The tube which forms the body of the whistle is also the protector or casing of the corkscrew. The mouth of the whistle forms a socket wrench, the opposite end the screwdriver. The pendant is sprung into the bulb at the end of the whistle, and has two hooks which span the base of a center fire shell, and may be used to withdraw it from the gun should the shell retractor fail to work. A hole is drilled in the mouth of the whistle to slip over the pin of a pin fire shell when it is required to draw it from the gun. When the device is used as a socket wrench, the pendant is unscrewed



BARTHEL'S GUN TOOL AND WHISTLE.

from the whistle and reversed, the straight portion being placed in the notches in the end of the whistle tube.

This tool is a fair example of the ingenuity of Americans in economizing space and materials.

A NOVEL DOOR CHECK.

The door check shown in perspective and in section in the accompanying engraving is designed to prevent the violent shutting and slamming of doors; it is especially intended for doors that are frequently opened and closed, but may also be applied to rolling shutters, hatchway covers, etc. In this device an air cushion is employed as a means of arresting the motion of the door, and its resistance may be varied according to requirements.

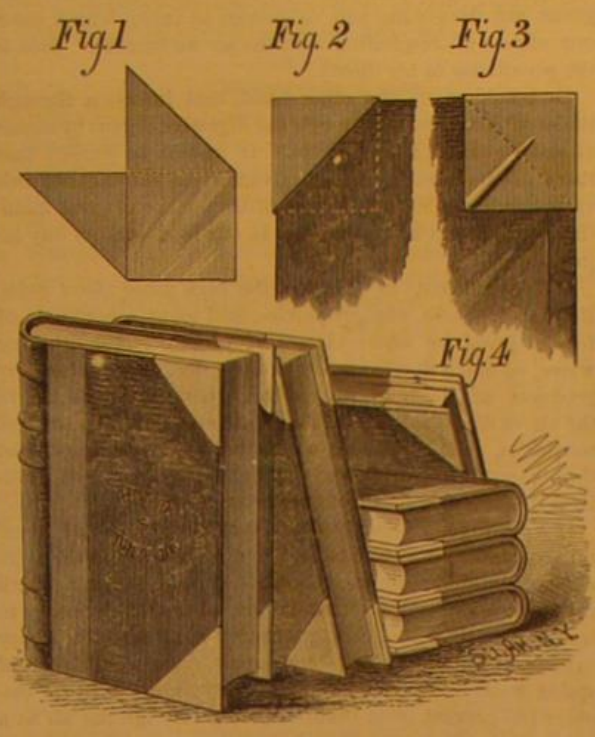
A cylinder, D, containing a piston and valves, is secured to the door casing at the hinged side of the door, and a cord which is connected with the piston rod runs over a pulley, *f*, at the top of the door, and is connected with a pivoted sector, G, supported by a bracket, K, projecting from the casing.

A rubber covered roller, L, turns on a stud projecting from a bracket attached to the top of the door, and rolls on one of the radial edges of the sector, G. The cylinder, D, contains a piston, E, and has at the top a valve chest inclosing two valves, M P. The valve, P, is pressed upward by a spiral spring against an adjusting screw in the cylinder head; it is designed to close the passage between the upper and lower ends of the cylinder, so as to control the escape of air from the upper to the lower end of the cylinder through the longitudinal passage shown in Fig. 2, and thus regulate the motion of the piston, E. The valve, M, is contrived so that it rises as the piston descends, and opens communication between the upper and lower portions of the cylinder. When the door is opened the piston, E, drops of its own weight, compelling the sector, G, to follow the roller, L. When the door is closing the roller moves along the curved side of the sector and turns it on its pivot. The piston, E, is, by this means, raised against more or less air pressure, offering more or less resistance to the closing of the door. The resistance of the air may be varied by opening or closing the valve, P, by means of the adjusting screw.

This invention was recently patented by Mr. G. S. Perkins, of Hartford, Conn., from whom further information may be obtained.

A NEW PROTECTOR FOR BOOK COVERS.

The device shown in the accompanying engraving is for the temporary protection of the corners of books during handling, packing, and shipping. It is made of any thin sheet metal in the form shown in Fig. 1, and it is applied by binding the part B down over the part A, along the dotted line, and bending the part B' over it so as to



WAY & RANKIN'S CORNER PROTECTOR FOR BOOKCOVERS.

form a triangular pocket over one half of the surface of the plate, A, as shown in Fig. 2. This pocket is placed on the corner of the book cover, when the ears, B B', are pressed down firmly, completing the protector and at the same time fastening it to the book cover. The plate, A, has a diagonal stiffening rib, *a*, formed in it in the process of manufacture. The advantage of this device will be apparent to those who have the handling of quantities of books. A corner once injured can never be restored; the book is damaged and must be sold at a discount. The device shown in the engraving is effective, simple, and cheap, and is well calculated to protect book corners so that they cannot be injured by ordinary handling.

This invention was recently patented by Messrs. Way and Rankin. Mr. B. G. Way may be addressed at New Lisbon, O.; W. A. Rankin, at Cleveland, O.

Revolution in Tanning.

Professor Knapp proposes the use of a basic ferric sulphate instead of oak bark or other tanniferous material. He adds to a boiling solution of copperas the quantity of nitric acid requisite for the peroxidation of the iron, and after the reaction is over adds more copperas. The hides are suspended in the cold solution at a suitable degree of concentration, and are ready in from two to four days.

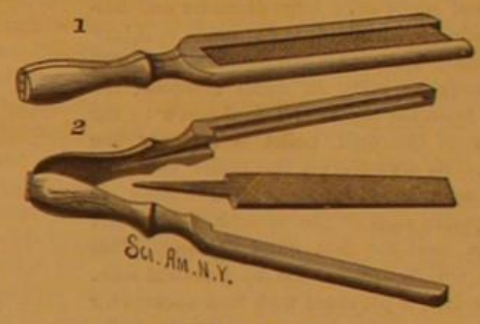
How Oysters are Freshened at Baltimore.

A new system of treating oysters is now practiced at Baltimore, by which their value is very much increased. The oysters obtained from Tangier Sound, Lynnhaven, and the kind called "seaside oysters," are rather small, although inclosed in large shells. These oysters when dredged and brought to the Baltimore market, are sold there at about 60 cents a bushel, but when freshened their value is enhanced at least 150 per cent. The manner of proceeding is somewhat different from the common practice of "floating" oysters at the East.

The oysters are transferred from the pungies on to the decks of covered scows that will each carry a deck load of about 600 bushels of oysters. The scows are then towed to a point in the Patapsco River where the water is quite shallow, and then sunk by letting water through a valve into the hold. The scows are left in this position during two flood tides, when the water is pumped out and they are then towed to the city again. The change from the salt to the fresh water swells the oysters until what were originally comparatively insignificant oysters, worth but 60 cents a bushel, become plump and luscious, fill entirely their immense shells, and command in the market from $1.50 to $1.60 a bushel. Two of the largest packing houses in Baltimore are engaged in this business, keeping 12 scows constantly employed. The whole operation is under the supervision of one man, who undertakes the freshening for a consideration of 10 cents a bushel, the packing houses referred to finding all the appliances.

AN IMPROVED FILE GUARD.

The accompanying engraving represents an improved file guard intended for use in mints where coins are reduced to a uniform weight by filing. It is customary to place a file on a table and remove the surplus metal by rubbing the edge of the coin on the file. As the files used in this operation must be new and sharp, the fingers are unavoidably brought into contact with the file and are soon skinned and sore. The guard shown in the engraving receives the file between its

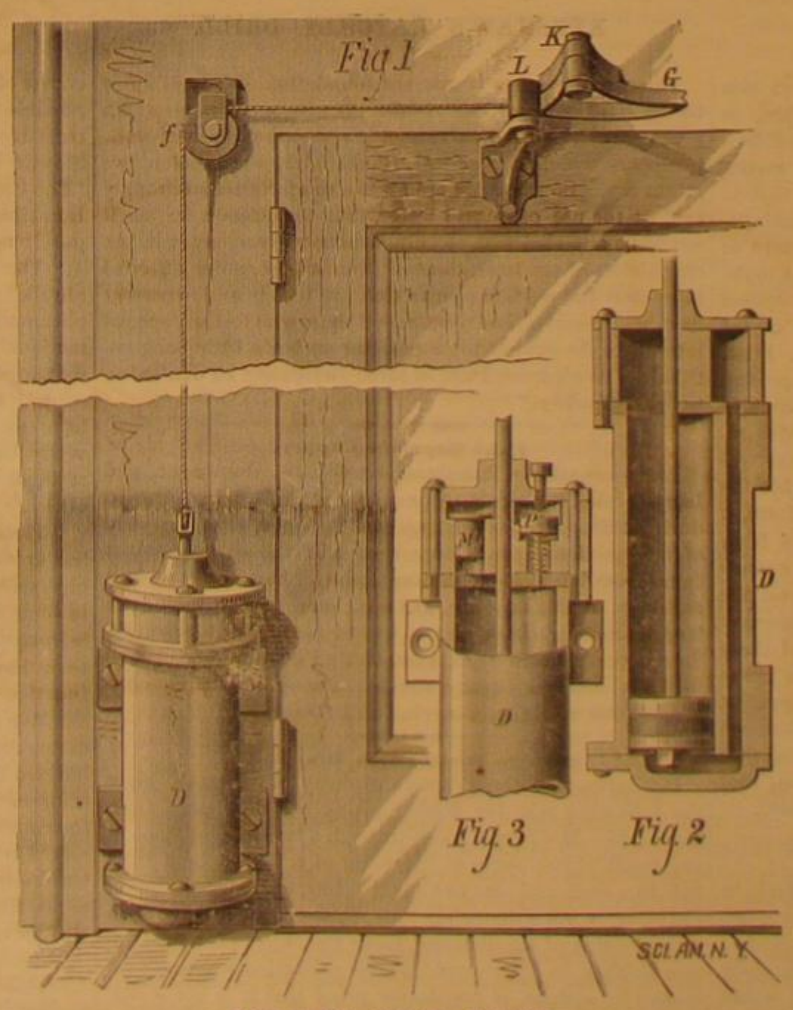


FILE GUARD.

two halves, and, being raised a little above the surface of the file, prevents injury to the fingers.

When a file becomes worn and dull it may be readily removed and replaced by a new one.

This simple but useful device is the invention of Mary P. Ayers, of San Francisco.



PERKINS' DOOR CHECK

RECENT ENGINEERING PATENTS.

A boiler furnace, capable of consuming smoke and gas evolved from the burning fuel, is the invention of Mr. Cyrus Smith, of Irwin's Station, Pa. It is stated that it will utilize all of the fuel and the heat generated from it.

Mr. G. T. Snyder, of Natrona, Pa., has devised a novel boiler, in which the main cylindrical portion is supported in a hollow casing or water leg, which forms the fire box. The two parts of the boiler are connected by inclined tubes.

A rotary valve for steam engines, consisting of two cylindrical valves placed upon a common stem or shaft which is revolved by connection with the engine, is the invention of Mr. C. A. Knowlton, of Kankakee, Ill. The valves have a plurality of ports, and are made tapering to admit of adjustment to compensate for wear. A simple and novel reversing gear is attached.

An improved tool for cutting flues out of boilers has been patented by Mr. J. H. McGraw, of Oswego, N. Y. The tool head carries revolving cutters, and may be inserted in the tube and expanded by a wedge pin while it is turned by a wrench to cut the flue.

Mr. C. Schirrmeister, of Brooklyn (E.D.), N.Y., has invented an improvement in sewers which is designed to prevent the back flow of sewage, and in this way to prevent the driving out of noxious gases.

An improvement in anglometers, devised by Mr. J. V. Capeck, of New York, N. Y., consists of a series of proportional wheels, having pointers and dials. The wheel train is connected with a wheel upon which a telescope or pointer is mounted.

Mr. P. Bardon, of Galveston, Texas, has patented a water tank which is formed of wood, with cleated seams and corner strips, the whole being coated with asphaltum, so that the wood is not affected by moisture.

The Planet Mars.

Professor Lockyer is of the opinion that human life on the planet Mars may be very much like human life on the earth. The light cannot be so bright, but the organs of sight may be so much more susceptible as to make the vision quite as good. The heat is probably less, as the polar snows certainly extend further, but by no means less in proportion to the lessened power of the solar rays. The professor agrees with others that several remarkable seas—including inland seas, some of them connected and some not connected by straits with still larger seas—are now definable in the southern hemisphere, in which, as in the case also with the earth, water seems to be much more widely spread than in the northern hemisphere. There is, for example, a southern sea exceedingly like the Baltic in shape; and there is another and still more remarkable sea, now defined by the observation of many astronomers—one near the equator, a long straggling arm, twisting almost in the shape of an S laid on its back, from east to west, at least 1,000 miles in length, and 100 miles in breadth.

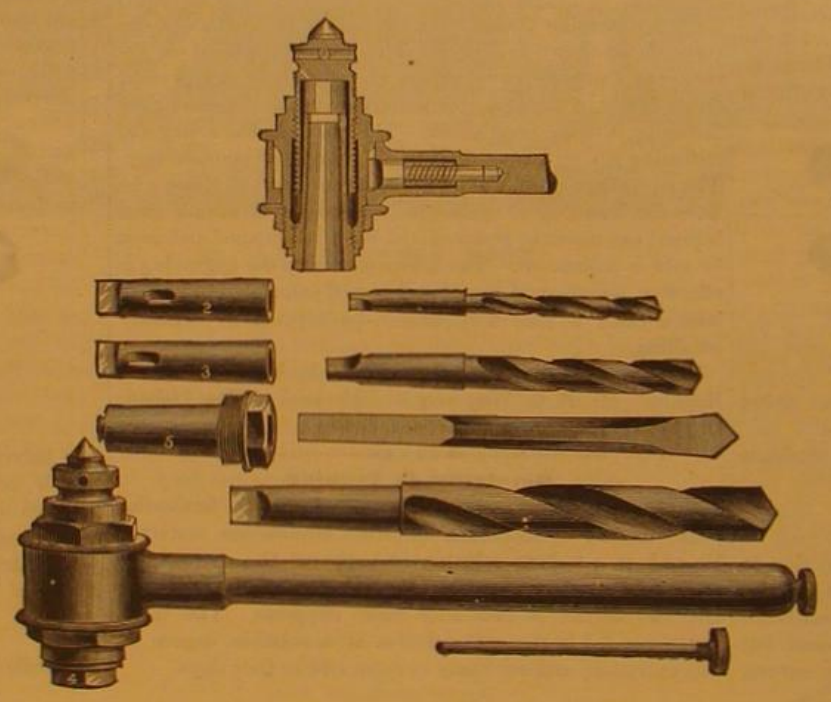
Does Invention Discourage Labor?

Burdette, of the Burlington *Hawkeye*, gravely remarks that it is a noticeable fact that the people in the prairie country of Iowa do more work than any other people in the West. This is because there is nothing about the top rail of a barbed wire fence that invites men to sit on it and talk politics while the grasshoppers get in the crops.

A NEW RATCHET DRILL.

The compact and useful tool shown in the accompanying engraving is made by the well known tool manufacturers, Messrs. Pratt & Whitney, of Hartford, Conn. This ratchet drill is contrived so that it will receive either twist drills or common drills. The handle is drop-forged of tough wrought iron; the spindle, of steel, has substantial ratchet teeth cut in its periphery, engaging with a pawl in the handle, which covers both pawl and ratchet, and protects them from dirt. The steel feed screw is of large diameter and hollow; being hardened, it is not liable to injury in ordinary use. This arrangement gives the drill large capacity in small compass, the length from the top of the feed screw to the bottom of the drill collet being only five inches. By transferring the collet and feed screw, as arranged for right hand drilling, to the opposite ends of the spindle, the ratchet may be used for left hand drilling. This feature will be appreciated by practical men.

Each drill is provided with four sockets for adapting it to the various sizes of twist drills, and to the ordinary drill having a square shank. The larger sockets are held in the spindle by a screw thread; the smaller sockets are fitted to the larger ones, and may be forced out by turning the feed screw until it bears upon their inner end. The feed rod, when not in use, is placed in the handle and held by a screw thread.



RENSHAW'S RATCHET DRILL.

The Origin of Comets.

In the exposition of his theory of the development of the solar system, Kant supposes the comets to be formed from the matter of the condensing solar nebula. By him they were regarded as planets, which, in some way, had been thrown out of their normally circular orbits. Laplace, on the other hand, in his exposition of the nebular hypothesis, took the ground that comets were formed from the matter which is scattered through the stellar spaces, and that in their origin they have no relation with the solar nebula. Have we, in the accumulation of facts since the days of Kant and Laplace, learned anything that may help us to decide between these theories? Such is the inquiry proposed by Prof. H. A. Newton, who, in a recent number of the *American Journal of Science and Arts*, considers: First, what peculiarities each of them requires in the shape and distribution of the cometic orbits; and, second, compares with the theories the facts that have been observed with regard to the paths of 247 comets. The cometic paths are represented by the writer in two graphic curves, and when the results of actual observations are put into the same form, it is at first found that the curve thus obtained differs from both the theoretical ones. However, as the known comets all have their perihelion (that part of their orbit nearest the sun) within the orbit of Mars, and are exposed to planetary disturbances, the author calculates the influence of these disturbances, and arrives at the conclusion that the curve corresponding to the actual cometary paths is thus brought into good agreement with the theoretical curve deduced from Laplace's hypothesis, whereas it does not agree so well with that deduced from Kant's. It would seem, then, that the origin of comets must be placed in interstellar space.

New View of Infection.

The theory that very small organisms, either vegetable or animal, are the cause of all infectious diseases is very generally accepted at the present day. It passes as established and almost mathematically proven, because this theory alone is able to explain for us a series of phenomena that would otherwise be totally inexplicable. Hence the alpha and omega of all precautions directed against infectious diseases and epidemics consist in combating and destroying these organisms.

C. Von Nägeli, a Bavarian investigator of some repute, makes a decided objection to this theory, and offers a new view, of great practical and hygienic importance. He retains the idea that the smallest organisms (*pilze*), fungi, are the cause of all infectious diseases, but he holds that only those germs are dangerous and calculated to infect which enter our organs of respiration with the air we breathe. This is the peculiarity of his theory.

He considers, on the other hand, that infection through the unbroken skin, or through the digestive organs by means of water or food, is impossible. It cannot be denied that there are important reasons advanced to substantiate this view. It is established that we often partake of great quantities of different kinds of fungi in our food without any injury.

It is sufficient to mention the high game (*haut goût*), Roquefort cheese, vinegar pickles, and many other kinds of food enjoyed by whole classes of people. Bad drinking water, so much decried as unsanitary, does not contain any products of decomposition other than those found in the above described foods. There are also examples in large territories, as in the Karat, where the people are accustomed throughout life to drink bad water exclusively, and yet infectious diseases are almost unknown among them.

If Von Nägeli's theory should prove true and find general acceptance, it would cause a total revolution in the principles of public regimen and sanitation, and in their practical application. Then it would be no longer necessary to trouble ourselves about the generation of products of decay in masses of liquid, as in sewers, canals, damp soil, river and spring waters. On the other side every means must be employed to prevent these fungi diffusing through the air as a result of the drying up of such decaying masses.

These are, in a few words, the foundation of Nägeli's new theory, and its immediate result. The theory will meet with much opposition, and we cannot say we are pleased with the prospects which its practical results offer, or threaten, we might say. So far as we are aware, the facts are so strongly against the use of putrid water, that the attempt to use it would be attended with too much danger to encourage it. As chroniclers of the latest theories, true or false, which affect so intimately the welfare of mankind, we feel bound to present its salient features, and recommend those who feel any special interest in the subject to procure the author's little book entitled "Die niederen Pilze in ihren Beziehung zu den Infectionskrankheiten."

Lake Superior Copper.

In the counties of Houghton, Keweenaw, Ontonagon, and Isle Royale, Michigan, 37 copper mines were in operation during 1878. The output exceeded by 20,000 tons the yield of any previous year. More than half the entire product came from the Hecla & Calumet mine. This mine employs regularly about 2,000 men, and each successive year shows a larger product. Last year it turned out 12,500 tons of refined copper, worth over $4,000,000. The mine was opened in 1868, and has already divided among its shareholders $14,650,000, retaining a surplus of $3,000,000.

How to Distinguish Diamonds.

M. Rabinet, of the French Academy of Sciences, gives the following test for distinguishing colorless gems from diamonds. If a person looks through a transparent stone at any small object, such as the point of a needle, or a little hole in a card, and sees two small points, or two small holes, the stone is not a diamond. All white colorless gems, with the exception of the diamond, make the object examined appear double; in other words, double refraction whenever exhibited by a stone, is conclusive proof that it is not a diamond.

Physical Consequences of Death.

While critically reviewing, in *Nature*, a very suggestive though decidedly speculative volume entitled "Paradoxical Philosophy" (a sequel to the "Unseen Universe," and evidently by the same authors), the learned university professor of experimental physics at Cambridge, England, Prof. J. Clerk Maxwell, takes occasion to discuss with characteristic acuteness the position of science with respect to the physical consequences of death. He says:

"No new discoveries can make the argument against the personal existence of man after death any stronger than it has appeared to be ever since men began to die, and no language can express it more forcibly than the words of the Psalmist: 'His breath goeth forth, he returneth to his earth; in that very day his thoughts perish.'

"Physiology may supply a continually increasing number of illustrations of the dependence of our actions, mental as well as bodily, on the condition of our material organs, but none of these can render any more certain those facts about death which our earliest ancestors knew as well as our latest posterity can ever learn them.

"Science has, indeed, made some progress in clearing away the haze of materialism which clung so long to men's notions about the soul, in spite of their dogmatic statements about its immateriality. No anatomist now looks forward to being able to demonstrate my soul by dissecting it out of my pineal gland, or to determine the quantity of it by the process of double weighing. The notion that the soul exerts force lingered longer. We find it even in the late Isaac Taylor's 'Physical Theory of a Future State.' It was admitted that one body might set another in motion; but it was asserted that in every case, if we only trace the chain of phenomena far enough back, we must come to a body set in motion by the direct action of a soul.

"It would be rash to assert that any experiments on living beings have as yet been conducted with such precision as to account for every foot-pound of work done by an animal in terms of the diminution of the intrinsic energy of the body and its contents; but the principle of the conservation of energy has acquired so much scientific weight during the last twenty years that no physiologist would feel any confidence in an experiment which showed a considerable difference between the work done by an animal and the balance of the account of energy received and spent.

"Science has thus compelled us to admit that that which distinguishes a living body from a dead one is neither a material thing, nor that more refined entity, a 'form of energy.' There are methods, however, by which the application of energy may be directed without interfering with its amount. Is the soul like the engine driver, who does not draw the train himself, but, by means of certain valves, directs the course of the steam so as to drive the engine forward or backward, or to stop it?

"The dynamical theory of a conservative material system shows us, however, that, in general, the present configuration and motion determines the whole course of the system, exceptions to this rule occurring only at the instants when the system passes through certain isolated and singular phases, at which a strictly infinitesimal force may determine the course of the system to any one of a finite number of equally possible paths, as the pointsman at a railway junction directs the train to one set of rails or another. Professor B. Stewart has expounded a theory of this kind in his book on 'The Conservation of Energy,' and MM. de St. Venant and Boussinesq have examined the corresponding phase of some purely mathematical problems.

"The science which rejoices in the name of 'Psychophysik' has made considerable progress in the study of the phenomena which accompany our sensations and voluntary motions. We are taught that many of the processes which we suppose entirely under the control of our own will are subject to the strictest laws of succession, with which we have no power of interfering; and we are shown how to verify the conclusions of the science by deducing from it methods of physical and mental training for ourselves and others.

"Thus science strips off, one after the other, the more or less gross materializations by which we endeavor to form an objective image of the soul, till men of science, speculating in their non-scientific intervals, like other men, on what science may possibly lead to, have prophesied that we shall soon have to confess that the soul is nothing else than a function of certain complex material systems.

"Men of science, however, are but men, and therefore occasionally contemplate their souls from within. Those who, like Du Bois-Reymond, cannot admit that sensation or consciousness can be a function of a material system, are led to the conception of a double mind:

"'On the one side the acting, inventing, unconscious, material mind, which puts the muscles into motion, and determines the world's history; this is nothing else but the mechanics of atoms, and is subject to the causal law; and, on the other side, the inactive, contemplative, remembering, fancying, conscious, immaterial mind, which feels pleasure and pain, love, and hate; this one lies outside of the me-

chanics of matter, and cares nothing for cause and effect.' We might ask Prof. Du Bois-Reymond which of these it is that does right or wrong, and knows that it is his act, and that he is responsible for it, but we must go on to the other view of the case, which Dr. Stoffkraft alludes to [in the volume under review].

"'I feel myself compelled to believe,' says the learned Doctor, 'that all kinds of matter have their motions accompanied with certain simple sensations. In a word, all matter is, in some occult sense, alive.'

"This is what we may call the 'leveling up' policy, and it has been expounded with great clearness by Prof. Von Nägeli. He can draw no line across the chain of being, and say that sensation and consciousness do not extend below that line. He cannot doubt that every molecule possesses something related, though distantly, to sensation, 'since each one feels the presence, the particular condition, the peculiar forces of the other, and, accordingly, has the inclination to move, and under circumstances really begins to move—becomes alive as it were. . . . If, therefore, the molecules feel something which is related to sensation, then this must be pleasure if they can respond to attraction and repulsion, that is, follow their inclination or disinclination; it must be displeasure if they are forced to execute some opposite movement, and it must be neither pleasure nor displeasure if they remain at rest.'

"Prof. Von Nägeli must have forgotten his dynamics, or he would have remembered that the molecules, like the planets, move along like blessed gods. They cannot be disturbed from the path of their choice by the action of any forces, for they have a constant and perpetual will to render to every force precisely that amount of deflection which is due to it. Their condition must, therefore, be one of unmixed and unbroken pleasure.

"But even if a man were built up of thinking atoms, would the thoughts of the man have any relation to the thoughts of the atoms? Those who try to account for mental processes by the combined action of atoms do so, not by the thoughts of the atoms, but by their motions. . . .

"Personality is often spoken of as if it were another name for the continuity of consciousness as reproduced in memory, but it is impossible to deal with personality as if it were something objective that we could reason about. My knowledge that I am is quite independent of my recollection that I was, and also of my belief that, for a certain number of years, I have never ceased to be. But as soon as we plunge into the abysmal depths of personality we get beyond the limits of science, for all science, and, indeed, every form of human speech, is about objects capable of being known by the speaker and the hearer. Whenever we pretend to talk about the subject we are really dealing with an object under a false name, for the first proposition about the subject, namely, 'I am,' cannot be used in the same sense by any two of us, and therefore can never become part of science at all.

"The progress of science, therefore, so far as we have been able to follow it, has added nothing of importance to what has always been known about the physical consequences of death, but has rather tended to deepen the distinction between the visible part, which perishes before our eyes, and that which we are ourselves, and to show that this personality, with respect to its nature as well as to its destiny, lies quite beyond the range of science."

Health and Recreation.

Dr. B. W. Richardson, F.R.S., in a recent lecture, at the London Institution, on "Health and Disease," took the ground that there was no difference other than one of sentiment between work and recreation, which latter he held to be a question of sentiment altogether both in the young and old. It had always struck him that in the short and brilliant bloom of Greek history the reason why such excellence, physical and intellectual, was attained was the circumstance that from the beginning to the end of the Greek's career there was no such thing as work or play, but only life. If by some grand transformation we could in our day approach this ideal handed down to us by history, we should, in a generation or two, attain a degree of health which no mere sanitary provisions in the usual sense of the term can ever supply. Perhaps our climate and other conditions of life rendered a joyousness like that of Greece at its best unrealizable here. To the drawbacks of our heavy clothing in winter and our gross food at all seasons is added the unequal struggle for existence, dooming millions to a monotonous round of toil, until the whole body lends itself to the drudgery like an automaton, the movements of which the mind fretfully follows with little hope of any earthly relief. The most striking exception was the small but happy class who find in mental labor of a varied and congenial sort that diversity of work which is truly a recreation of the healthy and vital powers. Dr. Beard, of New York, had found that the life-value of 500 men of the greatest mental activity—poets, philosophers, men of science, inventors, politicians, musicians, actors, and orators—to be 64 years. On comparing this average with that of an equal number belonging to the rest of society, he found the latter to be but 50 years. In both instances the selection was made from those who had reached 20 years of age. A later calculation gave for 100 brain workers 70 years of life. Among the causes for this difference of 14 or 20 years in favor of judiciously varied brain work, Dr. Richardson and others had ascertained the most influential to be the recreative character of intellectual labor. Brain work Dr. Beard describes as the highest of all antidotes to worry. Scientists, physicians, lawyers, clergymen, orators, statesmen, literati, and merchants, when successful, are happy in their work without reference to the reward, and work on in their callings long after the necessity has ceased. Good fortune gives good health, Dr. Beard adds, and nearly all the money in the world is in the hands of brain workers, whose life is one long vacation. No doubt there might be an over-cultivation of mind which, so far from being recreative to the health of the body, would be positively injurious, just as there was often a no less mischievous over-cultivation of muscular power.

Preserving Meats.

In a series of lectures before the British Society of Arts, Dr. B. W. Richardson has been calling attention to putrefactive changes and the preservation of animal substances. One of the most remarkable of the many experiments made by the lecturer was with cyanogen gas. Dr. Richardson does not recommend this poisonous agent for the preservation of substances intended for food, but he calls attention to some of the striking results of the action of the gas.

"In my research," says Dr. Richardson, "I used a saturated alcoholic solution. The mode of procedure was as follows: The specimens of beef and mutton, two pounds each, were placed in glass jars, the jars were charged with coke vapor, and, when quite ready, a measured quantity of the alcoholic solution of cyanogen was introduced from a graduated syringe. The stopper of the jar was immediately inserted, firmly secured, and closely sealed down. After many experiments I found that thirty minims of the alcoholic solution of the gas was the sufficient measure for the perfect result of preventing putrefactive change. Of thirty-six specimens sent out, on a return voyage all came back completely preserved. Of the same number of specimens retained at home in a room heated up to 84° Fahr., all remained in like manner free of putrefactive change. When a specimen so preserved is taken out of the jar it is found to be free of any taint of putrefaction. There is no escape of gas from the bottle; there is no change of color, there is no unnatural softness and no unnatural hardness of the structure. The only peculiarity that is noticed is a faint odor of the cyanogen, which lasts even after exposure of the structure to the air for a long time. Exposed to the air, the meat retains its freshness as long as fresh flesh does, and after it has been cooked it is preserved much longer than ordinarily cooked fresh meat. Two specimens of meat, one of beef, the other of mutton, after being preserved by this plan, and after making the return voyage, were cooked by roasting, and were placed in a larder by the side of other specimens of beef and of mutton of the same size which had been cooked, but in no other way treated. When these last were entirely changed, and were covered with mould, the cyanogen specimens were as fresh as ever. I replaced the changed pieces by others freshly cooked, and when again these were decomposing, the cyanogen specimens continued good. After keeping these cooked specimens eleven days, and finding that they no longer gave forth the odor of cyanogen, I fed a dog with some of the mutton, and, as he was uninjured, I breakfasted myself on the remainder. The meat had been through an extreme test—a return voyage to Rio, exposure to the air uncooked for three days, and exposure after cooking for eleven days—yet it ate as naturally as if it had been killed two days only, and cooked but a few hours. All I can report about it as peculiar is that it had a very slight bitterness, like the bitterness which is tasted sometimes in eating pheasant. It was the taste of cyanogen in an extremely diluted form. In some natural meats, in the flesh of the pheasant specially, the same taste is commonly present."

How the Velocity of Cannon Shot is Measured.

The initial velocity of a shot, or, in other words, the rapidity with which a projectile flies at the outset of its career, is now measured at Woolwich by an electrical instrument, the invention of Major Le Boulengé, a Belgian officer. As in the case of other instruments of a like nature, the shot is made to break through two wire screens, placed at some distance from one another. The interval is usually about 100 feet. The screen is simply a wooden framework with fine wires zigzagging across, and it is these fine wires which the shot cuts. One screen is near the muzzle of the gun, and the other at the distance we have mentioned. No. 1 screen is in connection with an electro-magnet in the instrument house, and No. 2 screen with a second, the two magnets hanging close together. While the wires in front of the screen are perfect, an electric current passes without interruption, and the electro-magnets in connection with them are endowed with power, but this power ceases as soon as the shot cuts the wires of the screen. Before the gun is fired there is suspended to the magnets two rods of iron, which remain, however, only so long as the magnets are magnets. When the shot is fired, No. 1 screen is torn, and down falls the rod suspended to No. 1 magnet; an instant afterward, when the shot has reached No. 2 screen, No. 2 magnet also loses its virtue, and down falls the second rod. The time between the falling of the two rods is so small, that ere the first has fallen half its length the second has dropped upon a trigger, which trigger darts and strikes the side of No. 1 rod. When the latter is picked up, the first thing is to examine the surface for the mark of the trigger, for the position of this mark, whether high or low, tells the operator what he wants to know. The rod, being of a given weight, always takes the same time to fall, and according whether it has fallen half or quarter its length, so the time taken by the shot to travel between the screens has been long or short. In a word, the rod has only to be compared with a prepared scale in order to read off the number of feet per second at which the shot has gone on its way.

The pressure of the gases inside the gun as the shot is being expelled is recorded by the crusher gauge, an American invention. This is a tiny pillar of copper placed loosely in a tube, the end of which, made of steel, stands firm and fast, no matter what the pressure; consequently the soft copper pillar, when subjected to the action of the gas, gets compressed, or crushed, and assumes something of a barrel shape. The pillar and its case, being affixed to the base of the shot, gets the full pressure of the gunpowder gases, and its length afterward denotes how much this pressure has been. To secure more trustworthy pillars of the metal it is the practice to compress them first of all to a certain degree, to remove any honeycomb or imperfection, and, thus uniformly compressed, they may be relied upon to record the strain with accuracy. Comparison of the fired pillar with other pillars which have been subjected to known pressures, at once reveals the degree of force to which the former has been subjected in the gun. The maximum pressure, or strain, to which the 80 ton gun should be subjected is set down as 25 tons on the square inch, and it is with the aid of this crusher gauge that the strain exerted in the various experiments has been ascertained.

The Progress of Dentistry.

Some hopeful results in the practice of dental grafting have been recently brought to the notice of the French Academy by MM. David and Magitot. Two principal forms of such grafting are distinguished—the graft by restitution and the graft by borrowing. In the former a tooth is reimplanted, after having been extracted with a view to certain operations, which would be impracticable in the mouth. M. David has adopted this method for rectifying the direction of teeth, for treatment of caries in the extracted tooth and periostitis, and for stopping, also for facilitating operations on another tooth, or in another part of the mouth. The consolidation of the tooth restored to its socket occurs generally on the tenth or twelfth day. In cases of periostitis the process is somewhat slower. In the graft by borrowing, a sound tooth may be substituted for a decayed one. As regards transplantation from the lower animals, of course no zoological species has hitherto furnished teeth similar to ours in form, dimensions, color, etc. Still, sound roots (from a lower animal) may be substituted for bad ones, and may serve as a solid base for pivoted artificial teeth. The transplantation from one human being to another would generally involve objectionable mutilation. But sound teeth may be utilized for the graft when their extraction has become otherwise necessary. A tooth may be transposed from one part of the mouth to another. Practicing the dental graft by restitution, M. Magitot has operated in sixty-two cases, and fifty-seven of these have been decided cures—a success amounting to ninety-two per cent.

The History of Diphtheria.

It is often said that diphtheria is of modern origin, a penalty for the unsanitary conditions of modern civilization. Dr. Mackenzie, senior physician to the Hospital for Throat and Chest Diseases, in London, finds the disease to be a very ancient one. The first description of it occurs in the writings of an Indian physician, a contemporary of Pythagoras. He next identifies it with "askara," a fatal epidemic frequently mentioned in the Talmud. In the seventeenth century diphtheria was widely prevalent in Europe, and extensively fatal. In 1802 Dr. Cullen, of Edinburgh, seems to have described the disease under the name of *cynanche trachealis;* and in 1826 Bretonneau's classical work appeared.

"After this," writes Dr. Mackenzie, "the disease seems to have passed from the minds of English physicians and its very existence to have been almost forgotten." From such forgetfulness the medical profession was thoroughly aroused by the great epidemic of the years 1858–9, since which time diphtheria has not appeared in England with anything like the same malignancy.

PATENTS PERTAINING TO THE HOUSEHOLD.

An improvement in the class of clothes driers having radial arms for supporting the line, invented by Mr. R. E. Rye, of Mount Pleasant, Mich., provides a means of easily raising or lowering the frame that supports the line.

A novel pounder or washing machine, which presses the clothes alternately in opposite directions, is the invention of L. C. White and G. M. Walton, of Cleaveland Mills, N. C.

Mr. F. Mohr, of New York city, has invented a platform rocking chair whose oscillations are limited by a novel arrangement of an arm and rubber covered stop pin.

A dishpan having a hinged cover and a drainer combined, in a novel and convenient way, has been patented by Mr. J. F. Hutchinson, of Portland, Me.

Progress of Steam Engine Economy.

With Smeaton's early Newcomen engines the consumption of coal was 29·76 lbs. per hour per horse power. Afterward, as improved, 17·6 lbs.

In 1811 the Cornish pumping engine required 10·87 lbs. per hour per horse power; in 1842 the improvements had reduced it to 2·90 lbs.

In 1863 the best marine engines consumed 4 lbs. of coal per hour per horse power, but in 1873 only 2·11 lbs. was required.

A NEW BEETLING MACHINE.

The accompanying engraving represents an improved beetling machine, invented by Mr. J. Patterson, of Belfast, Ireland, and exhibited in Paris at the late Exhibition by Messrs. Mather & Platt, of Manchester. It is designed to impart to linen, cotton, and woolen goods the necessary degree of finish by means of a series of weights or hammers beating rapidly and with equal force on the material, as it passes over a cylinder of wood and metal. The hammers are moved by eccentrics on a common shaft revolving in the upper portion of the machine.

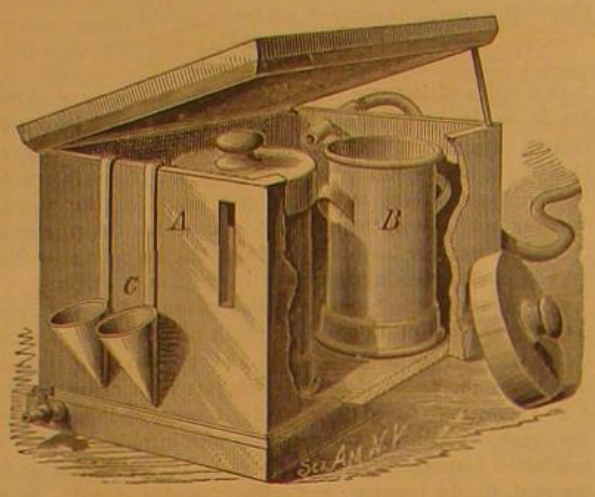
There are three cylinders for carrying the goods. They revolve slowly in journals formed on two large wheels, one cylinder only being exposed to the action of the hammers at a time. The goods may be removed from or adjusted on two of the cylinders while the fabric is being treated on the third, without stopping the machine, thus rendering the action of the machine continuous. The destructive effects of the shocks on the machine itself are materially lessened by the springs which support the weights. In the old machines, in which a series of weights were lifted by as many cam wheels, and then allowed to drop, the highest number of blows obtainable per minute from one hammer was 80. In the improved machine, when running at full speed, each hammer strikes about 420 equally effective blows.

The peculiar construction of the machine allows a perfect regulation of the number as well as the force of the blows. In Paris a machine with 14 hammers did the work of 7 of the old machines in the same length of time, furnishing goods of superior finish.

[This machine has been patented in England, and was recently patented in this country.]

A NEW CREAM-RAISING APPARATUS.

The inventor of the cream-raising apparatus shown in the accompanying engraving has endeavored to produce a creamer which should possess all of the good features of the more expensive apparatus with the advantage of cheapness. The tank in which are placed the milk cans is made of plank, and has at one end, near the top, a water inlet pipe, and at the other end an opening partly closed by a gate which regulates the height of the water. The milk cans which set in the water have perforated foot rims, which admit of a free circulation of water under the cans, and weighted covers are provided which fit loosely and extend downward sufficiently to dip in the water and thus hermetically seal the cans.



WELDON'S CREAM-RAISING APPARATUS.

A conical skimmer is used to remove the cream from the milk. It is carefully dipped, apex downward, into the milk until the cream flows over its edges; it is then removed and emptied, and the operation is repeated until all of the cream is removed.

This apparatus is designed principally for dairy use, and is particularly applicable where natural flowing springs are available.

MISCELLANEOUS INVENTIONS.

A novel nail extractor for removing nails from packing cases without injuring the cover of the case, is the invention of Mr. C. F. Knauer, of Urach, Würtemberg, Germany.

Mr. Otto Stark, of New York city, has invented an improvement in bellows for accordions and other instruments of the same character. The improvement consists in strengthening the folds by means of wooden strips.

An improved lamp for burning paraffine or mineral oils has been patented by Mr. W. C. Hughes, of London, England. This lamp has three distinct wicks, operated by separate racks and pinions. The wicks are arranged with a view to perfect combustion and the production of a strong light. The lamp is intended for magic lanterns, public streets, halls, etc.

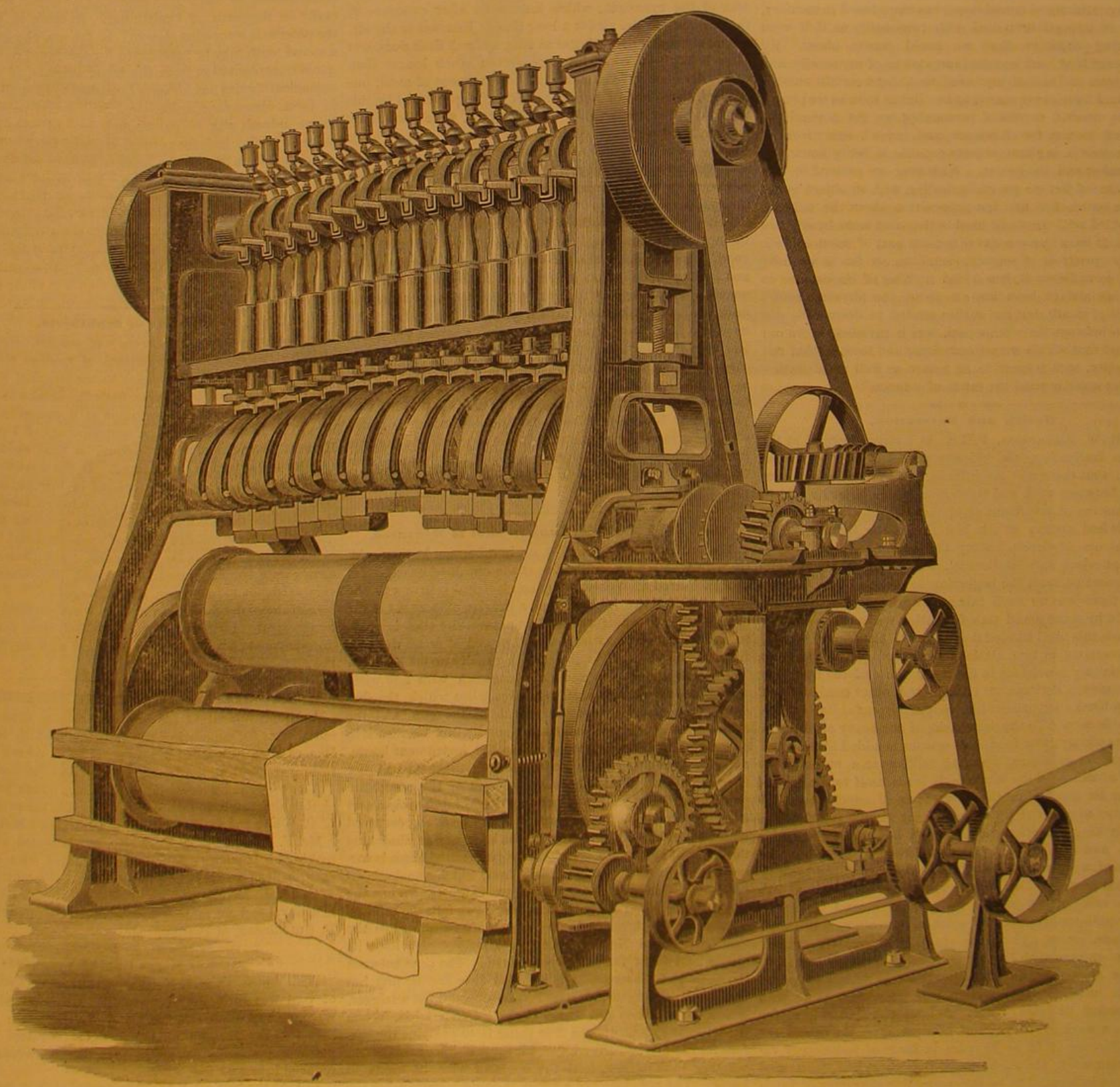
A wind motor for the heavier kinds of work, such as pumping large quantities of water, operating stamp mills, etc., is the invention of Mr. L. Brayman, of Gilbert Station, Ill. It consists of two series of wind wheels placed on horizontal shafts, which are arranged at right angles to each other and geared together so that either or both series may be employed in driving machinery.

Mr. C. J. B. Gaume, of Brooklyn (E. D.), N. Y., has devised an electro-magnetic engine in which the back pull upon its magnets is avoided. The invention consists in a new arrangement of armatures.

A simple and effective device for operating and locking and unlocking window blinds has been patented by Messrs. John Kelso and Wm. H. Ludewigs, of Lowdon, Ia. The principal feature of the invention is a jointed rod, which is turned, bent, pushed, or pulled to move the shutter in different directions and operate the slats.

A simple and easily constructed pump has been patented by Mr. A. Stoner, of Stony Point, La. This device may be made almost entirely of sheet metal, and may be used for extinguishing fires, washing windows, sprinkling floors, etc.

Mr. George Jackson, of Havre de Grace, Md., has invented a grate for coal burning stoves, furnaces, grates, etc., which may be vibrated vertically, to free the fire from ashes, and to prevent the accumulation of clinkers.



PATTERSON'S IMPROVED BEETLING MACHINE.

THE ORIENTAL EAGLE OWL.

Among the recent additions to the aviaries of the Zoological Society in Regent's Park is an example of the rare and little known owl of which we now give an illustration. This bird, which had not previously been received alive in Europe, was obtained in Siam by Mr. Charles Fowler, of Cheeryhinton, near Cambridge, and was presented to the Society on the 14th of last month. Its native home is said to be the forests of Karenne, in the interior of Siam. The Oriental owl belongs to the group of eagle owls, which are distinguished by their large size, and by the long tufts of feathers that spring from each side of their heads, and cause them to be commonly designated as "horned" owls. Of the habits of the species, which is found in Malacca, Java, and Borneo, as well as in Siam, little has been recorded by naturalists. But there is a closely allied species found in British India, which Jerdon, in his "Birds of India," calls the "forest eagle owl" (*Huhua Nepalensis*). Jerdon found this bird on the high forests of Malabar, where it was not very common, and was said to kill hares, various birds, cats, rats, and even fishes, and to have a low, deep, and far-sounding hoot. Other members of the group of horned owls are the great horned owl of Central Europe (*Bubo maximus*) and the Virginian owl of America (*Bubo Virginianus*), both which are also represented in the Zoological Society's collection.—*Graphic.*

THE ORIENTAL EAGLE OWL.

THE HUMPBACK WHALE.

The humpback whale, *Megaptera longimana*, is the most common representative of the mysticetes or toothless whales. It is met with in deep water all over the globe, and attains a length of from 50 to 70 feet. The fins are about 3 feet in width and 12 to 15 feet long. The tail is about 18 to 20 feet wide. In appearance it differs considerably from other members of the same family; the body is short and stout, the fore part is very thick, while the tail end is very thin, compared with the other dimensions of the body. The lower jaw is longer and wider than the upper. The back carries, at a distance from the tail end equal to about one fourth of the entire length of the animal, a fin consisting almost entirely of fat, to which the animal owes its name. Fatty growths of various form and size are also found in the center of the chin and near the shoulders. The back is lined with irregular lumps, varying in size from that of a marble to that of a man's fist. From the lower jaw twenty-five folds, of about four inches in width, extend along the neck down to the belly. These enable the animal to open its mouth very wide.

The color of the humpback varies greatly. The back is generally black, while the belly and sides are white and marbled with gray and black streaks. The fins and tail vary from a pure white to a jet black. The fins also vary greatly in form. They are sometimes long and pointed, sometimes short and thick. The tail is generally crescent shaped, but specimens have been found with short, thick tails, cut off straight at the end.

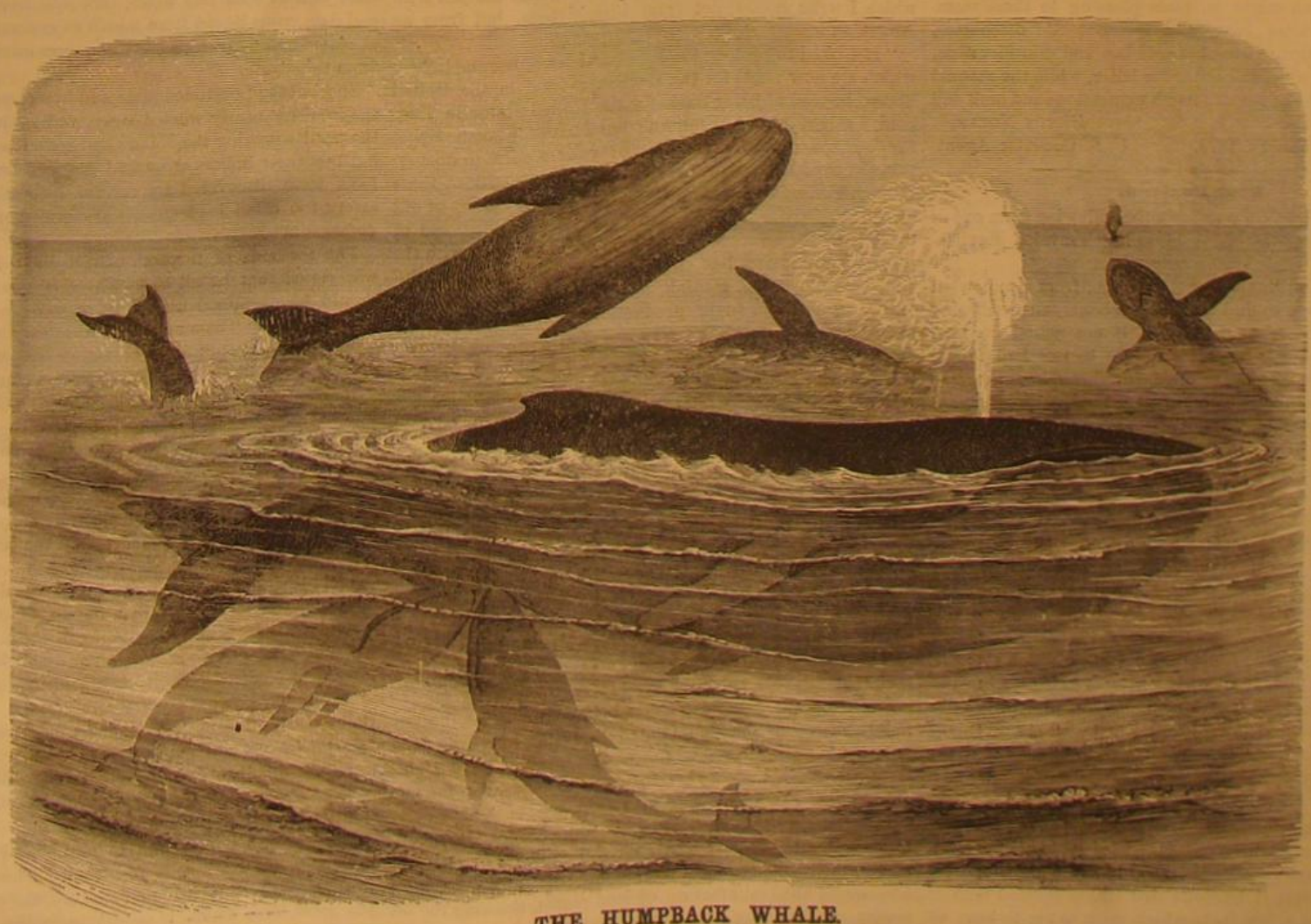
Few whales appear in larger numbers in the arctic and antarctic regions than the humpback, but it is not confined to these regions, as it is found in all latitudes. It is most probable that the polar zones are its home, and that the animals undertake annual journeys from the poles to the equator and back. They are caught in the greatest numbers on the coast of Oregon and upper California, during October and November; only a few are seen between December and April, as the animals travel from spring to December in a northerly direction, and return again between September and December.

The humpback is remarkable on account of the vivacity of its motions.

In swimming, the whole body bends together and straightens out alternately, describing an undulating line. It throws itself around in the water, swimming sometimes on the back, sometimes on the side or belly, and often it is seen to stand up vertically in the water. In fact this animal displays remarkable agility in its element, in which it seems to control its motions as perfectly as a bird in the air.

When filling its tremendous lungs it ejects, from six to twenty times in succession, a double stream of water, which rises from five to eighteen feet into the air. It feeds principally on small fish and crustaceæ.

Although the commercial value of the humpback is considerable, it is not esteemed as highly as the sperm whale or the Greenland whale, as its blubber contains considerably less oil than that of the other animals mentioned.



THE HUMPBACK WHALE.

Natural History Notes.

A Curious Case of Parasitism.—A recent number of the Bulletin of the Belgium Microscopical Society contains an account of a curious discovery made by M. Guinard, of Montpellier, of a case of parasitism on a diatom. In examining some *pinnulariæ* collected in cavities on the sea shore, from whence the sand had been removed for ballast, M. Guinard observed minute brown specks moving rapidly over the diatoms. Studied with an objective of a higher power, the little objects were found to be of a rectangular form, swollen in the middle, and having at each of their four angles a long hyaline appendage, which was constantly in motion. The animals were extremely agile in their movements, and were exploring every part of the frustule by means of their long, flexuous arms.

Rearing Sponges by Artificial Means.—During the past few years, Dr. Oscar Schmidt, Professor of Zoology at the University of Grätz, and a well known authority on sponges, has employed several weeks of the early summer in artificially producing and rearing the bath sponge. His labors have met with such success that his system has been adopted by the Austrian Government, and is now carried out on the coast of Dalmatia. It has for some time been a well known fact that several families of zoophytes have such great powers of reproduction, that a portion of one will grow and form on an entire new body. Dr. Schmidt has taken advantage of this property, his process being to cut the sponge into pieces, fasten each portion to a pile, and immerse it in the sea. The pieces then grow, and eventually from each one a spherical sponge is obtained. According to the estimates of Dr. Schmidt, a small piece of sponge at the end of three years will represent a value of about 10 cents. The total cost of raising 4,000 sponges, including the interest on the expended capital for three years, is estimated at $45, and the income at about $80, leaving, therefore, a net profit of $35. There is no doubt that the practice of this new branch of industry will prove a source of considerable benefit to the inhabitants of the Idrian and Dalmatian coasts.

A Toadstool with the Odor of Chlorine.—A writer in the December number of the Bulletin of the Torrey Club records his discovery of a toadstool, which was exhaling a strong odor of chlorine when found, and which has been described as a new species by Mr. C. H. Peck, under the name of *Agaricus chlorinosmus*. The writer states that "there could be no doubt that the plant was exhaling chlorine, since there is no other substance known having the same, or even a remotely similar odor." From this he draws the inference that the "chlorine was taken up from the soil by the plant, in the form of a chloride, most probably the chloride of ammonium, or possibly of sodium." As a comment on this the editor of the Bulletin calls attention to the fact that the Californian eschscholtzia is well known to have a colorless juice but with the odor of hydrochloric acid; yet this juice, on being tested, has been found to give not even a trace of chlorine, and "perhaps the same result will appear in the case of the new agaric."

The odors of different fungi, like those of flowering plants, are almost as numerous and varied as the species themselves. *Peziza venosa*, when fresh, is remarkable for a strong scent like that of nitric acid; *Agaricus odorus* and *A. fragrans* have an anise-like odor; some species of toadstools have exactly the odor of garlic acid; one has the scent of ripe nectarines; two or three smell like melilot; others like fresh meal; others like putrescent flesh; while almost all have a peculiar scent which has come to be called a "fungoid odor;" it is

the faint smell of a damp cellar which has been closed for a long time—an odor of mouldiness and decay.

Trees Freezing Solid.—The *Country Gentleman* states that Dr. Hoskins, who lives in the coldest part of Vermont, where the mercury sometimes freezes, says that when this takes place, he does not think that any portion of the sap of the trees remains unfrozen; yet the hardier varieties endure the trees remains unfrozen; yet the hardier varieties endure the trees remains unfrozen; yet the hardier varieties endure this cold unharmed. "We have observed," says the editor, "the shoots of the apple, pear, and peach frozen stiff (when the thermometer sank to 10° above zero) without injury. The microscope showed them to be filled with ice crystals, no injury resulting from the freezing."

Correspondence.

Alum Baking Powders.

To the Editor of the Scientific American:

I thank you for publishing the article of Dr. Robert Peter, on "Baking Powders, etc.," in your recent issue. Allow me to add that the poor operatives and workingmen in this State, who have families of children to support, and must do it on the present low wages, make it a point always to bake their own bread in the old fashioned way with yeast. "They cannot," as they say, "raise a family on baker's bread." They have long ago found out by experience, what science has proved true by experiments, that alum in bread neutralizes its best nutritive qualities. There is no doubt that baker's bread, made as it is of second and third rate flour, is doctored with alum and alkalies to give it a white appearance. Bread made of the very best Haxall flour with yeast retains its beautiful creamy yellow tint, while the same raised with alum baking powder becomes white and dry and tasteless. No doubt many of our national diseases, such as dyspepsia, have their origin in the universal use of baking powders, and I suggest that the early decay of teeth in the United States might be traced to the deprivation of natural phosphates of lime and the substitution therefor of other alkalic salts, such as those of soda and potash, in our daily food. Anything that deteriorates or improves the "staff of life," our daily bread, in the slightest degree, is of such immense importance, that I hope you will keep open the pages of the SCIENTIFIC AMERICAN till the subject is thoroughly understood. L. K.

Providence, R. I.

American Locomotives in Italy.

To the Editor of the Scientific American:

Mr. Edward A. Quintard, of Philadelphia, is here with a 38-ton locomotive, from the late Paris Exhibition. This is a right step in the true direction. United States manufacturers must do so, to bring effectively their products before the Italian people

It is to be hoped that Mr. Quintard may convince the Italians that it would be to their interest to buy his great and fine locomotive, as well as many others of them which may follow.

The Stenographical Machine of Michela.—One of these machines some days since was on trial before the city fathers of this city. The machine reported the debates fully and correctly, without flattery and with exact justice. However, the city fathers preferred to be reported by the representatives of the city press. Perhaps the latter have a way of reporting which might be more pleasing to those members who may utter hasty and inconsiderate discourses, which the machine, without conscience and consideration, reports word for word and letter for letter, while the manual reporters of the press smooth harsh expressions and omit and rearrange sentences. HENRY NOBLE,

Turin, Italy, January, 1879. U. S. Consular Agent.

Poor England.

The London *Standard* publishes the following from one of its correspondents, who signs himself "Traveled Englishman:"

"I came back to England, not long ago, from a somewhat lengthened journey to find my fellow countrymen suffering in no small degree from depression, if not actual distress. Banks had 'broken,' large mercantile houses had failed, great industrial works had stopped, and throughout the manufacturing districts the gloomiest apprehensions with regard to the future prevailed. Some of these apprehensions have unfortunately been realized since then, inasmuch as I see that the sufferings of the poor in Sheffield, Manchester, Leeds, Newcastle, and many of our great northern towns have been so severe as to require the formation of special public committees to collect and dispense the charitable offerings of the richer classes. It is only natural in these circumstances that a brisk controversy should have sprung up in various quarters on the subject of the cause of this distress.

"In London society people may not know much about it; but I can assure you, from what I have myself seen in some of the most important commercial and manufacturing districts, that the keenest interest is taken by all classes in the discussion of this question. What has brought about the present deplorable stagnation of trade? is the inquiry universally put nowadays in the North of England. 'High wages,' say the masters, and 'over production,' say the men, when they are asked this question. I belong to neither class, and I by no means set myself forward as an authority on the point at issue. But it happens that I have learned both at home and abroad a few facts which seem to me to have an important bearing on this question, and which, therefore, with your leave, I shall lay before your readers. How is it, I want to know, that my wife's maid, when she went, at Aix les Bains, at Homburg, and at Florence, to buy calico, found in shops where two years ago nothing but English goods were kept that the calico or cotton in stock was of American manufacture? I am not a judge of this article myself, and I really do not pretend to know whether the American goods are better or worse than those formerly supplied from the English markets. What I do know is that in this, one of our own staple manufactures, we appear to have been fairly beaten out of the field upon the Continent, and that in each case the shopkeeper when applied to for an explanation declared that he preferred American to English materials because he got a larger profit upon the former than upon the latter. How is it, again, that here in England if I want tools for my garden or my workshop I am constantly being invited by my ironmonger to try new American 'notions,' in the shape of spades, and hammers, and saws, and chisels, and axes?

"Some months ago I read a letter of Mr. Gladstone's upon a subject on which his authority can hardly be contested. In it he gave his opinion upon the common American wood man's ax, and described—as I happen to know quite accurately—the difference between it and the English article manufactured at Sheffield. The comparison, I need hardly say, was all in favor of the Yankee production. Sheffield is too conservative—in its manufactures, I mean, not in its politics—to make an ax of the best shape. So the sharp American comes in and wins. And he does this not merely in axes and the other tools I have mentioned, but in locks, bolts, stoves, lamps, and a thousand-and-one other household requisites which a dozen years ago were the peculiar production of this country. You have only, indeed, to cast your eye over your own household, sir, in order to see to how large an extent the English manufacturer has been beaten, even in articles of domestic use. Nor is it in the hardware trade only that we seem now to be getting flooded with American goods. American leather comes over here to be made up into shoes; and our famous English carriages are to a large extent built out of materials which have crossed the Atlantic, and for which the American has been duly paid. 'Glue, hair, and sandpaper' are mentioned in a recent copy of the Philadelphia *Ledger* as being now among articles largely exported to this country; and even slates—shades of the Welsh magnates!—are now quarried in the United States in order to roof in our English homes.

"Can any of your readers tell me how all this is brought about? And is not the fact alone sufficient to account in a large measure for the present depression in our manufacturing industries? I do not grumble because, if I want tomato sauce with my cutlets at this season, it is probably made out of American fruit; nor can I complain because my grocer, my butterman, and probably my butcher also, deal so largely in American goods of all kinds, for I freely admit that as a source of food supply the United States is naturally infinitely superior to our limited and over-populated country. But what I want to know is why, in the special manufactures which were once entirely ours, and which only a few years ago belonged to us more largely than to any other country in the world, we now seem to be running a bad second to the United States? Why, sir, even the cigarettes which I smoke are made in Richmond, Virginia, and the pen with which I write comes, not from Birmingham, but from an American manufactory.

"If I liked to prolong the list of articles of use and luxury which are now made for the English market in the United States, instead of being made for the United States in England, I might do so indefinitely; but I have too much respect for your space and for the time of your readers to do anything of the kind. It would be easy also to speak of those Belgian girders which are now used in the very heart of our own iron districts in the construction of buildings, and of those French engines which compete dangerously with the products of our own best engineering establishments. But I have said enough, I think, to show that, in addition to 'high wages' and 'over production,' foreign competition must be reckoned among the causes of the present distress; and I conclude by asking if any one can explain to me how it is that this competition should so suddenly have become serious, if not actually fatal to us, in the very fields of which recently we were the undisputed masters?"

Steam Boilers.

A very interesting and valuable lecture was lately delivered at Hartford, Conn., by Mr. J. M. Allen, President of the Hartford Steam Boiler Inspection Company, the discourse being devoted to the consideration of steam boilers. Mr. Allen commenced by speaking of the famous Corliss engine at the Centennial, remarking that although every one admired and wondered at it, but few really stopped to think of the source of its power and energy. Few recalled the fact that all this splendid machinery derived its motive power from the concealed steam boilers in the low line of buildings outside the Main Centennial Hall. In crossing the Atlantic in an ocean steamer, how few think of the unsightly, unattractive boilers that furnish the power for the machinery that carries the vessel forward.

In discussing this question it is proper, Mr. Allen said, that we should know of what material boilers are constructed and the methods of construction. He then gave a brief account of the manufacture of iron plates, showing the necessity of obtaining an ore free from phosphorus and sulphur, the former making a "cold short" iron, and the latter a "red short," either of which is unsuitable for boiler plates, when high pressures are to be used.

He also explained the process of "puddling," "shingling," repeating and rolling into finished plates. He showed that the presence of slag or scoria on the bars composing the pile prevent perfect welding, causing what are known as laminated sheets, illustrating all these points with diagrams, photographs, and specimens. He then described the methods of constructing boilers, punching holes in the plates, the use of the "drift pin," which was condemned, riveting, bracing, and staying. The defects from poor workmanship were pointed out and illustrated by specimens as the description progressed.

Mr. Allen devoted considerable time to the discussion of chipping and calking, showing that by the old methods boilers were liable to be very greatly injured and incipient defects developed. He recommended the planing of the edges of the sheets preparatory to calking in preference to the old method of "chipping."

The necessity of having good material and good workmanship in the construction of boilers was brought more forcibly to the minds of his hearers when he stated that a boiler 16 feet long, 60 inches in diameter, and running at a pressure of 60 lbs. to the square inch, sustained an internal pressure of not less than 1,000 tons, the tendency being to burst the surrounding metal asunder. He also stated that the railroad locomotives, which often stand near the cross walks at the depot, carry a pressure on their crown sheets of not less than 90 tons. This point was illustrated by drawings upon the blackboard. It is not to be understood that these are dangerous or excessive pressures, but are mentioned to give some adequate idea of the immense strain to which steam boilers are subjected, and also to show again the absolute need of the best material and workmanship in making them. Anything short of this he claimed was criminal neglect.

Mr. Allen then proceeded to show at what pressure a boiler may safely be worked. He stated that there were formulæ for all these, so that the bursting and safe working pressure could be easily arrived at. He further showed that the bursting pressure of the boiler above mentioned, 16 feet by 60 inches, was not less than 525 lbs. to the square inch, but that in practice only one sixth of the bursting pressure should be allowed, leaving a wide margin for safety. This would admit of about 87 lbs. of steam to the square inch as the safe working pressure of this boiler.

At this point Mr. Allen took up the subject of water used in boilers, showing that much solid matter carried in solution was precipitated by high temperatures. The carbonate of lime, sulphate of lime, carbonate of magnesia, aluminum, and other chemical ingredients, cause a hard, indurate scale, which adheres to the fire sheets of the boiler, greatly reducing the economy in fuel and rendering the plates liable to severe overheating and consequent great reduction of strength. This was illustrated by numerous specimens of scale taken from boilers in different sections of the country.

The internal corrosion of boilers was next discussed, showing that this was caused by impurities of the water. Manufactories situated on the banks of a stream, discharging their refuse and spent dyes into the current, render the water extremely impure. It will be readily seen that if those manufactories which are situated lowest down on the stream fill their boilers with this water, they will have a very impure and dangerous liquid from which to generate steam. Cases of severe and dangerous corrosion were mentioned as arising from this cause.

Specimens of corroded plate and braces were shown, where the iron was nearly wasted away, and yet it was stated that the parties owning the boilers had rested securely in the belief that their boilers are sound and well braced. These defects were discovered by careful inspection, a means of safety too often inadequately performed or neglected altogether.

The methods of inspection were next discussed, and it was stated that in all cases where it was possible, boilers should be examined internally as well as externally. Inspection by the "hammer test" was described, showing that a practiced ear, from light blows on the sheet, could detect defects in the material. The weaknesses arising from "the wear and tear" can only be discovered by the most careful internal and external inspection. Carelessness in the management of the safety valve was considered.

Instances of overloading safety valves far beyond the limit of safety were mentioned. In one instance, at least, a steam user was found to have wedged his safety valve down by driving a stick between the lever and the beams of the building overhead.

The principle of the steam gauge was described, and its importance in connection with the use of steam boilers. It is liable to defects and variations which can only be detected by comparing it with a gauge known to be correct. This process of comparison was illustrated by very unique apparatus, prepared expressly for use by the Hartford Steam Boiler Inspection and Insurance Company. The standard by which these test gauges are corrected is a mercury column, which is invariable and therefore reliable. The column in use at the company's office, which Mr. Allen described, is inferior to none in the country.

Mr. Allen next considered ebullition, the conduction of heat, and the generation of steam. These subjects were illustrated by diagrams prepared for the purpose, showing the great force which is stored up in the water in boilers, kept in place only by the superincumbent pressure of steam.

When this pressure is suddenly released, a great disturbance follows within the boiler. The water may be projected against the sides of the boiler at a velocity approximating 2,000 feet a second, which was considered sufficient in most cases to account for the terrific explosions which rend boilers in pieces, throwing portions of them hundreds of feet. Instances of terrific explosions were cited, and photographs illustrating them were exhibited.

Mr. Allen touched briefly upon the subject of the spheroidal condition of water, repulsion and deaerated water as the cause of mysterious (?) boiler explosions. His opinion, however, was that we need not look for mysteries in this manner, when we consider that there are so many things to decrease the ability and working age of a boiler, arising from poor material, poor workmanship, and careless management. He alluded briefly to the explosion of the boiler of the steamer Adelphi, at Norwalk, Conn., by which 16 lives were lost, and showed how this disaster might have been prevented by thorough inspection and timely repairs. This was illustrated by photographs and blackboard sketches and drawings.

The lecture closed with a brief history of the formation of coal, the carboniferous age, the wonderful growth of plants, the absorption of carbonic acid gas from the atmosphere, all energized by the rays of the sun, illustrating the words of Sir Robert Stephenson, who said that the energy in the coal was derived from the sun, the source of all power. The thinking mind, however, sees a power back and beyond all this, though science can go no further. We are on the boundary of the realms of faith.

Convict Labor.

First workman.—No; what I say is that no criminal ought to be allowed to work. 'Cause if he works he works cheap, and it knocks down your wages and mine.

Second workman.—Wal, I dunno—you see—

F. W. (quite warm)—There ain't no "see" about it! I tell you it degrades every human man's labor to have a State prison bird doing the same sort of thing fer a quarter of the wages. It ought to be forbid by law!

S. W.—Wal, I dunno; you see if—

F. W. (deeply excited)—Nonsense with your "ifs" and "buts" and "mebbies!" It's easy enough to see. If a lot o' chaps works fer 20 cents a day, you ain't goin' to get $2, be you? Not much! Don't it bring you right into competition with degraded culprit labor? D'ont it? Say! Don't it? Why don't you speak and say something?

S. W.—Wal, I dunno. Ain't it true that—

F. W. (furious)—No, it ain't true! They ain't a word of truth in it! You know ez well ez I do that—

S. W. (bristling up and interrupting)—Look a-here! You yaup every minute. 'Spose you jest shet your fly-trap tempo-ra-ri-o-ly and give me a chance to say a word.

F. W. (toning down)—Very well, ef you reely think you got anything to say thet amounts to anything, jest spill it.

S. W. (tuning up)—This ere: Ef prisoners don't work an' support themselves, somebuddy's got to work to s'port 'em.

F. W.—Wal, capital 'll support 'em.

S. W.—And who s'ports capital?

F. W.—Why—nothin'—it s'ports itself.

S. W. (laying his hand on the first workman's shoulder)—That's where you make your mistake. Labor s'ports capital.

F. W.—How do you make that out?

S. W.—If the State's prison don't s'port itself, it is s'ported by taxes. Whenever a property holder pays a tax he adds to the price of what he sells enough to reimbuss him. And labor eventooally pays every cent.

F. W.—It seems to me that if—

S. W. (now thoroughly aroused)—"Seems!" They ain't no "if" 'bout it! Any fool can see it! Somebody's got to pay that pris'ner's board. Ef he don't earn his own board, you an' I 've got to pay it out'n our wages.

F. W.—P'raps you're right. Ef thet's so, he might jest ez well go to work.

S. W.—And keep to work. Seems to me labor is degraded more by 'lowing a lot of rogues to shirk for the privilege of payin' their board, then by makin' 'em work at some price or other.

F. W.—But they work for less wages than we kin.

S. W.—But there's very few of 'em, and ez they work to pay the expense of keeping of themselves shet up, I don't see ez it makes much difference whether they earn a cent a day or $5 a day, ez fur ez we are concerned.

F. W.—But they shouldn't be let out on contract.

S. W.—Certin they should. They should be made to work, and their services should be let out to them that'll pay the most for it.

F. W.—Then sposen they earn more'n they cost?

S. W.—In that insposable case the surplus should be turned right into the State treasury.

F. W.—Ain't it demorlizin' and undignified for respectable folks to let their gov'ment be s'ported by the crim'nal classes?

S. W.—No, sir! It ain't! What awful stuff hev you got into your head? The more work you can git out of criminals the better! That's all they're good fer whilst they're bein' punished. Why, ef 'twan't fer the crim'nal classes there wouldn't be no need of gov'ment. Did you ever think of that? They ought to s'port it!

F. W.—That does look sort o' reason'ble after all. Why, that ain't wot that feller said down to the Union.

S. W.—Don't let anybody fool ye! Make all prisoners work jest as much as possible. It'll do 'em good. Make 'em earn ez much ez they kin, either under the superintendent or outside contracts. And remember that every cent a prisoner earns is jest so much in the pockets of the laborin' men.—*New York Graphic.*

American Locomotives in Switzerland.

English people are wanting work, and yet for some reason or want of it our locomotive builders allow a country nearly 2,000 miles farther away from Switzerland than we are to supply locomotives to that country. It is stated that the enterprise of our most energetic competitors in manufactures has sent a locomotive to Geneva specially in order to test its capabilities of producing steam from the anthracite coal found in the Valais. This cannot be used in Swiss or French locomotives, as at present constructed, but the experiment with the American appears to have been an entire success. The furnace arrangements of the American locomotive are said to be admirably adapted to the employment of this coal, which is not unlike, in its behavior in the fire, that used in America. The engine will run with fuel which would bring the ordinary continental locomotive to a standstill; and the system, if adopted in Switzerland and other parts of Europe, as some such doubtless will be, will effect an important saving in coal to those countries, and give work to others.—*London Engineer.*

THE ALHAMBRA VASE

The beautiful vase represented by our engraving was found in the Moorish palace, Alhambra, in the 16th century.

THE ALHAMBRA VASE.

It was filled with gold coins, the inscriptions upon which showed it to have been made not later than the beginning of the 14th century. The body of the vase is of dark terra-cotta, splendidly decorated with colored enamels and gold. It is regarded as the most valuable specimen of Moorish industrial art that has been preserved.

It will be remembered that at the time this vase was made the Moors of Spain monopolized almost entirely the civilization of Europe. Decorative art was especially encouraged among them, their skill excelling not only that of their most skillful rivals, but in many respects has never since been surpassed. Their most extensive potteries were situated at Malaga, where several thousand workmen were employed. The art of enameling was well understood there, as the Alhambra Vase so admirably shows, silica and the oxides of lead, tin, cobalt, etc., being used for such decorative purposes.

The Chesapeake and Delaware Ship Canal.

The surveys for the proposed canal across the peninsula of Maryland are being prosecuted with vigor. The Baltimore *Sun* says that very careful and accurate measurement of the tides in the two bays is being made, and it is a singular fact that when it is high water in the Delaware Bay it is low water in the Chesapeake.

Eight routes have been surveyed, and they all cross each other at some points, so that they may be modified indefinitely. This number, however, covers all the courses that can be called main routes. There is nothing new in the suggestion of this work; it has been often made, and for many years the intelligent portion of the population of both States has looked forward to the undertaking and accomplishment, under the developing influence of the necessities of trade, as a maritime improvement which sooner or later must occur. Foreign or coasting vessels coming to Baltimore through this canal would require no pilots, as the mouth of the Delaware Bay, unlike that of the Chesapeake, is freely navigable. There will be no locks, as in ordinary canals, to lift up or let down the boats. The ship canal will be nearly level throughout, and only guard locks will be required, which will be to regulate the entrance of tide water at each end, and the inflow of water from any rivers or streams which it may cross.

Australian Exhibitions.

Mr. Samuel H. Roberts, Hon. Corresponding Member of the Society of Arts, London, writes as follows: Preparations are being actively carried on for no less than three exhibitions. The International Exhibition at Sandhurst (one of our largest mining centers), to be held next year; a Juvenile Industrial Exhibition, also to be held next year in Melbourne; and the great International Exhibition of Melbourne, to be opened in 1880. Tenders for the building are to be opened next week. A splendid design has been prepared by the architects, Messrs. Reid & Barnes. The estimated cost of the building is between £60,000 and £70,000. The commission to carry out the undertaking consists of about fifty members, and they have just appointed J. C. Levey, C.M.G., as the secretary. I send circulars and programmes of the Sandhurst and the Juvenile Exhibitions. Those of the International Exhibition are not yet out, but are expected before the mails leave to-morrow. If they are issued I will send you them also.

There is also to be an exhibition in Sydney next year, and so many applications for space have been received, that the enterprise has assumed a magnitude not at first expected, and above the present means of the committee; it is, however, probable that the New South Wales Parliament will come to their aid with an adequate grant.

The question of Chinese immigration is agitating the minds of the people of Sydney and the northern portions of Australia. Public meetings have been held, and resolutions adopted, calling upon the government to take measures to restrict these in coming to the colony. One very serious result of the antipathy to the Mongol race is a strike of the seamen engaged by the Australian Steam Navigation Company, owing to the Chinamen being employed on some of their steamers, and the probability of the number being shortly increased; meanwhile the ships of the company are laid up for want of crews. The commerce of the port is, for the time, much injured by the dispute.

Large additions are in progress at the Melbourne University through the princely generosity of Sir Samuel Wilson, who has presented £35,000 to the institution. This good example has just been followed by Mr. Ormond, who has promised £10,000 toward building a Presbyterian College in connection with the University, on condition that an equal sum be subscribed within twelve months. As already £6,000 has been sent to the committee, there is no doubt as to the condition being fulfilled.

Money by Mail.

A correspondent offers the following suggestion with regard to an inconvenience widely felt. The plan proposed would doubtless prove as great a convenience to the receivers as to the senders of small sums by mail. The writer says:

"Now, since postal currency has gone out of use and dollar bills are getting scarce, we, in the country, need some mode of sending small sums of money by mail. The money order system is excellent, but the charge for sums less than one dollar is too high a percentage on the value of the thing wanted. I would suggest that postmasters be authorized to receive change in sums less than one dollar, and issue certificates for the same, which shall be receivable at any post office for stamps, or when presented in quantities of five dollars and over to be cashed. The certificates to be issued to postmasters in book form, and so printed that the piece torn off will represent the sum, the whole page representing one dollar. The certificates to be at the sender's risk. Postmasters to make returns when a book is used up. Such a system would facilitate trade between distant points and increase the revenues of the post-office department."

Railway up Vesuvius.

It is thirty years since a concession was granted for a railway up Vesuvius. It has been promised many times, but never so positively as now. The plan proposed involves the construction of an iron elevated railway about three feet high above the ground, on which is to run a train of eight cars operated by a steel cable. Each car is to be furnished with two automatic brakes. The cable will be double, in case of accidents. The actual tension on it will be 3,000 kilogrammes, but it will be made to support a tension of 33,000 kilogrammes. A small station with a restaurant will be constructed on the cone and another at the foot of the mountain. The ground has been chosen where there is least danger from an eruption, and all the material is movable, so that it can easily be taken up and stored in the observatory in case of eruption. It is expected that the railway will be completed before the summer of the present year.

ELECTRIC LIGHTING.

The problem of electric lighting is far from solution at present, and the popular enthusiasm and belief in the future of electricity as a means of general illumination has received some severe checks. The late accounts from Paris show that gas still competes successfully with the electric light for street purposes. The company, however, which is striving to introduce the new method of lighting are still sanguine of ultimate success, and the city authorities of Paris, anxious to stimulate discovery in such a popular direction, are still willing to encourage by small concessions and aids the plans of the inventors. Mr. Preece, a prominent English electrician, proves mathematically the impossibility of the ultimate subdivision of the electric light—the problem upon the solution of which so much inventiveness is now bestowed. The results of his mathematical analysis show that, beyond a certain limit, when n lamps are in the circuit the total light becomes diminished by $1 \div n$, and the light emitted by each lamp becomes diminished by $1 \div n^2$. This limit is reached by the Gramme machine when five Jablochkoff candles are placed in the circuit, and by the American Wallace-Farmer machine when six of their plate carbon lamps are burning at the same time.

The owners of the Brush machine, also of American make, claim that they have lately made a machine which maintains seventeen or eighteen lamps on the same circuit with an expenditure of only thirteen or fourteen horse power. This statement, however, should be accompanied by accurate tests, which do not appear to have been made. Mr. Preece maintains that this partial success has led many sanguine experimenters to believe in the ultimate subdivision of the electric light—that is, the maintenance of many small lights equal in intensity to four or five ordinary gas burners. He believes that such ultimate subdivision is an impossibility.

Mr. Schwendler, Superintendent Electrician of the Government of India, also has been making experiments upon the same subject, and arrives, from a practical point of view, at the same conclusion which Mr. Preece has reached from mathematical analysis. Mr. Schwendler thinks that each dynamo-electric machine or generator of electricity should maintain but one light, for it is only when one light is maintained by the generator that it is economical. Used in this way he finds that the unit of light produced by electricity is at least fifty times cheaper than the unit of light produced by combustion of coal, when the expenditure of power is alone considered. Endeavors to divide the electric light into a large number of small lights, however, he regards as futile; for nobody would be willing to pay for the luxury of such lights. These results seem to show that inventors should turn their attention to the production of small generators, one for each light, instead of to the problem of subdivision of the lighting effect of one current. The number of new lamps to be used in electric lighting increases each day.

M. Ducretet immerses several carbons in a column of mercury, and as the current burns away the carbons the difference of density produces a thrust which brings the carbons to their points of application in proportion to the amount they are consumed.

Mr. Wilde, in England, has shown that one can dispense with the fusible substance between the carbons of the Jablochkoff candle, for he places in his lamp the carbons at a slight angle, or parallel with each other, and the voltaic arc is repelled always to the tips or ends of the carbons. This is in accordance with Ampère's law, which shows that a current in a movable conductor is repelled by the parts of the current which approach and recede from it. In this case the voltaic arc itself is the movable conductor. The methods which have been criticised above all depend upon the production of the electric light between carbon points. The plans for utilizing electricity as a lighting agent by means of the incadescence of carbon in nitrogen, or the incandescence of platinum or iridium wire, have not been successful up to the present time, and are open to the same theoretical and practical objections as the method now in use.

One of the great difficulties in the way of solution of the problem of electric lighting is the want of training of the inventors and experimeters in accurate quantitative scientific work. Companies may be formed and great enthusiasm created by what are apparently great discoveries; but inventiveness must be supported by accurate tests made in a scientific manner to prevent the ruin of the stock companies; or rather of those deluded ones who have risked their money. Scientific men have often been too skeptical; but conservatism has great strength where money questions are involved.

A Revolution in Stone Cutting.

A revolution in stone cutting seems likely to be accomplished by a machine invented by Mr. R. R. Atchison of this city. It is operated by steam power, equivalent to that of a single horse; but it does the work of a dozen or more men, within a given time, in this laborious and unhealthy occupation, with the greatest accuracy and perfection. Heretofore it has seemed an impossibility to substitute machinery for hand labor in the preparation of stone for costly buildings; but, after four years of unremitting thought and labor, Mr. Atchison appears to have accomplished that result. Few persons, except those engaged in building operations, can realize the amount of labor required to prepare a single stone designed for the walls of a substantial building, or the cost of the same. Days, weeks, and even months, are sometimes expended in the cutting of a single block to the requisite dimensions; and, of course, large buildings, such as the post office, require the labor of years for their completion. By the use of Mr. Atchison's machine, great blocks of granite or other stone are smoothed with about the same rapidity that iron is planed by the well known machinery used for that purpose. The tools for cutting, two in number, are arranged in a strong head piece attached to a moving platen, similar to the iron planing machine. This platen, with the head piece, is made to move forward and backward over the stone, and the tools, having a perpendicular, reciprocal, rotating motion, cut the surface at the rate of not less than 6,000 blows per minute. The rapidity of this motion is said to be of great value in the use of the tools—the wear being much less than in hand work. The cutting tools are semicircular in shape at the edge, and can be used constantly for three quarters of an hour without changing—thus one set of tools will make more than a quarter of a million strokes without resharpening. The machine is very simple in construction and very substantial, and it is likely that it will work as great a change in the present methods of stone cutting as the sewing machine has wrought in the manufacture of clothing, or the power loom in the manufacture of textile fabrics. By adapting a movable arm, the tools are made to cut irregular forms, such as cornices, mouldings, and letters, with as much precision as they cut plain surfaces. In view of the magnitude of the quarrying business throughout the United States, and the perfect adaptation of this machine to stone cutting of every description, there would seem to be little doubt that Mr. Atchison's invention will rapidly make its way into public favor as one of the great labor saving inventions of the times.—*Boston Herald.*

ANCIENT WORKS OF PERU.

The feats of modern engineering in Peru are unexcelled in this age of ambitious undertakings; yet they are more than surpassed, on their own ground, by works that have been abandoned, if not in ruins, for untold centuries.

Dr. E. R. Heath furnishes an amount of detail on this point that will surprise even those generally familiar with the fact that Peru was once densely populated by a people given to cyclopean undertakings. Only a few can be cited here; but these will suffice to show that nothing of modern times, not even our thousands of miles of railways and canals, can begin to rival the achievements of those mysterious people who have passed away, leaving only these gigantic monuments to tell of their capacity and power.

Ruins, some of them of enormous extent, are scattered along the entire coast line of Peru, a distance of 1,235 miles, while nearly every hill and spur of the mountains have on it, or about it, some relic of the past; and in every ravine from the coast to the central plateau, there are ruins of walls, fortresses, cities, burial places, and miles and miles of terraces and artificial watercourses. Across the plateau and down the eastern slope of the Andes, into the unexplored, almost impenetrable forest, still they are found, mutely testifying to the successive empires that rose, flourished, and decayed where the desert and wilderness now prevail. Even more imposing are the vestiges of human wealth and power among the mountains, now almost uninhabitable for their altitude and the severity of the climate. Here the explorer finds cyclopean structures of granite, porphyry, and other rocks, which have resisted the disintegration of time, geological transformations, earthquake shocks, and the destructive hands of warriors and treasure-seeker. The masonry composing these walls, temples, houses, towers, fortresses, or sepulchers, Dr. Heath remarks, is uncemented, held in place by the incline of the wall and the adaptation of each stone to its place, the stones having from six to many sides, each dressed and smoothed to fit its neighbor with such exactness that the blade of a small penknife cannot be inserted in any of the seams, whether in the central parts entirely hidden, or on the internal or external surfaces. These stones, selected with no reference to uniformity in shape or size, vary from one half cubic foot to 1,500 cubic feet solid contents, and if in the many millions of stones one could be found to fit the place of another it would be purely accidental. In the wall of the center of the Cuzco fortress there are stones 13 feet high, 15 feet long, and 8 feet thick, and all were quarried miles away.

At Tiahuanaco, a few miles south of Lake Titicaca, there are stones in the form of columns, partly dressed, placed on line at certain distances from each other, and having an elevation above the ground of from 18 to 20 feet. In the same line there is a monolithic doorway, now broken, 10 feet high, and 13 wide. The space cut out for the door is 7 feet 4 inches high, by 3 feet 2 inches wide. The whole face of the stone above the door is engraved. Another, similar but smaller, lies on the ground beside it. These stones are of hard porphyry, and differ from the surrounding rock.

At Quelap some extensive works have been lately examined. Here is found a wall of dressed stone, 560 feet wide, 3,660 feet long, and 150 feet high. The lower part is solid. Above this is another wall, 600 feet long, 500 feet wide, and the same height as the other, 150 feet. Over both walls are niches, 3 feet long, and 1½ feet wide and deep, containing remains of those ancient inhabitants, some naked, others enveloped in shawls of cotton of distinct colors, and well embroidered. Their legs are doubled so that the knees touch the chin, and the arms are wound about the legs. The wall has three uncovered doors, the right side of each being semicircular, the left side angular. From the base an inclined plane ascends almost insensibly the 150 feet of elevation, having about midway a sentry box of stone. In the upper part there is an ingenious hiding place of dressed stone, having upon it a place for an outlook, from which a great portion of the province can be seen. Following the entrances of the second and higher wall, there are other sepulchers like small ovens, 6 feet high and 24 in circumference; in their base are flags, upon which mummies reposed. On the perpendicular, rocky side of the mountain on the north side is a brick wall having small windows 600 feet from the bottom. No reason for this, nor means of approach can now be found. The skillful construction of utensils of gold and silver that were found here, and the ingenuity and solidity of this gigantic work of dressed stone, are reasons for assigning it a pre-Incal date.

Imposing as structures of this sort are, they are, after all, but secondary in comparison with the industrial labors of the ancient Peruvians. The density of the population and the nature of the country—probably also the gradual desiccation of the region by geological changes—made it necessary to terrace the sides of the mountains and ravines for cultivation. Estimating 500 ravines in the 1,200 miles of Peru, and 10 miles of terraces of 50 tiers to each ravine, which would be only 5 miles of 25 tiers to each side, there would be in this region 250,000 miles of stone wall, averaging from 3 to 4 feet high, or enough to encircle our globe ten times. Surprising as these estimates may seem, Dr. Heath is convinced that actual measurement would more than double them, for these ravines vary from 30 to 100 miles in length, and 10 miles of terracing to each is a low estimate. At San Mateo, a town in the valley of the river Rimac, 77 miles from the coast, where the mountains rise from 1,500 to 2,000 feet above the river, he counted 200 tiers, none of which were less than 4, and many were more than 6 miles long. Even at 4 miles, there would be at that point alone 800 miles of stone wall, and that only on one side of the ravine.

Readers of Prescott will recall the splendid description he gives of the great highway of ancient Peru, an undertaking compared with which Meiggs' railways are but child's play. What were those ancient toilers, whom Dr. Heath eloquently describes as a people capable of cutting through 60 miles of granite, transporting blocks of hard porphyry, of Baalbec dimensions, miles from the place where quarried, across valleys thousands of feet deep, over mountains, along plains, leaving no trace of how or where they carried them; people ignorant of the use of iron, with the feeble llama their only beast of burden; who after having brought these stones together and dressed them, fitted them into walls with mosaic precision; terracing thousands of miles of mountain side; building hills of adobe and earth, and huge cities; leaving works in clay, stone, copper, silver, gold, embroidery, many of which cannot be duplicated at the present day—people apparenty vying with Dives in riches, Hercules in strength and energy, and the ant and bee in industry?

Who were they? Whence came they? Whither have they gone? Who among our rising students will solve these problems?

The Sale of Machinery Hall.

A striking illustration of the difference between cost and value is furnished by the recent sale of Machinery Hall, the second of the mammoth structures erected for the Centennial Exhibition. It comprised a main hall 360 feet wide and 1,402 feet long, with an annex 208x210 feet. Its original cost was $634,867.48. Had there been any permanent use for such a building there, its value would have been fairly measured by its cost. But no one could use it there, and few could make use of it anywhere, except as old lumber. It was accordingly knocked down at public auction for the pitiful sum of $24,000, a firm of car builders being the purchasers. The Japanese pavilion was sold for $150.

A New Chemical—Siliciureted Hydrogen.

We have received from Dr. Theodor Schuchardt, of Goerlitz, a specimen of a new body which he calls silicium strontium. It is formed from the preparation of metallic strontium by electrolysis, but no particulars are given as to the substances present or the reaction by which it is formed. As received from Dr. Schuchardt, the compound is a gray powder with a slight odor resembling phosphureted hydrogen. When mixed with dilute hydrochloric acid, a rapid evolution of the spontaneously inflammable siliciureted hydrogen takes place. No particulars as to price are mentioned, but, if obtainable in quantity, this compound will probably be the readiest source of siliciureted hydrogen.—*Chemical News.*

TO INVENTORS.—THE GREAT WANT.

In a recent address by Professor Atwater, of Middletown, Conn., before the Farmers' Meeting at Concord, N. H., he said that the great want of agriculture at the present time is nitrogenous manures or fertilizers. This is the most costly element that the farmer has to buy. Four fifths of the atmosphere around us is composed of nitrogen; and the man that discovers a way of obtaining it from the air, at a small expense, will be the greatest material benefactor that the world has ever produced.

ACCORDING to Dr. Richardson, hot water at 120° Fah. will kill typhus germs, and soap acts as a poison to them. The remedy against typhus, then, is to be found in every house hold, and more's the pity if it be not applied. Considering the deadly nature of this fever, and the fact that 50,000 typhus germs will thrive in a space no bigger than a pin's head, it is clear, the *Christian at Work* thinks, that in such a matter a quart of prevention is worth several hogsheads of cure.

TO INVENTORS.

An experience of more than thirty years, and the preparation of not less than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly, the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent complete—including the model—to the Patent Office the same day the papers are signed at our office, or received by mail, so there is no delay in filing the case, a complaint we often hear from other sources. Another advantage to the inventor in securing his patent through the Scientific American Patent Agency, it insures a special notice of the invention in the SCIENTIFIC AMERICAN, which publication often opens negotiations for the sale of the patent or manufacture of the article. A synopsis of the patent laws in foreign countries may be found on another page, and persons contemplating the securing of patents abroad are invited to write to this office for prices, which have been reduced in accordance with the times, and our perfected facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion—about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

National Steam Pump; best and cheapest. National Iron Works, New Brunswick, N. J.

Valves and Hydrants, warranted to give perfect satisfaction. Chapman Valve Manuf. Co., Boston, Mass.

Circulars for Inventors and Manufacturers. Pamphlets on machinery, price lists, etc., written, illustrated, and printed; estimates furnished. Park Benjamin, Ph. D., Editor Appleton's "Cyclopædia of Applied Mechanics," 37 Park Row, New York.

To Sell.—Canada Pat. for Burglar Alarm. Winn, 69 Barclay, N. Y.

Marine Governor.—No racing of propeller; uses no power or steam. Wanted capitalist to get patents. E. Side, Brooklyn, E. D., N. Y.

Try the new fragrant Vanity Fair Cigarettes, both plain and halves. Most exquisite of all.

Electro-Bronzing on Iron. Philadelphia Smelting Company Philadelphia, Pa.

Scroll Saws for sale cheap.—Five Moyer's patent at half cost to manufacture. Address Wood, Smith & Co., Fort Plain, N. Y.

Asbestos is now extensively used in various forms for steam packing. It possesses the advantages over all others of being indestructible by fire or acids, is self-lubricating and will wear ten times as long as the packing made of hemp or cotton. The flat packing is rapidly taking the place of all others for cylinder heads and all kinds of flange joints. Samples and reduced price lists will be sent free on application. H. W. Johns Manufacturing Company, Manufacturers of Asbestos Materials, 87 Maiden Lane, New York.

No gum! No grit! No acid! Anti-Corrosive Cylinder Oil is the best in the world, and the first and only oil that perfectly lubricates a railroad locomotive cylinder, doing it with half the quantity required of best lard or tallow, giving increased power and less wear to machinery, with entire freedom from gum, stain, or corrosion of any sort, and it is equally superior for all steam cylinders or heavy work where body or cooling qualities are indispensable. A fair trial insures its continued use. For further particulars, samples and testimonials, address E. H. Kellogg, sole manufacturer, 17 Cedar St., New York.

Two of the handsomest and best Guns ever brought to this country but little used, for sale for less than half their cost. One a double-barreled breech-loading shotgun, and the other a double express rifle. A rare chance to procure two valuable weapons. See advertisement on back page.

Wanted.—Lightest practicable 4 H. Vertical Engine and Boiler. W. S. Hull, Jackson, Miss.

For Sale cheap.—Boilers and Engines of all descriptions in thorough good condition. Send Stamp for descriptive circular. E. R. Young, No. 68 and 70 Franklin St., Titusville, Pa.

For Sale.—4 H. P. Vertical Engine and Boiler (New York Safety Steam Power Co.'s make), as good, and in some respects better, than new. Address H. M. Quackenbush, Herkimer, N. Y.

Patent or State Rights for sale.—Stafford's Scroll Saw, very low, also tools and patterns, to good party, to manufacture on royalty. See SCIENTIFIC AMERICAN, April 6, 1878. N. Stafford, 66 Fulton St., New York.

Vick's Illustrated Monthly Magazine is one of the most beautiful magazines in the world. Each number contains a chromo of some group of flowers, and many fine engravings. Published monthly at $1.25 per year. Address James Vick, Rochester, N. Y.

Wanted—Machinery for Manufacturing Logwood Extract. Address E. Koch, Franklin, La.

A Cupola works best with forced blast from a Baker Blower. Wilbraham Bros., 2,318 Frankford Ave., Phila.

For Sale.—Patent of the best Ice Cream Machine, the "Dexter." Any reasonable offer considered. Address C. L. Dexter, 245 S. 15th St., Philadelphia, Pa.

Shaw's Noise Quieting Nozzles and Mercury Pressure Gauges. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

For Steam Pumps send to Dean Bros., Indianapolis, Ind.

Little Giant Screw Plates, Adjustable Dies, Taps, etc. Wells Bros., Greenfield, Mass.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Vertical Burr Mill. C. K. Bullock, Phila., Pa.

Corliss Engines. Watts, Campbell & Co., Newark, N.J.

Catalogues and Circulars of our latest Scientific Publications, mail free. E. & F. N. Spon, 446 Broome St., N.Y.

Case Hardening Preparation. Box 73, Willimantic, Ct.

H. Prentiss & Company 14 Dey St., N. Y., Manufs Taps, Dies, Screw Plates, Reamers, etc. Send for list.

Needle Pointed Iron, Brass, and Steel Wire for all purposes. W. Crabb, Newark, N. J.

Belcher & Bagnall, 25 Murray St., N.Y., have the most economical Steam Engines, Boilers, Pumps, in market; also improved wood and iron working machinery.

Hydraulic Elevators for private houses, hotels, and public buildings. Burdon Iron Works, Brooklyn, N. Y.

For Sale Cheap.—Second-hand 8 foot Boring and Turning Mill, Lathes, Planers, Drills, Bolt Cutters, etc. Circulars. D. Frisbie & Co., New Haven, Conn.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

For Sale.—Brown & Sharp Universal Milling Machine; Bement Profiling Machine; first-class 2d hand Machine Tools. E. P. Bullard, 14 Dey St., N. Y.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

Galland & Co.'s improved Hydraulic Elevators. Office 206 Broadway, N.Y., (Evening Post Building, room 22.)

The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are to be sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Bevins & Co.'s Hydraulic Elevator. Great power, simplicity, safety, economy, durability. 94 Liberty St. N.Y.

Pulverizing Mills for all hard substances and grinding purposes. Walker Bros. & Co., 23d & Wood St., Phila., Pa.

Inventors' Models. John Ruthven, Cincinnati, O.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Band Saws, $100; Scroll Saws, $75; Planers, $150; Universal Wood Workers and Hand Planers, $150, and upwards. Bentel, Margedant & Co., Hamilton, Ohio.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

Eagle Anvils, 9 cents per pound. Fully warranted.

The best Friction Clutch Pulley and Friction Hoisting Machinery in the world, to be seen with power applied, 95 and 97 Liberty St., New York. D. Frisbie & Co., New Haven, Conn.

Johnson's Universal Lathe Chucks; the best are the cheapest. Lambertville Iron Works, Lambertville, N. J.

Cutters shaped entirely by machinery for cutting teeth of gear wheels. Pratt & Whitney Co., Hartford, Conn.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Best results obtained from Success Turbine Water Wheel. References given. S. M. Smith, York, Pa.

Vertical & Yacht Engines. N.W.Twiss, New Haven, Ct.

Dead Pulleys that stop the running of loose pulleys and their belts, controlled from any point. Send for catalogue. Taper Sleeve Pulley Works, Erie, Pa.

NEW BOOKS AND PUBLICATIONS.

THE WORKSHOP. Von J. Engelhorn, Editor and Publisher. Stuttgart, Germany.

An edition of this meritorious illustrated art monthly is now being published in English, and furnished to the American public by Messrs. Willmer & Rogers of this city. For furniture manufacturers, decorators of dwellings, and public buildings, fabricators of gas fixtures, fireplace utensils, ornamental hardware, such as door knobs, hinges, locks, etc., this publication will be found of special interest and use. Every number contains beautifully executed engravings of new patterns or copies of antique designs of various periods from the most celebrated specimens found in the continental museums. Published in monthly parts at $6 a year (50 cents single number), and may be had at the Willmer & Rogers News Company, Beekman st., New York.

THE ART INTERCHANGE.

A fortnightly journal devoted to art and household decorations. The mania existing among the more refined American women for executing fine needle work, painting on china, ornamenting panels for furniture, embroidering curtains, and a variety of other work coming under the head of decorative art, has created a demand for a newspaper to be devoted to these various subjects. Under the auspices of a dozen well known ladies in this city, and under the editorial management of an energetic and talented young graduate of Princeton College, the publication of *The Art Interchange* has been commenced, with very encouraging prospects of a successful existence. It is handsomely printed on a superior quality of paper, at the moderate price of $1 25 a year, and will be found extremely interesting to those interested in woman's art work in all its branches. Persons desiring to subscribe or to know more of the publication, should address *The Art Interchange*, No. 34 East Nineteenth street, New York.

Notes & Queries

(1) J. H. asks how to prepare battery salt for Grenet batteries. A. It may be prepared by triturating together in a dry atmosphere—

Potassium dichromate, about..... 4 pounds.
Sulphuric acid, sp. gr. 1·8, about..... 1 "

The dichromate should be perfectly dry, and the acid may, with advantage, be warm. The mixture should be kept from the air in glass, to preserve it in the dry state, as it is very hygroscopic. Its oxidizing action is so strong that it very quickly destroys organic matters by contact at ordinary temperatures.

(2) E. R. writes: Suppose two locomotives in which the only difference is six drivers (one having 5 foot, the other 6 foot wheels), using the same amount of fuel and consequently of steam. Which will pull the greater load at 30 miles an hour, friction, etc., not being considered? A. We reply that, the steam being the power, and the quantity of steam being equal in both cases, there can be no difference in the loads at 30 miles an hour. We do not, however, desire to be understood as saying that there is no difference in engines with 5 and 6 foot driving wheels. On the contrary, we believe a locomotive, properly handled, having 5 foot driving wheels, when unrestricted as to fuel and not confined to a uniform velocity, will take the largest load over an undulating track in a given time between terminal stations. Such an engine will have the advantage on grades over an engine with larger driving wheels; and the more frequent exhaust produced by the more rapid revolution of the 5 foot wheels will produce more steam, and consequently more power.—B., P., W. & Co.

(3) L. H. R., F. S., and others.—The dimensions of the great electro-magnet at the Stevens Institute, at Hoboken, N. J., are as follows: Total weight, 1,600 lbs.; coil wound on 8 spools, each 9½ ins. high by 11½ inches external diameter; 400 lbs. of copper wire, one fifth inch in diameter, are wound on these spools, which are split and the slits filled with vulcanite; the iron cores are hollow, 6 inches in diameter, 3 feet 3 inches long. It has a lifting power of several tons; some have estimated it at 30 tons.

(4) W. C. R. asks: 1. What pressure should the air have in a sand blast apparatus? A. Sand should be driven by an air blast having a pressure of about 4 inches of water. 2. Is it made by ordinary circular fan? A. Yes. 3. Is the sand let into the air passage from a hopper of its own gravity? A. The sand is introduced into the air passage by an endless belt carrying cups or scoops.

(5) J. F. B. writes: 1. There appears in your SCIENTIFIC AMERICAN SUPPLEMENT, No. 157, an article on inks, in which appears "A Brilliant Red Ink." I boiled the compound as directed, but did not succeed in getting it very bright. Would you please inform me the reason, and give a recipe for making vermilion ink or red ink (not carmine)? A. Use more or better Brazil wood, and concentrate your solution. Aqueous solutions (strong) of aniline red or scarlet make very brilliant, but, unfortunately, not very permanent red inks. Powdered cochineal, 1 oz.; hot water, ½ pint; digest, and when quite cold add ammonia water, 1 oz.; dilute this with 2 or 3 volumes of water, digest for a few days, and decant the clear liquid.

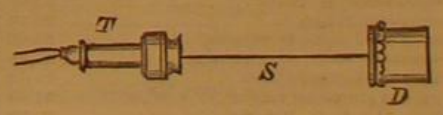
2. How to correct sour sirup. A. Heat the sirup to the boiling point, strain through a piece of linen, and stir in a little calcium sulphite; or, filter the hot sirup through fresh boneblack.

(6) Subscriber asks: Where will I find Edison's tasimeter described? A. In SCIENTIFIC AMERICAN, vol. 38, p. 385.

(7) N. T. R. asks why it is that malleable castings, heavy ones especially, are nearly always full of flaws and blow holes. A. We do not think this statement is generally true. When such flaws occur, as a rule, it is on account of some deficiency on the part of the mould, the moulder, or the material used.

(8) F. B. H. asks: What amount of Lehigh or other hard coal is necessary per day to heat 1,000 cubic feet in first-class stone building with any of the best hot air heaters? I want the average, or as near as you can give it, weather such as we have had since December 1, 1878. A. If the building has only to be heated in the day time, we think it might not require more than 100 pounds of coal in 24 hours. We should be glad to receive data on this subject from those of our readers who have kept records.

(9) J. F. B. suggests the following experiment to show that the action of a telephone diaphragm is to all appearances a mechanical pulsation. T is an



ordinary telephone, to the center of whose diaphragm is attached one end of a waxed string, S (which may be 10 or 20 feet long), by first stringing through a piece of parchment about one half inch in diameter, knotting, and then gumming on to the middle of disk, it is secured: the other end is connected with a small parchment drum, D, 2 inches in diameter; the string is kept taut. A sound now produced in the sending telephone will be distinctly heard in the drum connected with the receiving telephone, and conversation can be kept up at the drum, D, not as clear, of course, as at the receiving telephone, but the results are sufficiently conclusive, for no sound could be transmitted along the stretched string unless the telephone plate had vibrated. This I might venture to say, goes to prove that the sound at the receiving telephone is due to the attraction of the diaphragm by the magnet, in virtue of its variation of magnetism.

(10) E. B. sends the following directions for drilling glass: Take a common drill, run a little fast; do not press on, the weight of the drill press is enough. Drill from both sides, keeping the glass and drill wet with turpentine. Be very careful when the two holes meet not to let the drill catch. After a hole is made large enough for a small round file, file to the desired size, keeping the file and glass wet with turpentine.

(11) J. H. P. asks: 1. If I drop the end of a telephone wire into a well of water, or into a tub of water through which a stream is constantly running, will it constitute a sufficient ground connection? A. Yes. 2. Will fine brass or copper wire the size of a common pin answer for the line wire? A. Yes. 3. Does it require to be insulated, the distance being 400 feet? A. It should be supported on insulators. 4. Will such a wire connecting two houses be a source of danger during thunderstorms? A. It would be prudent to employ lightning arresters. 5. Are the phonograph and the carbon telephone now in the market? A. Yes. 6. Why does condensation take place in a stove pipe? A. It is usually owing to a great length of pipe between the stove and chimney, which condenses the vapors resulting from combustion before they can escape.

(12) G. S.—To prepare good cider, choose ripe, sound apples, sweat them in small heaps for a few hours, and wipe dry. Then grind them, place the pomace between layers of clean straw, or preferably hair cloth, in a suitable screw press, and apply the pressure. As the juice runs from the press strain it through a hair cloth sieve into a large open cask capable of holding all the juice to be expressed in one day. In a day, or sometimes less, the pomace will rise to the top and grow very thick. When little white bubbles break through it draw off the liquid through a spigot placed about 3 inches above the bottom, leaving the lees behind. The cider must be drawn off into very clean casks, and repeatedly racked off until the first fermentation is over, which is known by no more of the white bubbles, before mentioned, forming. Then add a goblet ful of sweet oil to each cask, fill it up with cider in every respect like that contained in it, and bung up tight. Sugar or glucose is sometimes added at this stage—8 to 15 pounds to the barrel, according to the character of the apples used—sweet or sour. When the cider has attained the proper taste, add one quarter to one half pound of isinglass dissolved in some of the cider, and then about one quarter pound (not more) of freshly prepared sulphite of lime (common preserving powder), and draw off, after shaking and allowing to settle, into very clean barrels, or bottle. The sulphite (which must not be mistaken for *sulphide*) preserves the cider perfectly.

(13) R. N. asks if ferrocyanide of potassium is made in this country, and what is the process of manufacture. A. Yes. It is usually prepared by heating to redness potassium carbonate with dried and partially carbonized horn, or other similar nitrogenous substance, and iron filings, digesting the black mass with hot water, from which the salt is afterward crystallized and purified by recrystallization. The proportions may be: 100 of potassium carbonate, 400 of nitrogenous coal, and 10 of iron filings. The furnaces used are somewhat similar to those illustrated on p. 33, Wagner's "Chemical Technology."

(14) J. B. W. writes: I wish to ask if it is a fact generally known that the sun when in partial eclipse casts shadows similar in shape to that part of the sun not eclipsed; in other words, when the sun looks like a new moon all shadows are new-moonlike in shape? A. Under favorable conditions the light from the sun, shining through a small opening in an opaque body, will form an image of the sun on the surface upon which it strikes. When the sunlight falls through the foliage of a tree, multiplied images of the sun will appear. These images during an eclipse will, of course, take the form of the visible portion of the sun.

(15) C. W. G. writes: I have an old cistern (cemented) about 6 feet deep by 6 feet in diameter (round. If I pack it with ice will the ice keep, or would the heat get at it through the ground? It is mostly under ground, and in a shady place. The cement is whole and good. A. We think this arrangement would not prove very economical. You will find much useful information respecting the preservation of ice in Nos. 38, 55, 99, and 116 SCIENTIFIC AMERICAN SUPPLEMENT.

(16) H. A. M. asks: What shall I use to black brass, and so that it will not peel when bent? A. Dip the articles bright in nitric acid, rinse in clean water, and place in the following mixture until they turn black: Hydrochloric acid, 12 lbs.; ferrous sulphate (copperas), 1 lb.; arsenious acid (white arsenic), 1 lb. When taken out, rinse in cold water, dry in sawdust, and polish with blacklead or lacquer as desired.

(17) H. C. W. asks: 1. How shall I melt the paraffine to be used as a coating on the plaster of Paris cylinder for the phonograph described in SUPPLEMENT No. 133? A. Make the plaster quite warm, and rub on the paraffine as long as it will melt and soak in. 2. I wish to know whether it will make any difference in the power of common horseshoe magnets to rivet a number of them together? A. A compound magnet is stronger than a single one of the same size, but its strength is not equal to the combined power of the several magnets of which it is composed when they are separated.

(18) A. M. P. asks: In transmitting messages by the telephone long distances, say 100 miles or more, is a battery with electricity used to transmit the message? A. A battery is used with Edison's telephone. Bell's requires none.

(19) A. B. asks: 1. What is the difference between the actual falling velocity of water and its theoretical falling velocity? A. Little, if any. 2. If a broad belt pass over two pulleys 12 feet apart, one above the other, and upon this belt at short intervals are fastened buckets similar to flour elevators, and 10 feet from the bottom of the lower pulley a jet of water fills these buckets as they pass, so that the combined weight of the buckets from where they are filled to the bottom of the lower pulley, where they are emptied, is 1,000 pounds, and this weight thus acting causes the upper pulley, which is 50 inches in diameter, to make 70 revolutions per minute when meeting with no resistance, what is the horse power of this pulley? Now, if the pulley is made to drive machinery, so that its speed is reduced one half, the weight remaining the same, is the horse power the same, or only one half of what it was in the first case? A. The horse power is the weight in pounds multiplied by the distance in feet it moves per minute divided by 33,000. So that, when the speed is decreased to one half, the horse power is diminished in the same proportion.

(20) T. B. L. asks: Will the temperature of the inside of a mass of ice fall much, if any, below the freezing point, notwithstanding the surrounding atmosphere may be at zero, or below zero? A. Yes. The temperature of the ice under the conditions assumed would vary with the temperature of the surrounding air in common with other solids of a similar nature, under similar conditions.

(21) M. J. H. writes: 1. I have tried the receipt given in one of your late issues for making gelatine moulds for plaster castings. The mould is a success, but the face of the cast is destroyed by the glue. Can you tell me how to overcome this difficulty? A. Coat the mould uniformly with a film of oil. 2. Could you

give a receipt for painting plaster casts, so as to render them impervious to the action of the weather? A. They are warmed and saturated with melted stearine or paraffine wax. The former is preferable. Soluble glass is also used.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

F. W. D., Jr.—No. 1. Bornite—composed of sulphur 25, copper 63, and iron 12 per cent. No. 2. Epidote—silica 37, aluminum 23, iron oxide 14, magnesia 23, and water 3 per cent.—M. T. F.—It is not tin ore. The quartz contains augite and epidote.—S. H. M.—The ore contains a large amount of manganese oxide. Its value can only be ascertained by assay. It is worth assaying.—J. K. M.—No. 1. Marcasite—iron 46, sulphur 54 per cent. Not an iron ore. No. 2. A ferruginous clay slate of little value. No. 3. An impure steatite or soapstone. No. 4. This ocher, if properly ground and calcined, may have some market value. No. 5. An impure limonite iron ore.—F. and M.—It contains gold, of the variety known in works on mineralogy as "foel's gold" or iron pyrites—composed of iron and sulphur. E.B.S.—It is not sulphur as suggested, but iron sulphate, arising from the decomposition of pyrites. It is soluble in water, from which it crystallizes upon evaporating the solution slowly. It is used extensively in the arts.—J. C. U.—The crystals are quartz; when small and perfect they are sometimes employed as cheap imitation diamonds.—J. A. W.—It is zinc blende, of good quality, containing small amounts of cadmium.—Z. Y. X.—The small button consists chiefly of metallic iron.—W. J. B.—It is quartz.—L. H.—The quartz contains a notable amount of silver, copper, and traces of gold. An assay would be requisite to determine the precise value of the ore.—Poughkeepsie—No. 1. Gray limestone. No. 2. An impure pipe clay—suitable for drain pipes, cheap pottery, tiles, etc.—J. B.—It consists chiefly of iron sesquioxide, organic matters and clay, of little value.—J. B.—It contains no silver. The crystals are iron sulphide-pyrites.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

On Watch Making. By D. B. F.
On the Work of Rats. By H. J. M.
Manufacture of Watches. By D. B. R.
Aerial Navigation. By C. M.
On the Captive Balloon. By A. C. M.
On Writing Mediums. By M. L. B.

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FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

January 21, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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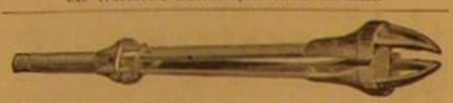

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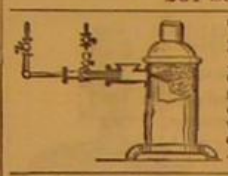

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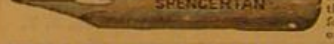

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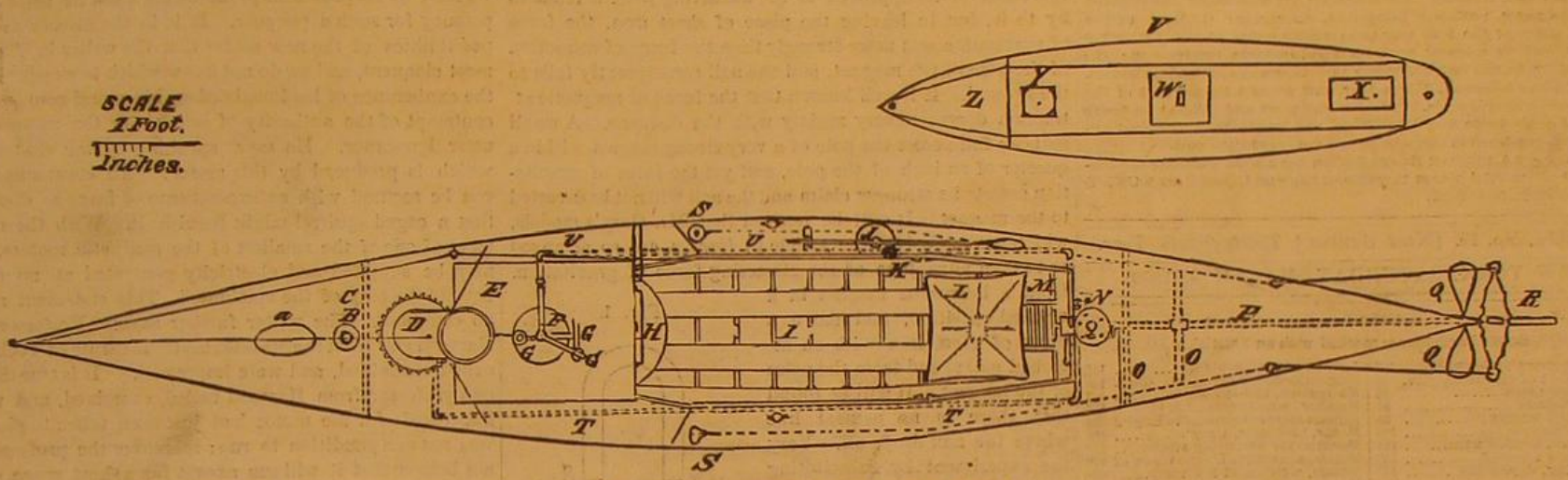
Vol. XL.—No. 10. [NEW SERIES.] NEW YORK, MARCH 8, 1879. [$3.20 per Annum. [POSTAGE PREPAID.]

THE SMALLEST STEAMBOAT IN THE WORLD.

We illustrate herewith the steam canoe Nina, designed and constructed by Mr. J. Davidson, of this city, at Fordham, N. Y. Several unsuccessful attempts have been made in England to construct a steam or electric craft designed to carry one person, but all failed in some essential point, and it was left for an American to solve the problem, and it has been done in an original manner

The keel length is 13 ft., over all 14 ft.; width, 28 in.; draught at bow, loaded, 6 in.; aft stern, 8 in. The boiler is circular, of copper, felt-covered, 20 in. long by 17 in. diameter; fire-box, 10 in. diameter, of cylindrical form, with 22 transverse tubes, in two tiers, the lower ones constituting the grate.



PLAN OF THE STEAM CANOE NINA.

Stroke of engine 2¾ in. The feed pump is worked by hand. There are two propellers, three-bladed, of 9 and 14 in. diam.; for shoal or deep water; 1½ buckets of fine coal a day is required. With steam at 50 lbs. it runs very smoothly at 4½ miles per hour, but with a steel boiler, now planned to carry 100 lbs., a speed of 5½ miles will easily be obtained.

The hull is of the Nautilus pattern, built of hickory, oak, and cedar, copper-fastened throughout, a marvel of strength and lightness. Two water-tight bulkheads float it if swamped or capsized. A rubber pipe with live steam quickly clears any accumulation of water in the hold. The funnel is jointed, to turn down when running under low bridges or while in the boat house. When on an extended cruise all extra fuel, tools, provisions, etc., are carried in the small air-tight tender, which is towed behind, or fastened alongside by a simple contrivance, to serve as an outrigger in rough water; it also carries, in sections, a small truck, on which the boat can be drawn ashore or launched.

The weights are as follows: Hull, 90 lbs.; boiler, 80 lbs.; engine, 25 lbs.; piping, shaft, propeller, pump, steam gauge, etc., 20 lbs.; total, 215 lbs. Forty pounds of fine coal in 5 lb. canvas bags can be stowed each side of the boiler. The steering gear consists of a stirrup on the port side, and spring coil on the starboard; wires run under the deck to the rudder yoke, so that steering is done with the foot, leaving the hands free to manage the furnace and tend the engine, which is regulated by a valve at the right, under the engineer's hand, so that starting, stopping, backing, and steering are all accomplished without moving from the seat.

For quiet river or bay cruising this boat is admirably adapted, and would prove a source of pleasure and study to any one fond of machinery and desirous of being his own captain, crew, and engineer. The cost of this neat little steamer is $250, but much of this can be saved by the designer doing portions of the work himself.

A Novel and Curious Instrument—The Telectroscope.

M. Senlecq, of Ardres, has recently submitted to the examination of MM. du Moncel and Hallez d'Arros a plan of an apparatus intended to reproduce telegraphically at a distance the images obtained in the camera obscura. This apparatus will be based on the property possessed by selenium of offering a variable and very sensitive electrical resistance according to the different gradations of light. The apparatus will consist of an ordinary camera obscura containing at the focus an unpolished glass and any system of autographic telegraphic transmission; the tracing point of the transmitter intended to traverse the surface of the unpolished glass will be formed of a small piece of selenium held by two springs acting as pincers, insulated and connected, one with a pile, the other with the line. The point of selenium will form the circuit. In gliding over the surface, more or less lightened up, of the unpolished glass, this point will communicate, in different degrees and with great sensitiveness, the vibrations of the light. The receiver will also be a tracing point of black lead or pencil for drawing very finely, connected with a very thin plate of soft iron, held almost as in the Bell telephone, and vibrating before an electro-magnet, governed by the irregular current emitted in the line. This pencil, supporting a sheet of paper arranged so as to receive the impression of the image produced in the camera obscura, will translate the vibrations of the metallic plate by a more or less pronounced pressure on that sheet of paper. Should the selenium tracing point run over a light surface the current will increase in intensity, the electro-magnet of the receiver will attract to it with greater force the vibrating plate, and the pencil will exert less pressure on the paper. The line thus formed will be scarcely, if at all, visible; the contrary will be the case if the surface be obscure, for, the resistance of the current increasing, the attraction of the magnet will diminish, and the pencil will leave upon it a darker line.

THE STEAM CANOE NINA THE SMALLEST STEAMBOAT IN THE WORLD.

Scientific American.

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NEW YORK, SATURDAY, MARCH 8, 1879.

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VII. MISCELLANEOUS.—A Nut for Congress to Crack. By P. H. WATT.—Effect of Ocean Currents.

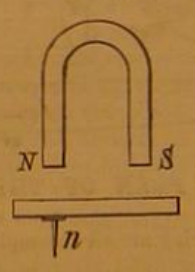
GARY'S MOTOR.

He who credits the statements concerning Gary's motor, contained in an article in the March number of *Harper's Magazine*, can readily believe in the wonders of that division of China where the rivers run up the mountains, the moon outshines the sun, and the cats have the power of elephants. He can, moreover, add to this belief a feeling of utter contempt for scientific men. Faraday, Rumford, Joule, and Helmholtz have lived in vain. Their work can be demolished by the simplest use of tenpenny nails and a few magnets combined with the use of a piece of sheet iron.

It would be difficult to find such utter ignorance of the first principles of science as is contained in this article on Gary's motor; it encourages men to spend time and money in fruitless effort, and at the same time to despise all training. The allegation is made that scientific men are slower than the general public to acknowledge a new step in advance; and the discovery of the neutral line, the principle of Mr. Gary's motor, together with the near possibilities of the grand discovery, are affirmed in an *ex cathedra* manner by one whose own statements show that he has no knowledge of the subject of which he speaks.

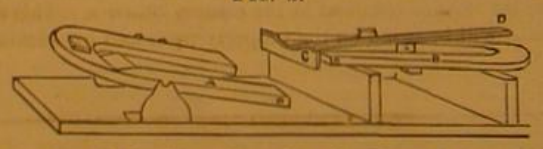
Mr. Gary's discovery of the neutral line is not a discovery. There is no neutral line in the sense that the polarity changes when Mr. Gary moves his piece of sheet iron with its attached shingle nail across the pole or near the pole of a magnet. The most delicate instruments fail to detect such a change of polarity. Mr. Gary is perfectly right in his description of the behavior of the nail: at a certain point it leaves the sheet iron and falls to the ground, simply because, by reason of its approach to the attracting pole, it tends to fly to it, but in leaving the piece of sheet iron, the force of gravitation acts more strongly than the force of attraction of the pole of the magnet, and the nail consequently falls to the ground. It is well known that the force of magnetic attraction decreases very rapidly with the distance. A small nail can fall across the pole of a very strong magnet within a quarter of an inch of the pole, and yet the force of gravitation asserts its stronger claim and the nail will not be diverted to the magnet. It will be noticed that Mr. Gary's models, which are figured in the article in *Harper*, are so arranged as to take advantage of the attracting force of gravitation. Hold a horseshoe magnet in a vertical position, and move a piece of sheet iron with an attached nail to and from the poles of the magnet. It will be found that there is no neutral line where the nail drops off. Vary the experiment by substituting an iron wire for the piece of sheet iron, and with an attached nail explore the space in front and beside the poles, and it will be found that the nail shows no evidence of a neutral line. Slip a small coil of wire along the wire or sheet iron, and connect its terminals with a delicate galvanometer; if there is any change of polarity, the galvanometer needle should be diverted first in one direction, then in another, as you move the sheet iron or the wire away from complete contact with the poles; no such change of deviation will be perceived.

Fig. 1.



In Fig. 2 the magnets are set in motion by vibrating, with the aid of a lever, a piece of sheet iron, so that it may "move

FIG. 2.



on the neutral line," as the writer in *Harper* expresses it. This acts as a cut-off, and one of the two opposing horseshoe magnets drops from its former position, where it was held by mutual attraction. Let us see what is the cause of this action. Place a horseshoe magnet on the table, and bring a compass needle directly in front of one of the poles of the horseshoe magnet. The compass needle will be strongly attracted to the neighboring pole. Now bring a thin piece of iron in front of the poles of the horseshoe magnet and between them and the compass needle; the latter will immediately dip, and will have its attraction for the pole of the horseshoe magnet diminished, not because the sheet iron acts as a cut-off for magnetism, but because the poles formed by induction in the thin sheet iron are nearer the end of the compass needle, and accordingly exert their influence. Here we see again the effect of proximity. Magnetic action acts through very short distances, and the nearest magnetic mass exerts more influence than a remoter one, which may nevertheless be the stronger magnetic body. Mr. Gary experiments with a box compass. The indications obtained in this way are apt to be very misleading, and the use of such a method was abandoned by scientific men more than forty years ago. The friends of the new magnetic motor have only to consult the experiments of Jamin, of Dub, and a host of others to discover that what are claimed to be new facts have long been known and discussed under the head of distribution and redistribution of magnetism caused by armatures to magnets and the presence of iron in the neighborhood of magnets. Abundance of time and patience to look up the subject will be needed, for the literature of the subject is immense.

Let us now consider the possibilities of the application of these well known facts; for it may be said, "Explain the neutral line as you may, there is still an important application of the force of magnetism in the invention of Mr. Gary." It is said that this little motor requires a careful adjustment of the fine pivots upon which the movable magnet turns, and particles of dust are sufficient to bring it to rest. The excursions of the so-called cut-off are limited to the one twentieth or one thirtieth of an inch, and a fine adjustment is also needed here. This is the motor which is to produce the electric light and to drive locomotives across the continent. The line of argument of the inventor's friends is very striking, and deserves notice. In the article in *Harper*, which we have taken as our text, the writer says: "To gain a large amount of power the inventor would place groups of compound stationary magnets above and below the beam at each side, and the soft iron induced magnets, in this case four in number, connected by rods passing down between the poles of the stationary magnets. A 'pitman' connecting the beam with a flywheel to change the reciprocating into a rotary motion would be the means of transmitting the power. With magnets of great size an enormous power, he claims, could be obtained in this way."

This is the old, old fallacy; and is always stated in this way: "A small magnetic motor will run and produce a comparatively great result, a large one will necessarily give a corresponding increase of power." This is not true; there is a limit beyond which one cannot pass. One can see this even in magnetizing pieces of steel of various sizes and in the construction of dynamo-electric machines. In regard to the use of Mr. Gary's motor in producing the electric light we have no hesitation in pronouncing upon its utter incompetency for such a purpose. It is in the discussion of the possibilities of the new motor that the writer in *Harper* is most eloquent, and we do not know which to wonder at most, the exuberance of his imagination, his moral courage in the contempt of the authority of science, or the naïveté of his utter ignorance. He says, speaking of the electric light which is produced by this motor: "An enormous volume can be secured with an expenditure of force so diminutive that a caged squirrel might furnish it. With the employment of one of the smallest of the magnetic motors, power may be supplied and electricity generated at no expense beyond the cost of the machine." This statement requires no comment. The writer further says: "Professors from Harvard and from the Massachusetts Institute of Technology called, examined, and were impressed." It is true that only one professor from Harvard called, examined, and was *not* impressed; for the motor had just been taken to pieces and was not in a condition to run; moreover the professor does not believe that it will run except for a short space of time. The only way that it could run would be by weakening it or using up the potential energy of the permanent magnets, and allowing the earth's magnetism to replace it. If such a toy could be made it would have great scientific interest; it would not contain the idea of perpetual motion, for it would be the employment of the magnetism of the earth, just as we employ the force of the winds. We should be delighted if Mr. Gary has done this; and a scientific reputation would be within his grasp. There is no evidence, however, that he has really made such a toy. We have called it a toy; for as a motor it could not do any appreciable amount of work except in a romance of Jules Verne.

SENATE PATENT BILL NO. 300.—SHALL IT PASS THE HOUSE OF REPRESENTATIVES?

The term of the present Congress is rapidly drawing to a close, and little time is left for the friends of industrial progress and the rights of inventors to express their disapprobation of the obnoxious clauses of the new Patent Bill (Senate Bill 300).

We are informed, by parties whose knowledge and integrity cannot be questioned, that the concerted plan of the promoters of the bill is to allow no further discussion of it, but to await a favorable moment for their scheme, and rush it through during the last days of the session in the hurry and excitement preceding adjournment—a period noted for hasty and ill-considered legislation.

We are confident that, were time enough allowed for all the members to become thoroughly informed in regard to the mischievous tendency of several of its provisions, the bill would be overwhelmingly defeated; but there would seem to be no time for that now. It is too late for extended arguments against the impolicy of crippling and discouraging the class of men who (as all parties acknowledge) have been and are one of the great motive forces of national progress: too late for elaborate protests against the threatened invasion of the constitutional rights of inventors, and the disorganization of our industries by the legalizing of infringements.

But it is not too late, we trust, for an effective expression of popular disfavor—by telegraph. Disregarding the slow formalities of memorials and like communications by mail, all who regard the inventor as more worthy of encouragement and protection than the infringer, should promptly avail themselves of the means which invention has provided for such emergencies, and telegraph their disapproval of Senate Bill 300. No member not already known to be opposed to the bill should be left a moment in doubt as to the feeling of his constituents. The changes which the bill would make in the spirit and the ruling of the patent system, should it become a law, are fatal; and no surer means could be devised for preventing its passage than an electric expression of popular will against it.

Hitherto the inventor has enjoyed, so far as the courts could secure it, the exclusive control of his invention which the Constitution guarantees. His patent has been regarded in the courts as presumptive evidence that his claim to the invention covered was a just claim. Under the proposed amendments of the law, all this will be reversed. The patentee's right will be burdened by needless penalties in the shape of heavy fees, and laid open to invasion by any one who chooses to infringe it. And when his case is brought into court the inventor, not the infringer, will be treated as the culprit.

Every inventor feels that the bill is aimed against him; and should it become a law, we fear that there will result a disastrous fulfillment of the prediction of a hard-working and hitherto successful inventor, who says:

"One thing I have decided upon. If the law is changed, so as to lessen my rights as an inventor, I am through, I quit the field, and thousands of others will be compelled to do the same."

The country cannot afford to have such men quit the field. Policy, as well as justice, forbids any measure tending to compel them to quit the field; and the members of the lower house should not be left to enact the proposed wrong unwarned.

Let every citizen, who has the great question of justice and wise policy at heart, use the telegraph freely, and encourage his friends to do likewise. The cost will not be great, while the good that may be done in preventing hasty or underhanded action may be enormous.

In case our suggestion arrives too late, or the telegraphed advice fails to stay the passage of the bill, then by the same means the popular will might be brought to bear directly and successfully upon the President. In either case use the telegraph.

THE SAWYER-MAN ELECTRIC LIGHT.

It will be remembered that in our issue of December 7th, 1878, we gave illustrations of this novel and promising form of electrical apparatus. Since that date the inventors have been busy with endeavors to perfect the invention, and on the evening of February 20 a public exhibition of the light was given in this city by the Dynamo-Electric Light Co. Several improvements in details of construction have been made, but no radical changes. The chief improvement is in the bearing of the upper carbon holder, to allow for expansion; the lamp has also been made slightly taller. The light exhibited was soft, pure, and steady, and susceptible of perfect regulation. Any lamp in the circuit could be turned up or down, from a dull glow to brilliant incandescence without affecting the rest. An important improvement has also been made in the switch.

The dynamo machine used was about half the size of the one previously employed; there were more lights in the circuit, and the illumination was more brilliant and satisfactory. Comparison was made with gas light, and also with the voltaic arc, clearly demonstrating the superiority of light by electric incandescence for ordinary uses. The carbons used in the Sawyer-Man lamp are now proved to be comparatively indestructible. If, however, the lamp should be broken or otherwise injured by accident, it can be as easily and cheaply removed and repaired as an ordinary gas-burner. As regards economy, tests upon a large scale have not yet been feasible. With the power at command the indications are that the production of light by this system will range between one-fifth and one-half the cost of gas.

A NEW FORM OF CARBON.

In describing the Sawyer-Man electric light, last December, mention was made of the peculiar carbons employed, the manner of their production being a secret which Mr. Sawyer did not choose at that time to disclose.

We have now been favored with an exhibition of the process, and a very pretty experiment it makes. The carbons in question are about half an inch long, with the diameter of one-sixteenth of an inch. Their color is steel-gray, and the surface is hard as steel; within the carbon is tolerably soft.

In his earlier experiments Mr. Sawyer employed as the source of incandescence slender pencils of gas retort carbon in an atmosphere of illuminating gas. The carbons were slowly destroyed, but at the same time they took on a superficial deposit, evidently of carbon, but unlike in luster and hardness any carbon that Mr. Sawyer had seen. Inferring that a more rapid deposit would be made in a denser hydrocarbon, Mr. Sawyer experimented with a great variety of such liquids, finding olive oil most satisfactory. His method is simply to heat the carbon to an extremely high temperature, by passing through it an electric current, while it is immersed in the oil. The best results are obtained by the use of a pencil of willow charcoal, upon which an intensely hard deposit of carbon rapidly forms as the hydrocarbon is decomposed by the heated pencil.

Life Saving Mattresses.

The Navy Department has been experimenting with a mattress designed for use on vessels at sea, with results said to be favorable. The mattress is filled with cotton, but the process of preparation to which the cotton has been subjected makes it impervious to water for many hours, and renders it capable of sustaining a heavy weight—that of a man without any difficulty. It possesses other properties which, it is claimed, make it a most comfortable bed; the cotton being free from all oils and impurities, not liable to knot or pack, and proof against vermin of every kind.

THE GARY MAGNETIC-MOTOR DECEPTION.

In the latter part of November last the New York *Times* printed a column letter from Boston describing, as a fact accomplished, a magnetic motor which was to supersede steam; a contrivance which produced motion "by no external agency, simply from the magnetic power of the machine." It was a great discovery, sure to revolutionize the world. There was a lot of talk about polarity, magnetism, "the neutral line," and the usual story of humble genius upsetting all the established laws of science. The inventor had not been a student; knew nothing of philosophy from the books; "had I studied or read books," he said, "I should never have experimented, as the books told that what I was after was an impossibility, that there was no such thing;" but he kept on—and got it!

The world is too full of perpetual motion mongers to justify the SCIENTIFIC AMERICAN in noticing them until they become obtrusive. Toward the middle of December, the *Times* gave another lift to the deception. This time the Gary Magnetic-Motor was about to startle the world by producing the electric light out of—nothing. In the words of the writer: "By the simplest of devices, which he exhibited to me to-day, Mr. Gary utilizes his own newly discovered principle in such a way as to generate electricity for the light at absolutely no expense beyond the cost of the machine, which itself is automatic." After listening to a pretended description of the working of the machine, the *Times* writer remarked to Mr. Gary: "Your new invention, then, is simply a practical application of the principle, which you have discovered, of the existence of the neutral line, at the point of the magnetic field where the polarity changes, and which is antagonistic to the heretofore universally accepted theory that magnetism is a static force?"

"Precisely," was the reply. "It is only on this principle that the thing is possible."

In its March issue, *Harper's Monthly Magazine* comes to the aid of the *Times*, by printing without comment, as a regular article, a long and cleverly written account of "Gary's Magnetic Motor," with several illustrations, which will be found on another page in this issue of the SCIENTIFIC AMERICAN.

We may be mistaken, but the internal evidence is extremely strong that the same hand that wrote the first (possibly also the second) *Times* article, also wrote the account in *Harper's*. It was shrewdly done; and the manifest attempt to insinuate more than his words really implied, in regard to the quasi-indorsement of the machine by scientific men, raises the suspicion that the writer may not have been so thoroughly deluded as he seems. Be that as it may, THE SCIENTIFIC AMERICAN is in position to say that the assertions in regard to the exhibition of the Gary motor in motion by self-generated force are not true; that the assertion that "professors from Harvard and from the Massachusetts Institute of Technology called, examined, and were impressed" is not true; that apparatus constructed according to the drawings in *Harper's* will not do what the writer says they will do; in short, that the pretended motor is a deception, to be classed with the Keeley motor and like contrivances.

It is very much to be regretted that the editors of periodicals so worthy of esteem as the New York *Times* and *Harper's Magazine* should give place to such assertions, unsupported by the most positive, competent, and conclusive evidence.

The world is full of snares for capitalists, always prompt to snatch at delusive promises of sudden profit; and the fact that the pretensions of the Gary motor have been accepted without a question by a magazine like *Harper's* may be the means of inducing many to put money into projects that are sure to result in disappointment and loss.

THE PRESERVATION OF FORESTS.

In an article with the above title in the *North American Review*, Felix L. Oswald, after reviewing the disastrous effects which have followed the wholesale destruction of forests in various countries of the world, remarks that since the year 1835 the forest area of the western hemisphere has decreased at the average yearly rate of 7,600,000 acres, or about 11,400 square miles; in the United States alone this rate has advanced from 1,600 square miles in 1835 to 7,000 in 1855, and 8,400 in 1876. Between 1750 and 1835 the total aggregate of forests felled in South and Central America (especially in Southeastern Mexico), and in the Eastern, Southeastern, and Southwestern States of our republic, may be estimated at from 45,000,000 to 50,000,000 acres. In other words, we have been wasting the moisture supply of the American soil at the average ratio of seven per cent for each quarter of a century during the last one hundred and twenty-five years, and are now fast approaching the limit beyond which any further decrease will affect the climatic phenomena of the entire continent.

If we consider how the agricultural products of the eastern continents become from year to year more inadequate to the wants of their still growing population, we may foresee the time when the hope of the world will depend on the productiveness of the American soil; but that productiveness depends on the fertilizing influence of the American forests. If they are gone we shall have on earth no newer world to hope for—no future Columbus can alleviate the struggle for existence. To stay such a catastrophe the author suggests that in every township, where the disappearance of arboreal vegetation begins to affect the perennial springs and water courses or the fertility of the fields, a space of say 50 acres should be appropriated for a "township grove," an oasis to be consecrated for ever to shade trees, birds' nests, picnics, and playing children. In all new settlements, where a remnant of the primeval forests has survived, let the woods on the upper ridges or on the summit of isolated hills be spared by mutual agreement of the proprietors. In the treeless regions of the great West not only amateur societies, but every grange and farmers' union of every county, should devote themselves to the work of tree culture; and every landed proprietor should see to it that the boundaries of his estates be set with shade trees, and that wooden fences be supplanted by quickset hedges. Let fruit trees be planted wherever there is a piece of ground neither otherwise occupied nor absolutely barren; and be sure that their influence on the atmosphere in summer and their fertilizing leaves in fall will more than indemnify the adjoining fields for the modicum of sunlight they may intercept. Any State where these precautions should be generally adopted, would soon be so unmistakably distinguished by the unfailing humidity and freshness of its fields and the abundance of its crops, that the sheer necessity of competition would induce backward neighbors to try the same experiment; and before long the maxim would not only be generally recognized, but generally acted upon, that husbandry and tree culture are inseparable.

THE TROUBLE WITH WIRE BINDERS.

So far as their utility at harvest time is concerned the self-binding machines cover one of the greatest improvements of the time. Their immediate money advantage is estimated as high as 20 cents on each bushel of wheat grown. The presence of bits of wire in the wheat when it reaches the mill is, however, a serious offset to the gain by automatic binding. The wire injures the stones, is liable to strike fire and explode the mill, cuts the bolting cloths, and is otherwise so mischievous that many millers have protested against wire bindings, and threaten to retaliate with special charges for grinding wire bound wheat.

It has been the practice of farmers to run wire and all through the thrashing machines. So long as the wire is bright and tough no harm is done; but if the wire is rusted and brittle, fragments remain with the grain, and serious trouble may result.

The conditions seem to call for a new invention, an attachment to the thrashing machine which shall cut the wire binding and remove it while the straw passes on to the thrasher. The work of removing the wire would seem to be nowhere near so difficult as the original task of putting it on the sheaf. If rusted wire cannot be entirely removed before thrashing, it would seem to be quite feasible to separate the bits of iron that remain in the wheat by a train of magnets in the cleaner. In either case we are sure that our inventors can overcome the difficulty by some cheaper means than the abandonment of automatic binders.

THE WASTE OF FIRE.

During the past year, without the occurrence of any remarkable fires, it has cost the United States about $200,000 a day to furnish employment to our town and city fire departments. What the fire departments cost we do not know; it is a good round sum at the least calculation. Architects say that 10 or 15 per cent of the cost of any building, properly expended, will make it practically fireproof. Our daily fire losses would therefore fireproof from $1,000,000 to $2,000,000 worth of new structures a day, or upwards of $300,000,000 worth a year. At this rate it would not take many years to reduce the daily fire losses to comparative insignificance.

It might not be a bad thing to forbid in towns and cities the erection of houses upon which less than 5 per cent of the total cost should be devoted to approved plans for preventing the spread of fire. In view also of the increased indifference to fire risks incident to fire insurance, it might be good policy to require that, for every dollar spent for insurance, a proportional sum should be expended upon means for preventing fires, or upon appliances for securing the prompt extinction of such as might be started. If preventive measures were thus made imperative for a decade or so, the country would soon be able to save a considerable portion of the $100,000,000 a year now directly or indirectly sacrificed to the "fire fiend"—an item certainly worth taking account of.

Neptune Favors Eads.

The opponents of Capt. Eads' jetty system at the mouth of the Mississippi used to threaten all sorts of disaster to that work by storms. There are indications now that storms may in reality act as an efficient co-operator and ally to Eads. During the severe storms of January a ridge of sand was raised some feet above high water mark, and half a mile long, across the jetties at an angle of 45°, about 100 yards back of the wing dams. Though broken in two by the jetties the ridge continues throughout of the same height and thickness. Captain Brown, who has charge of the works at Eadsport, says if the ridge remains as at present the triangles formed by it on either side of the jetties—the one being acute and the other obtuse—will eventually fill up with sand, and thus the jetties be greatly strengthened.

A correspondent, writing from Guilford, Conn., protests against the classification of the oriole among mischievous birds. He says that he has frequently seen them tear open the nests of apple worms and devour them, and thinks that birds with pluck enough to destroy such disagreeable pests ought to be fostered rather than destroyed.

Bleaching Vegetable Fibers.

The processes usually employed for bleaching fibers that are to be spun, especially linen and flax, consist essentially in boiling the fibers strongly for several days with alkaline lyes, which dissolve the gelatinous vegetable matter and other impurities that surround the fiber, and thus expose it, so that it is susceptible to bleaching with chlorine, which is to follow. The chlorine bleaching itself consists in putting the substance to be bleached alternately in chlorine baths and in hydrochloric acid or sulphuric acid, also in soda baths. The bath in which it is put at first is the strongest, and those that follow are successively weaker and weaker. The object of the acid bath is to release the chlorine that remains in the fiber and neutralize the lime with which the hydrochloric acid is combined, while the alkali baths neutralize the acid in the fabric or yarn, and prevent its destructive effects. During this treatment the goods are purified several times with a great deal of water, and to obtain a purer kind of white are put upon the lawn so that the actions of the chemicals shall be aided by the sunlight.

The disadvantages which this old process carried with it are somewhat as follows: The repeated operations with large quantities of water and of chemicals, partially with the aid of heat, require a considerable outlay of capital for works and utensils, a large outlay for the coal and chemicals used, as well as for labor, besides the time consumed. Besides this, the production of a perfectly pure white requires the aid of grass bleaching, limiting it to certain seasons, and necessitating a certain area of grassground, which increases the capital required. Finally, the chlorine baths, by the present process, are in winter frequently inactive, or of very feeble action. These are said to be overcome by a new method of bleaching invented by Beyrich, in Arnsdorf. The principles upon which this new process is based are briefly as follows:

Hypochlorite of lime develops much greater bleaching power when it acts in combination with oxalic acid or oxalate of potash than alone, or with any other acid.

Oxalic acid and its potassium salt do not attack the fibers as powerfully as the strong acids previously employed for bleaching.

The vegetable slime and woody cellulose which had to be removed by previous bucking, do not hinder the bleaching action of chlorine when oxalic acid or its salts are present. Beyrich is of the opinion that the great superiority of the process depends upon the circumstance that a part of the oxalic acid unites with the lime of the bleaching powder dissolved in the water, as is shown by the clear solution turning milky, and thus liberates the hypochlorous acid, which, in a free state, rapidly separates into its separate constituents, chlorine and oxygen, which act very energetically in this nascent state, hence the outer woody fiber does not check their action. Probably another part of the oxalic acid releases the fiber from the slimy portions owing to its own solvent properties.

The method of applying this new process depends somewhat upon the goods or fiber, but is in general as follows: They are placed at once, without previous boiling or bucking, in a chloride of lime bath containing oxalic acid for five or six hours, the time depending upon the fiber and on other circumstances. The temperature of the bath varies between 20° C. (68° Fah.) to 25° C. (77° Fah.). It is well washed and put into a weak sulphuric acid bath, or this may be omitted. It is better not to add all the oxalic acid at one time, but after putting in the larger part of it the fibers are put in very quickly, as the chlorine and oxygen are more active at that time. A while after the remaining acid is put in, and fresh chlorine and oxygen are produced and used. The weak acid bath that follows has as its object not merely the liberation of the hypochlorous acid that remains in the goods, so as to make it more active, but also to convert the lime salts (carbonate and hypochlorate) that are still in the goods into sulphate, which has a whiter color and does not diminish the luster of the fiber. The operation ends with washing well, passing through a soda bath to neutralize any acid that remains in it, and then wringing out well. These operations are repeated in this order a greater or less number of times, according to the quality of the goods, the baths being weaker each time, until the goods are a beautiful white.

It is advantageous, even in this process, to put the goods upon the grass a few days after the second course of baths, as it not merely imparts a purer white color, but makes them more durable, owing to the escape of the chemicals into the free open air. This airing must, however, follow the alkali baths, for otherwise it would produce a contrary effect to the one desired.

All vegetable matter, linen and hemp yarn and cloth, can be treated in the manner briefly described above; but those which are greasy, like raw cotton, and are not wet by water when immersed into it, must, of course, first be boiled in soda to remove this fat or grease, whatever it may be, and then when put into the bath of oxalic acid and bleaching powder, bleach much more rapidly, so that in the case of cotton, as well as of linen, hemp, etc., the oxalic acid proves an invaluable addition.—*Poly. Notizblatt.*

The Dode Method of Protecting Iron.

Mr. J. B. A. Dodé, of Paris, has patented a method of protecting iron from rust by a process of "platinizing." He coats the surface to be protected with a thin film of borate of lead, having a little oxide of copper dissolved in it, and suspended in it also bright scales of precipitated platinum. A red heat is employed to fuse the composition, which is either applied with a brush or employed as a bath, in which small articles may be dipped. Its effect is to cover the iron with a thin glassy coating of a bright gray tint, not far removed from that of polished iron itself, and unaffected by sewer gases, dilute acids and alkalies, and the heat of a kitchen fire. Modifications of the composition give the means of imparting different colors to the coating, and these are as easy of application as the platinum gray. The cost of platinizing is said to be about equal to that of applying three coats of paint, and about one tenth of that of electro-plating with nickel, Paris prices. A detailed account of the treatment of eight stoves is as follows:

	Fr.
1 liter preparation (retail)	3·75
1st furnace operation	3·20
Reagents for platinizing	4·00
2d furnace operation	3·20
Manipulation, wear and tear, etc.	1·85
	16·00

This is less than 40 cents a stove. By treating the castings before they cool a still greater saving is said to be possible.

The "Evaporation" of Fruits and Vegetables.

The preservation of apples, potatoes, and the like by evaporating their juices rapidly, is becoming an important industry in Ohio and Michigan. A correspondent of a Detroit paper describes the operation of a factory in Lenawee county, having a capacity of 400 bushels a day. The apples are pared, cored, and sliced at once by hand machinery. The slices are then spread on galvanized screens and placed in the evaporator, a chamber running from the top of a large furnace in the basement upward, out through the roof of a three story building. The current of heated air is kept as near as possible to 240°. The screens of fruit rest on endless chains that move upward at intervals of three to five minutes, when a fresh screen is put in below and one is taken off at the third story completed. The dried or evaporated produce is then packed in pasteboard boxes holding from one to five pounds, and these in turn are packed in cases of 200 pounds each.

A bushel of apples makes about five pounds of the dried fruit; and the process of evaporation is so rapid that the fruit loses none of its freshness and flavor. In some of the factories the cores and peelings are converted into vinegar; in others into apple jelly, out of which every variety of fruit jelly is made by the addition of flavoring extracts.

Sweet corn, potatoes, and other vegetables have been successfully preserved by this process. The chief market for these products is the mining region of the West. Doubtless a large export trade will ultimately result from it.

Effect of Arsenic on the Body.

The London *Lancet* states that C. Gies, in a recently published paper, has given the results of a series of experiments undertaken by him on the effects following the administration of arsenic for a period of four months on pigs, rabbits, and fowls. The quantity given was extremely minute, the rabbits having only 0·0005 to 0·0007 of a gramme; the pigs, 0·005 to 0·05; and the fowls, 0·001 to 0·008 per diem. In all these animals the weight of the body increased, and the subcutaneous fat was augmented. In young growing animals the bones developed considerably both in length and girth, and they presented the peculiarity that wherever in the normal state spongy tissue exists, it was replaced by compact bone. The bones of the carpus and tarsus were in this way converted into solid bony masses. Moreover, a compact layer of bone was found immediately beneath the epiphysial cartilages of the long bone, just as Weigner found to be the case in animals supplied with small doses of phosphorus in their food. This was most distinct beneath the upper epiphysial cartilage of the humerus and the lower one of the femur, and was apparent after the arsenic had been given nineteen days, and where only 0·02 to 0·035 of a gramme had been taken. It was observed that other animals, fed in the same stable, presented the same appearance in their bones, and this Gies ascribes to the air being loaded with the arsenic eliminated by the lungs and skin of the animals to which it was administered, since he found that the changes were also observed in animals kept in a cage, the bottom of which was strewn with arsenic. Besides the changes in the bones, the heart, liver, kidneys, and even the spleen, underwent fatty degeneration. The young of animals fed with the arsenic were invariably born dead, though they attained a large size, and presented remarkable hypertrophy of the spleen and incipient changes in the bones.

Undue Haste in Education.

Barnes' Educational Monthly has an article from the pen of George Harper, in its last number, on the baneful influence of haste in the matter of education, from which we make extracts:

Partly owing to the stimulating nature of the climate, and partly also to the partially developed condition of the western country, which thus supplies to all comers unlimited scope for activity and enterprise, to the visitor from an older country, where things have long got into ruts, and where the wheels of progress, if they revolve at all, move along more slowly and systematically, it always appears as if, in whatever occupation they may be engaged, Americans are generally in a great haste and hurry about it! Thus the cry of "hurry up," in many keys, and in every accent known to the Aryan tongues, is heard in all directions, wafted on the wings of every wind to the newly-arrived immigrant's ears. Indeed, it is usually the first sound that greets his ears on landing on our shores, and the first words of our language that he learns.

Naturally enough, says the writer, this general propensity to hurry and restlessness is not without its influence also upon the character of the common schools; and here, it must be confessed, it really does very considerable harm, by introducing the unnatural brain-forcing, mind-weakening process into education, of which we are now beginning to reap the bitter fruits, as well as to hear not unfrequent complaints. In everything our people seem to be too impatient of results; they want, and must have, immediate returns for their outlay, whether in affairs of business or in education. They cannot afford to wait patiently for the slow progress of mental growth which is the law of the development of the youthful intellect, and consequently teachers must adapt themselves to the popular whimsies, and follow the unnatural cramming system which weakens instead of invigorating the mental powers. It should not be forgotten that, in one sense at least, teachers are just like other trades; they simply supply, or make to order, what is wanted in the educational line. Like other dealers, they must strive to please their exacting customers by furnishing the precise article which they find best suits the market; otherwise, like the unfortunate Moor of Venice, they would very soon find their "occupation gone." And thus it happens that under this false system, the pupil is pitchforked from one "branch" to another, crammed with one text-book after another, and boosted from one grade to another with a rapidity and "business dispatch" which rivals machine-made hard biscuits; with this very important difference, however, that usually when the baking process is completed, the bread is found to be well done; while the minds of the children are (according to natural temperament and mental constitution) often either overdone or underdone, seldom indeed are they done to a turn, which could hardly indeed ever happen under a process so opposed to nature's wise yet unyielding laws—which can never be insulted with impunity. To have got through so many score of wearisome pages in so many different text-books seems to be the one object of attainment. But, although there is only the difference of one small letter between through and thorough, there is a wonderful difference in the educational significance of the two words! To fond, unthinking, ignorant parents, this result may seem highly satisfactory; but to the reflecting mind this brain-forcing process exhibits a melancholy instance of great want of conformity to nature's wise and salutary rules, which it is ever our highest wisdom to discover, and when known, our bounden duty implicitly to obey.

The writer facetiously adds that, in the triumphant progress of mechanical discovery, some ingenious person may come out some fine morning with an invention which will do away altogether with teachers of both sexes. "May we not," says he, "reasonably imagine that, in the pages of some future school journal, there might be found an announcement of the result of such discovery, graphically described as 'a self-acting, self-adjusting, metallic, patent teacher; a wonderful machine, which is warranted to secure at once the most perfect discipline and the highest order of scholarship in all branches; cheap, safe, and expeditious; and adapted to all classes of schools, colleges, and seminaries of learning?'"

Could not a patent metallic teacher, somewhat after the pattern of Frankenstein, be ingeniously put together by somebody, and made to work by the combined action of clock work, steam, and electricity? The complicated mechanism and clock work, combined with steam power, to do the teaching (which would be conducted mainly on the object teaching, or oral method); and the electricity, which is always on hand and ready for business on a moment's notice—the briskest and liveliest spirit of this nether world—just the thing for a teacher of the modern advanced school, would of course be equal to the task of preserving the most perfect order and discipline in the largest school or college, by a simple apparatus of wires attached to the roof, whence, on the least occasion for interference, an invisible hand might instantaneously descend, and slap their cheeks, rap them over the knuckles or elbow, pinch their ears, etc., etc.—the punishment being always exactly suited to the offense, and no favor shown.

To realize all those fond dreams, however, may yet take a long time; possibly may be delayed till the dawn of the millennium, if not a little while longer; but as for mechanical, soulless, routine teaching, where the individuality of the teacher is entirely lost and absorbed in the modern cast-iron system of education, Heaven knows we have enough and to spare of that commodity already, and thus can the better afford to wait patiently for the full fruition of the system—in the advent of the patent metallic, automaton teacher.

Incendiary Rats.

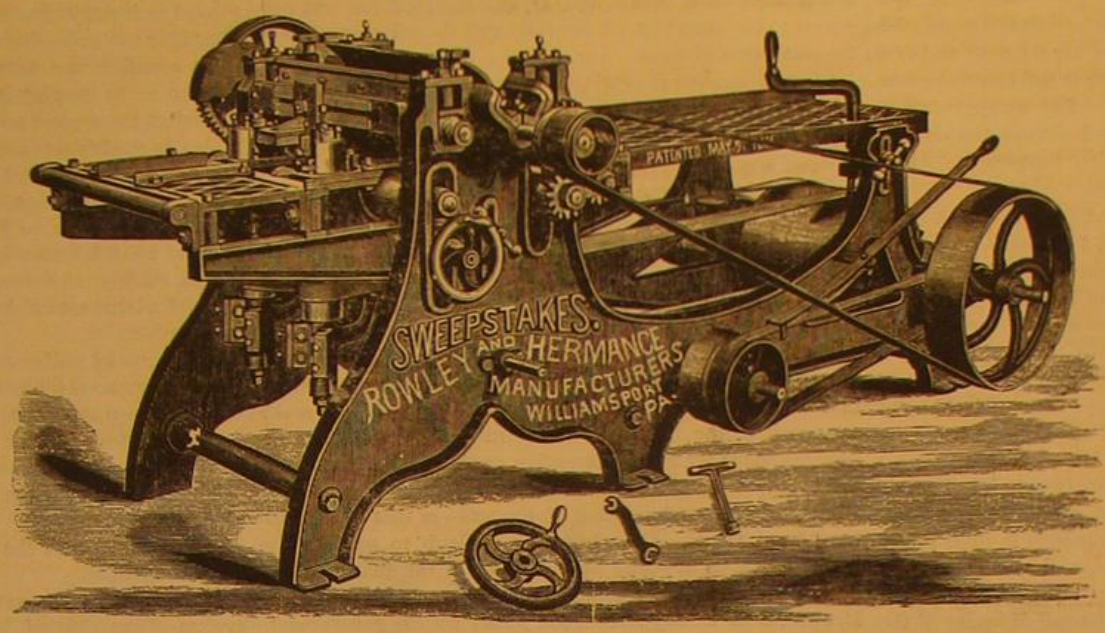
A correspondent calls attention to a fire risk attending open spaces about chimneys and other sources of heat. So long as such spaces are empty they are a protection; but they make admirable nesting places for rats, in case they are accessible to these vermin; and when filled with waste paper and other rubbish dragged in by the rats, the case is materially altered. In a recent fire in a mill, happily extinguished before any serious damage was done, the fire began in the space between the boiler chimney and the sill upon which the flooring was laid, in which the rats had collected a large quantity of broom straw and other inflammable material. Had the fire burst out in the night the single watchman would have had more than he could manage to put it out.

THE SWEEPSTAKES PLANER AND MATCHER.

Good judges of mechanical design will appreciate the well-balanced, light, yet strong construction of the efficient planer and matcher illustrated in the accompanying engraving. With a weight of from 2,100 to 2,500 lbs., according to capacity, it contains all that is essential to a first class machine. It offers also several novel features of great merit, among them its solid forged steel head and steel matcher spindles, running in the Ellis patent journal boxes shown in the lower right hand corner of the engraving. By means of this improvement the journal can be kept central and tight until the box is worn out, thus preventing any tremble and jar of the shaft, a very important gain where smooth work is required. The machine can be quickly and easily changed to a surfacer, simply by loosening two nuts and removing the matcher head, when the spindles will swing below the surface of the table. When required again the spindles can be swung into position without measuring or other delay. A shaft, crossing the machine behind the matcher heads, carries a head with cutters, to be used in making California rustic siding, beaded ceiling, small mouldings, and the like.

The machine has four 4½ inch feed rolls, connected with expansion gear, securing a powerful feed of 45 feet a minute. It has two pressure bars, one in front and one back of the head; and the rolls are held down by forged steel coil springs. The long table makes room for the long gauge indispensable in a good flooring machine. The countershaft is heavy, and is fitted with tight and loose pulleys 10 inches in diameter and 6 inches face. It should run 900 revolutions a minute.

Further information, if desired, may be had of Messrs. Rowley & Hermance, Williamsport, Pa., who also manufacture a large variety of other wood-working machinery.



THE SWEEPSTAKES PLANER AND MATCHER.

An Educated Seal.

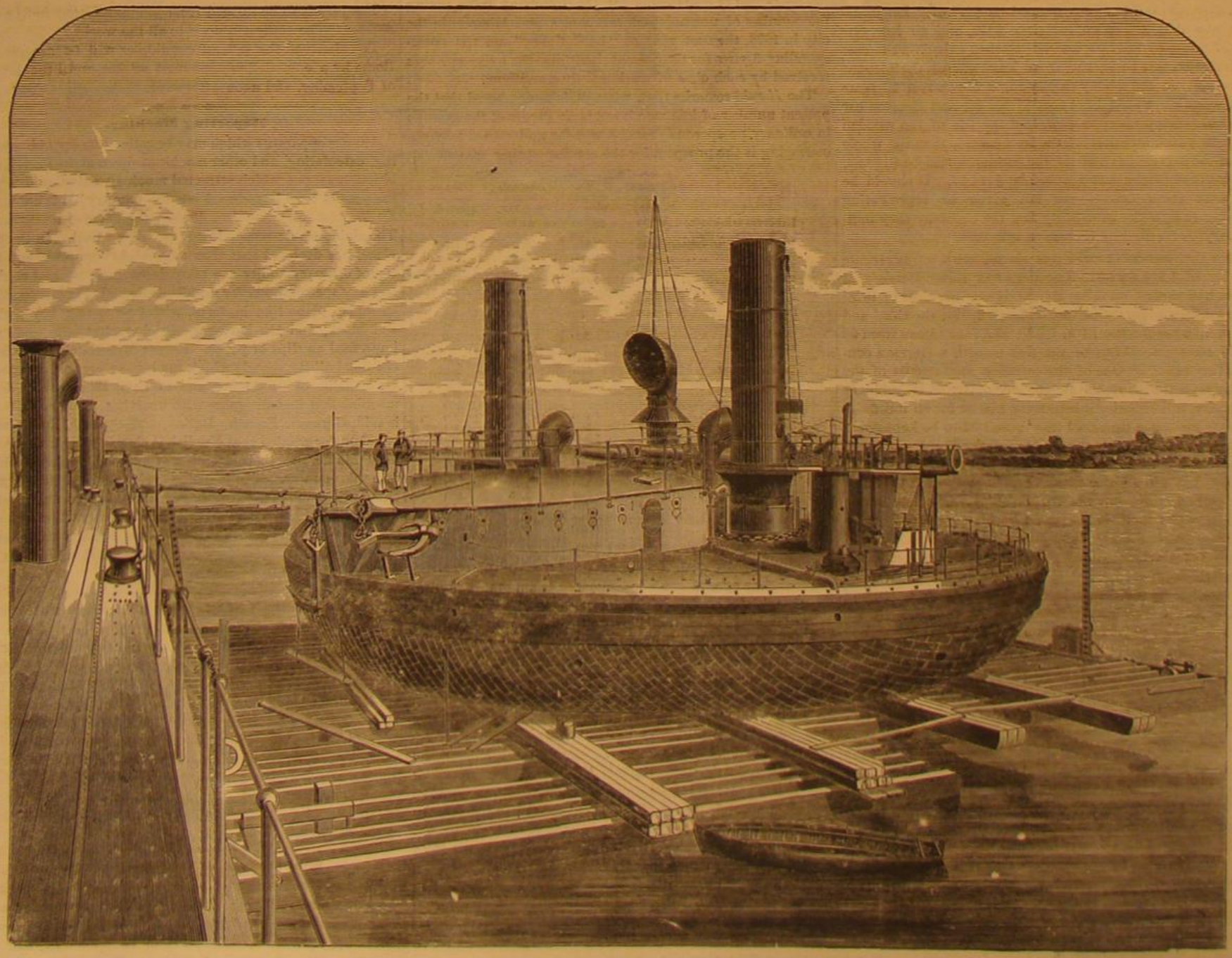
The naturalist of the Westminster Aquarium has been experimenting on a young seal, training it to perform many curious tricks. A London exchange says the seal now goes through a performance which includes plucking the strings of a guitar, beating a tambourine, climbing a flight of steps, taking a "header," smoking, or pretending to smoke, a pipe, firing a revolver, and drawing a boat to which it is harnessed.

The performance to meet public taste is made more sensational than anything M. Leconte did, who had some trained seals at the Zoological Gardens; but the way in which the seal enters eagerly into the fun, with a keen eye on the fish given to it now and then in its performance, is a good illustration of how these animals can be educated.

NICOLAIEFF DEPOSITING FLOATING DOCK.

The accompanying perspective view, which we take from *Engineering*, represents the Nicolaieff floating dock, a structure which, from the novelty and boldness of its design, possesses more than ordinary interest. The engraving shows the dock carrying one of the Russian circular ironclads, the Novgorod. This ironclad is 101 feet in diameter, and weighs 2,450 tons. The dock has also been successfully used for raising the other ironclad, the Vice-Admiral Popoff, which is 121 feet in diameter, and weighs 3,850 tons.

This dock consists of a series of pontoons, each 72 feet long, 18 feet deep, and 15 feet broad, placed 5 feet apart, and connected with a pontoon, 280 feet long, 44 feet 6 inches high, and 12 feet broad. The structure resembles a comb, the larger pontoon forming the back; the smaller ones the teeth. An outrigger connected with the larger pontoon opposes and counteracts the oscillations of the smaller ones. The smaller pontoons are submerged by allowing the water to enter, the vessel is floated over them, when the water is pumped out by machinery carried by the longer pontoon. The keel takes its bearing on the blocks, and the bilge blocks are hauled into place by chains in the usual manner. This dock appears to have met very successfully the difficulty of dealing with exceptionally broad vessels. It can deal with vessels of 150 feet beam, and the system upon which it is constructed is such that it can be very readily extended to take any greater widths or lengths required. It is capable of depositing the vessels lifted by it on fixed stages erected along the shore. In these days when there are decided indications of growth in the beam of our ironclads, this system of dock promises to be of much value, as when a dock of this kind is available, the restrictions in width which ordinary graving docks impose are at once removed. The facility with which this system of dock can be extended, and the manner in which the sections of which it is composed admit of variation of arrangement to suit different conditions, are also many points in its favor, and altogether the dock at Nicolaieff deserves to be the forerunner of many others.



THE NICOLAIEFF FLOATING DOCK.

Railway Notes.

A LOCOMOTIVE electric light has been constructed in England for railway use. It consists of a light six horse power four-wheel locomotive, with a dynamo-electric machine attached. Any electric light can be used. When the engine is moving along the line, the electric machine rotates at its proper speed, and when it is necessary to stop in order that the light may be directed on some particular spot, the driving wheels are thrown out of gear by means of the disengaging handle attached to the pinion on the crank shaft, and the machine ceases to be locomotive, while the engine continues to move the dynamo machine at its proper velocity. The engine is furnished with sensitive governors, so that the speed of the dynamo machine may be accurately regulated, which is very important in order to insure a bright and continuous light. If required, this engine is sufficiently powerful to drive two electric machines. The arrangement is compact, and the engine may be used during the day for pumping, sawing, drilling, or any other purpose for which this type of engine is usually employed.

THE engineers of Europe are watching with considerable interest the behavior of the American locomotive exhibited at Paris by the Reading Railway Company, and since then a working exhibition on the Northern Railway of France. The *Continental Gazette* states that recently Messrs. Delbec and Bandasalli, of the Northern Railway, accompanied by a party of gentlemen, among whom were Messrs. C. Geshardt and A. Mensier, of the Eastern Railway; Henry Mathieu, of the Midi Railway; David Woeflin, of the Orleans Railway; B. Meissonnier, Inspector-General of Mines; and a number of other eminent engineers, made a journey with it to Persan-Beaumont, passing over the heaviest grades and shortest curvatures of the line, and were enthusiastic in their praise of the powerful effort of the engine, and the very great smoothness and steadiness with which it passed around the shortest curves. Mr. Wootten, the General Manager of the Reading Railway Company, who was also of the party, has since taken the locomotive to Switzerland and Italy, for the purpose of demonstrating the desirability of anthracite coal for fuel for locomotives in those countries.

THE *Railroad Gazette* discusses the possible displacement of wooden cars by cars of iron. The question of economy, based on relative cost and endurance as determined by actual experience, is figured out as follows, assuming the mileage of freight cars to be 15,000 miles a year, which is about the average on most American roads. From data in hand the cost of maintaining a wooden car at 0·5709 cent per mile is found to be $85.63 per year. If it costs 0·0922 cent less to maintain an iron car, the cost per year would be only $71.80, or $13.83 less than the cost of maintaining a wooden car. The latter sum is 7 per cent interest on $197.57. Let us assume now that a wooden car costs $450, and an iron one $197.57 more, or $647.57, and let us then calculate the cost of service on this basis, and if we leave out of the account the interest on the money expended, at the end of 10 years the wooden car would have cost $1,306.30, and the iron car $1,365.57. Supposing, though, that the life of the wooden car is 10 years, and that of the iron car 15, then the whole cost of the service per year of the former would be $130.63, whereas that of the latter would be $114.97. It should be said that these figures are not given as representing anything except the possibility that the economy they indicate may be realized by the use of iron cars.

GERMANY has 20 locomotive shops, with an aggregate capacity of 1,922 a year. The largest of these, Borsig's, at Berlin, had turned out 3,750 locomotives at the close of 1878; the second in capacity had made in all 2,600; the third and fourth, 1,700 each; the fifth, 1,250; and four others from 90 to 980 each. Speaking of the first named, a German contemporary says: "One of the proudest monuments of the iron trade of Germany, the Borsig locomotive and machinery works, are, it is reported, about to be closed for an indefinite period. For some time past they have had to be kept going out of savings, and this the trustee of the Borsig estate declines to continue to do any longer. The works have been conducted at a loss for so many years in succession that they threaten to swallow up the entire estate. The late Borsig kept the works open for the purpose of finding bread for his numerous workmen, the thought of whose dispersion and distress was painful to him." There are 5 locomotive works in Austria-Hungary, and 3 in Switzerland, though one of the latter has turned out no locomotives since 1867. One of the Austrian works belongs to a railroad company; it has built 1,560 engines, and can turn out from 80 to 100 yearly.

THE received opinion, as to the relation between the hardness of steel rails and their wearing capacity, has been that, barring the tendency of a hard steel to be brittle, the harder the rail the better it would wear. Dr. Dudley, Chemist of the Pennsylvania Railroad, finds the experience of that road to be different, and is rather of the opinion that under the conditions of wear to which a steel rail is subjected, namely, rolling friction, unlubricated surfaces, and great weight with small bearing surface, the quality of the metal necessary to most successfully withstand the disintegrating forces is best expressed by the word toughness, and not by hardness. He says: "Some two years ago the Pennsylvania Railroad Company, in view of the unsatisfactory wear it was obtaining from its steel rails, asked to have more carbon put into its rails, with a view of making them harder, to resist wear. Before the increase the limits of carbon for rails to be used on Pennsylvania Railroad was from 0·30 to 0·50 per cent. After the increase the limits were from 0·40 to 0·50 per cent, thus securing on the average, perhaps, about a tenth of a per cent more carbon in the steel. Now Mr. W. H. Brown, Chief Engineer Maintenance of Way, Pennsylvania Railroad, informs me that these rails of higher carbon are giving poorer wear than before the lower limit of carbon was raised. This opinion of Mr. Brown is based on his observation of the wear of these higher carbon rails, and on the number of renewals of these rails rendered necessary by the condition of the track." This experience appears to be in harmony with that of the General Manager of the Barrow Hæmatite Steel Works, England, Mr. J. T. Smith, who, as early as 1875, expressed the conviction that, contrary to what might have been anticipated, greater hardness has not conduced to the longevity of the rails, and the softer ones show the minimum of wear.

IN their report for 1878, the Executive Committee of the Western Railroad Associations deprecate any movement to repeal or to seriously impair the integrity of the patent system, and say:

We believe that the gradual and continuous reduction in the rates of fare and freight which has taken place would have been impossible without the economy of the labor-saving and operative devices which invention has furnished. It is evident that while "railroading" is being gradually more and more reduced to an exact though unwritten science, and while its masters are members of a profession that is growing in wisdom and importance, still, that further reduction in fares and freights, which the logic of events will make necessary in the future, is dependent largely upon further improvements which the inventive genius shall furnish. It is seriously doubted by some whether invention has not been stimulated too much in some of the arts—as that of agricultural implements. It is, however, difficult to see how the inventor can in any way do too much in the matter of reducing the cost or increasing the facilities of transportation. If, then, it is in any sense good policy for the government, by arbitrary means and the offering of special inducements, to stimulate invention, so much more is it wisdom for transportation companies to use every proper means toward the same result.

Again, the right of the inventor to his invention, though a statutory right, is also a property right, and entitled to respect as such. The spirit which would knowingly deprive an honest, original inventor, or his assignee, of his right, or of the reward due for its use by another, simply because it is a patent right, is the same as the spirit which plunders a railroad corporation simply because it is a railroad corporation.

Labor in New York City.

The *Herald* is responsible for the following table giving the number of unemployed mechanics and laborers in the city in 1873, the first year of "hard times," and the corresponding figures for the present time: also the average wages received by each class of workmen then and now.

The *Herald* remarks that, when it is remembered that the present number of idle men is not far in excess of the average in ordinary prosperous years, it will be understood how encouraging is the prospect for the coming spring season.

	1873		1879	
	Average wages per day.	No. unemployed.	Average wages per day.	No. unemployed.
Laborers (all kinds)	$2.00	10,000	$1.10	3,000
Carpenters	2.50	2,000	1.75	1,000
Masons & stone-cutters	3.50	1,500	3.00	1,000
Bricklayers	3.50	2,000	2.25	800
Plasterers	3.50	1,500	2.00	600
Painters	3.50	1,000	2.00	800
Roofers	3.00	300	2.00	100
Moulders	2.50	250	2.25	150
Sawyers	2 50	50	1.90	25
Harness makers	3.00	50	2.50	40
Blacksmiths	3.00	300	2.00	100
Longshoremen (ship work)	4.50	1,000	2.50	100
Cabinetmakers	2.55	500	1.75	200
Boxmakers	2.75	200	1.80	150
Printers	3.50	800	2.00	600
Wagonmakers	3.00	200	2.50	100
Brass finishers	3.50	200	2.50	50
Engineers	3.00	500	2.00	400
Ironworkers	2.50	1,500	2.00	1,000
Tailors (custom)	4.50	200	2.50	50
Jewelers	3.25	50	2.25	30
Shoemakers	3.50	500	2.00	200
Capmakers	2.50	200	1.70	50
Cigarmakers	3.00	500	1.75	300
Weavers	3.00	100	2.00	50
Total		25,400		11,395

The Welding of Metals at Low Temperatures.

Some time ago, in order to estimate the amount of hydrocyanic acid in a solution, Mr. Charles A. Fawsett, of Glasgow, Scotland, precipitated it with silver nitrate. After having filtered and washed the precipitate, he reduced it to the metallic state by heating to the required temperature. Just as he was about to allow it to cool he noticed a small piece of dirt among the reduced silver. In order to separate them he took a thin platinum wire and pushed the silver to one side, but on attempting to take the wire away the silver remained in contact with it. As he thought this curious, he tried the following experiment: He took a piece of silver foil, about one centimeter square, placed it in an inverted porcelain crucible lid, and heated it to about 500° C.; then he brought into contact with it the extremity of a thin platinum wire, and to his astonishment the wire raised the silver from the lid, and it remained in contact when cold.

The silver being so much below its melting point its behavior puzzled him, so he wrote to Sir W. Thomson for an explanation. On witnessing the experiment Sir William pronounced it a remarkable case of "cohesion," the two metals, in fact, "welding," although the temperature was far below the melting point of silver. Mr. Fawsett says that the experiment can be performed successfully at lower temperatures than 500° C. if smaller pieces of foil are taken; and that other metals, for instance copper and aluminum, cohere to silver in the same manner as platinum, but less strikingly.

A Universal International Exhibition of One.

Signor Louis Josue Raynusso, of Santa Clara Mill, Lima, Peru, proposes a grand universal contest, to take place in Rome, Italy, during the month of October, 1879. His experience and study have inspired him with the profound conviction that water power is not so widely nor so wisely employed as it might be; also that he has unequaled plans for obtaining the following results, to wit:

To canalize any waterfall; to elevate the water of any river so as to employ it in the irrigation of high grounds; to perfect the system now in use for grinding corn and other grain; to modify advantageously the current mode of making bread, biscuits, and vermicelli.

To test the question, he proposes the competition above named, with prizes to be furnished by himself. The first prize of 100,000 francs is offered for the best three plans of works, edifices, and machinery, as follows:

I. Of a large establishment to contain four manufactories, as follows:

1st. A model mill to grind wheat and other kinds of grain, with its proper machinery moved by hydraulic power, and stores to keep the grain, flour, and bran.

2d. A factory for the manufacture of bread, with all the necessary facilities and advantages for this industry.

3d. A factory for the manufacture of crackers, with the above conditions.

4th. A factory for the manufacture of vermicelli with the same conditions.

II. To employ the water of a river, by means of a new system of canalization, in irrigation, and for the factories worked by hydraulic power.

III. A new system to control any fall of water, regulate it, and employ the same as motive hydraulic power in factories.

If only two plans among all those exhibited shall equal his, he will pay 50,000 francs; if only one, 25,000 francs. A further reward of 2,000 francs is offered for each piece of machinery, either cast, in wood, or drawn, of a new pattern and useful to the mill industry, provided it be superior to those exhibited by him.

Also a reward of 1,000 francs for each improved piece of machinery, either cast, in wood, or drawn, of those actually employed in the mill industry, provided it be superior to those employed by him.

The jury is to be formed from judges selected by the candidates. The contest is open to all the world.

The plans of the several candidates will be accepted at Rome by a commission appointed *ad hoc*, until the 1st day of September, and none afterward.

Reporting Machine.

Among apparatus which may be called literary aids—writing, calculating, and other machines—seen at the Paris Exhibition, was one which attracted much attention, and which has not yet been introduced into this country. It is known as *La Machine Sténographique Michela*, the name of its inventor. The claims made respecting it are very broad. In the first place, it is declared that after a fortnight's practice, any person of ordinary ability can take down in shorthand characters any speech, however rapidly delivered. It is a small instrument, piano like in form, with twenty-two keys, white and black, and the stenographic characters are small and impressed on slips of paper. Signor Michela claims to have classified all the sounds which the human organs of speech are capable of producing, and to have so constructed his machine that it shall report with unerring fidelity whatever is said, German, French, Italian, and Spanish, and it may be taken for granted that English is also included, as the exhibitors announce their intention of introducing the machine into this country. The inventor even believes that his machine will do much towards the realization of that philosophic dream, an universal language. To what extent the hopes of the inventor may be realized, of course remains to be seen, but the machine is certainly highly ingenious, and seems to work satisfactorily.

A New Method of Planting Telegraph Poles.

A new method of planting telegraph poles has been introduced in Pennsylvania. The ground is staked off at distances of 200 feet apart; a man starts off with cartridges of "electric powder," and with a crowbar in his hand. The bar is driven four or five feet into the ground, a cartridge with a lighted fuse is dropped into the hole, and the man proceeds to the next stake, but before he reaches it the cartridge has exploded, making a cavity as big as a flour barrel in the ground, and a gang of men who follow plant a telegraph pole in the spot. In this way four men will set up 100 to 150 poles per day, and at a cost two thirds less than by the old way.

Simple Mode of Silvering Metals.

Small articles may easily be coated with silver by dipping them first into a solution of common salt, and rubbing with a mixture of one part of precipitated chloride of silver, two parts of potassa alum, eight parts of common salt, and the same quantity of cream of tartar. The article is then washed and dried with a soft rag.

WHAT WE FIND IN HONEY.

Among objects familiar to all, honey may be mentioned as one capable of affording the microscopist considerable entertainment. Before enlarging on this, however, perhaps it will prove of interest if we take a rapid glance at the composition of honey.

During the growth of flower buds, copious deposits of starch take place in their receptacles and disks. When the flowers open, this starch, by the absorption of oxygen and evolution of carbonic acid, becomes converted into sugar, to aid in the rapid development of the delicate floral organs. The excess of sugar thus formed, and naturally deposited in nectaries of flowers, is extracted from the latter by working bees. These deposit it in their crop or honey bag, and from this receptacle again disgorge it when they return to the hive. But during this short interval the sugar, by admixture with the liquids secreted in the mouth and crop of the insect, becomes somewhat altered; so that the honey we obtain from the comb is perhaps not exactly of the same chemical composition as when it was sucked from the flower by the industrious bee. The solid crystallizable portion of honey consists of grape sugar (also called glucose or dextroglucose), which is abundantly diffused throughout the vegetable kingdom, being more especially a product of those plants or fruits which possess distinctly acid or sour juices. Another constituent of honey is an uncrystallizable, colorless sirup, as sweet as cane sugar, and called lævulose. A mixture of lævulose and glucose in equivalent quantities constitutes fruit sugar or inverted sugar. Honey also contains some cane sugar, which is usually the product of such plants as have little acid in their saps, and which also exists in the nectaries of some flowers, notably in those of cactuses, where the sugar is almost wholly of this kind. In addition to these sugars, we find, as constituents of honey, a small quantity of gum, mucilage, and a little wax. All of the sugars mentioned vary in sweetness; cane sugar, for instance, being popularly distinguished from other varieties by its greater sweetening power; three pounds being equivalent, in this respect, to five of grape sugar. Both the solid and liquid sugars of the honey have the same general properties, the liquid differing from the solid chiefly in refusing to crystallize, and in containing a mixture of various coloring and odoriferous substances characteristic of the flowers from which the bee extracted it. To such foreign matters as these honey owes the varied color, flavors, and odor which it has been recognized as possessing in different districts. To this fact is due the high estimation in which was held by the ancients the honey of Mount Hybla, in Sicily, a locality noted as the habitat of thyme and an abundance of other odoriferous flowers. The fame of the honey of Mount Ida, in Crete, is owing to the same reason. Hence, also, the perfume of the honey of Narbonne, of Chamouni, and of the Moorlands of England when the heather is in bloom. It occasionally happens that these foreign substances possess bitter, narcotic, and poisonous qualities, as is the case with the Trebizond honey, which produces headache, vomiting, and even a kind of intoxication in those eating it; the poisonous quality being derived from the flowers of a rhododendron (*Azalea pontica*). It was probably a honey of this kind which poisoned the soldiers of Xenophon, as described by that general and author in his "Anabasis."

As might be expected from what has been said, then, when we place a small drop of honey on a slide, cover it with a thin glass, and examine it with a high power of the microscope, it will be observed to contain a large quantity of sugar crystals (Fig. 1), which will be found elegant objects when viewed with polarized light and the use of a selenite stage. But in addition to these constituents there are various foreign matters to be found in all honey, and among the most interesting of these are the pollen grains which the bee had detached from the stamens of the flowers in its nectar-gathering visits. By careful investigation, very many different kinds of pollen may be detected in any sample of honey, and the prevalence of one kind over the others will give a clew to the sort of locality the bees frequented in collecting their sweet spoil. In an examination made of a beautifully clear sample of honey, contained in a very white comb, a short time since, we found the varieties of pollen grains figured herewith, each of which is represented magnified 500 diameters. We are at present unable to assign them to the plants from whence they were derived, since no work has been as yet published giving figures of the pollen of our American plants.

Perhaps some of our readers who are microscopists, and who have made the subject of pollen a specialty, will recognize our figures, and be able at once to identify them.

The pollen, Fig. 2, was the prevailing form, and the greater part of the honey had probably been derived from the flowers whence this variety came. The other pollens occurred in less frequency, but all in considerable quantity. In addition to the pollen grains, we found, in more or less quantities, scales from the wings of various butterflies, which had probably been brushed off these insects on their visits to the flowers in search of nectar, and which had adhered to the hair of the bees on the subsequent visits of the latter to the same blossoms. We found many brown fungus spores also, like those in Fig. 14; we are not able to place these definitely, as we are acquainted with several fungi that have spores very similar to this.

A few insect hairs, probably derived from the bee itself, completes our list of what we discovered on a cursory examination of a very nice sample of comb honey. It would be an interesting matter for those who possess microscopes, and who live in the country, to collect pollen grains for themselves, and compare them with those introduced into the honey by the bees.

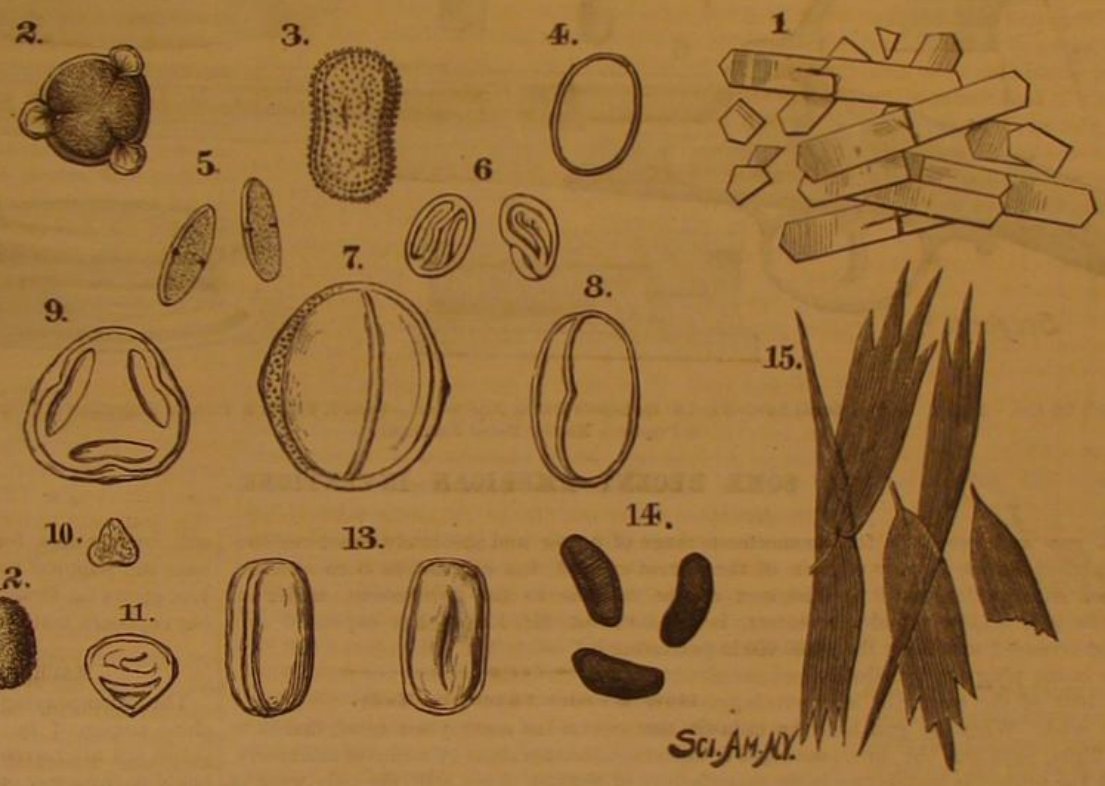


Fig. 1.—Crystals of Grape Sugar in Honey, magnified 100 diameters. Figs. 2 to 13.—Pollen grains, magnified 500 diameters.
Fig. 14.—Fungus spores, magnified 500 diameters. Fig. 15.—Scales from Butterflies' Wings in Honey, magnified 100 diameters.

Chinese Rice Paper.

The thick, soft, translucent material called Chinese rice-paper, is commonly supposed to be made of rice, or some sort of fiber obtained from the rice plant. A recent writer says that it is not so made, but is the pith of a *Fatsia papyrifera*, sliced thin. The tree grows about twenty feet high, and its pith is an extensive article of commerce in China, for it is used in the manufacture of many articles, especially toys and artificial flowers. The cylinders of pith exposed on removing the bark and woody fiber are rarely an inch and a half in diameter, and as the substance is delicate and tender, rare skill and practice are required to cut the whole stick from the circumference to center into one continuous sheet. A long, thin, very sharp knife is used for this operation. The largest sheets that can be obtained in this way are about fifteen inches long by ten wide. As soon as the sheets are cut they are spread out, all little holes carefully mended, and then they are pressed under weights until dry. The refuse scraps, etc., go to make pillows; the ordinary sheets are dyed brilliantly and sold to the flower makers, while the largest sheets are destined for the foreign market after being carefully painted by skillful native artists. There is no substance yet discovered that so well represents the delicate texture of the petals of flowers as this paper of pith, and it is exported to some extent by artificial flower manufacturers. The tree could no doubt be grown here, as our climate is much like that of China.

Diversified Industry, and How to Get It.

An Eastern contemporary discusses this question with uncommon force and pertinence. The free trade theory, "get your work done where it can be done cheapest," sometimes leads to painful, humiliating, if not disastrous results. Men are yet living who remember that period of national crudeness or national disgrace, when the United States could not so much as strike a medal in honor of its own victories. At the very moment when, in our diplomacy, we were defying England in a series of measures which led to the war of 1812, we had occasion to strike some medals for our naval heroes. At that time there was no machinery in the country strong enough for the purpose, and we had to ask the British mint, as a favor, to strike our medals for us.

"Nations have other functions than trade, other desires than to buy in the cheapest market. And, as it happened to us in our late war, a nation may find the cheapest market suddenly closed when the need of buying is greatest. Under conditions not dissimilar our Western farmers are learning the same lesson. "They were once bewildered," says our contemporary, "with the simple theory that each nation is for one thing—the United States for food, England for machinery, Italy for fine arts, and Germany for philosophy. How charming it all was, to be sure! We send to England our wheat, and England sends to us our hoes, and shovels, and drag chains. But as the Western farmer gets beyond a pioneer's position; as he finds it necessary to work with tools more useful than hoes and shovels; as the complicated machinery made in gigantic establishments at Springfield and Chicago, and a hundred other places, cuts down for him his grain and stacks it, cuts down his hay and tosses it into the loft for him—the farmer on the prairies has every reason to be thankful that the invention of this machinery was not left to people four thousand miles away, who had never seen a prairie, who knew nothing of an American summer or of the exigencies of an American harvest. He has reason to be thankful that, under the auspices of such men as Henry Clay and John Caldwell Calhoun, a diversified industry was forced upon this country, unwilling enough to accept it; that the foresight of the country's leaders almost compelled the country, against its will, to create the machinery, the machinist, the inventors, and the machine shops which now enable the farmers of this country to feed the world.

"If anybody supposes that the very existence of a great harvest will, by a natural law of evolution, develop the machinery which will reap it, he has only to travel through Southern Russia or through the fertile fields of Poland, and inquire how many centuries the harvests of grain have existed there without developing McCormick's reaper, or such a firm as Whitely, Fasselar & Kelley. The truth is, you must have your inventor, your machinist, and even your machine shop close by the field of their work and their triumph. They must know the need; they must talk with the men who feel it; they must see the early experiment; they must be able to correct, in person, the first mistakes. There must also be that sharp and generous competition between different shops which shall secure to the farmer the best result at the cheapest price, at his own door.

"No person, indeed, who sees the daily operation of agriculture at the West would, for an instant, relegate to Europe the manufacture of any part of the necessary machinery. Suppose a casting gives way in a Louisiana sugar mill. 'Buy where you can buy cheapest,' says Herbert Spencer. 'Telegraph to us in Birmingham the shape of your casting and its size, and in three weeks you shall have it renewed in the best workshop in the world.' To which, of course, the planter replies that at the end of three weeks his cane will be nowhere. He does not want to buy where he can buy cheapest. He wants to buy where he can buy quickest. The nearer the foundry the better. . . .

"It is usual to reply to the repetition of such fundamental principles that, under the great law of accident, under this wonderful law of 'let-alone,' if the farmer wants a reaper he will surely get it somehow, and if the planter wants a cog wheel or a roller it will come to him somehow. Supply, it is said, will always meet demand. Supply meets demand when intelligent men come between and compel the supply. This city of Boston needed an easy highway to the Hudson. And long enough it would have continued to need it, if intelligent men had not forced an unwilling community to legislate, to incorporate, and to subsidize, until at last those railroads were built which Governor Rice so well called 'our open rivers to the West.'

"Every inch of railway in New England has been created by the principles which are at the bottom of the system of protection. If you want a man to establish a ferry, so that you shall be sure to find him there of a stormy night in December, you must encourage that man by certain privileges which you give him in pleasant days in summer. If you want men to establish the workshop which shall, in the end, train your inventors, make your reapers, and repair your sugar mills, you must at the outset give those men certain advantages for which, in the end, you will find you are repaid a thousand-fold."

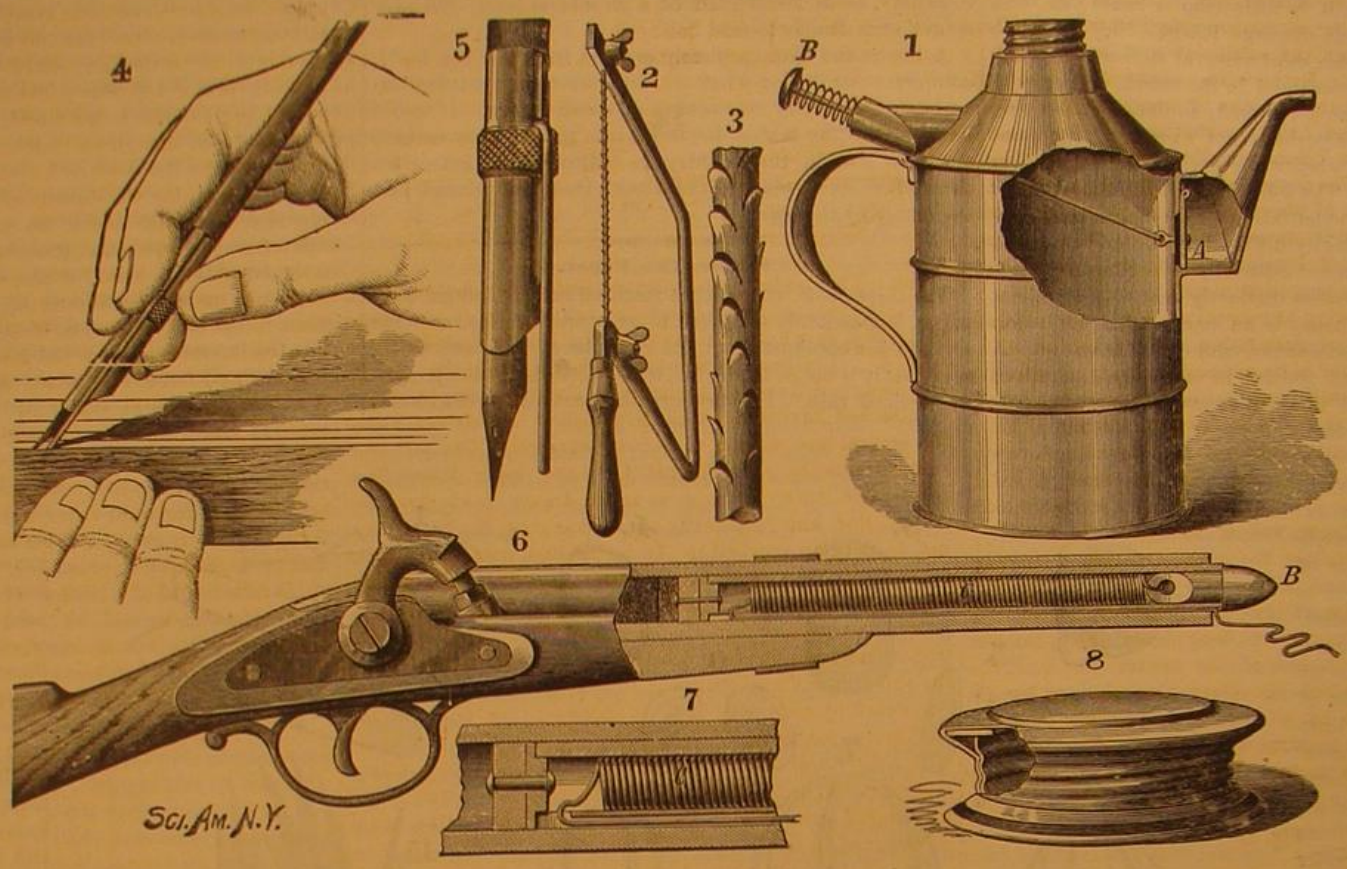
LICE ON CATTLE.—An immediate and effective remedy for lice on cows and other cattle, also for ticks on pigs, is to wash the affected parts with potato water, or water in which potatoes have been boiled. One application is generally sufficient.

RECENTLY PATENTED INVENTIONS.

A few novelties are shown in the accompanying engraving which illustrate the versatility of American inventive genius. Fig. 1 represents an improved can for containing common petroleum oil. The spout, which is enlarged at its lower end, contains a hinged valve, A, connected with the rod, B, which extends through a tube projecting from the can just above the handle. The rod carries a piston, which slides in the tube as the valve, A, is operated by pushing the rod. The movement of the piston opens an aperture, through which air enters the can, allowing the oil to flow out freely. On releasing the valve rod the spring returns the parts to their normal position, sealing the can completely.

In Figs. 2 and 3 a saw is shown that is capable of sawing in any direction without being turned. It consists of a bar or wire having struck up burr teeth. The saw is stretched in a frame in the usual way, and is designed to follow the line of the pattern in any direction without the necessity of turning the saw frame.

Figures 4 and 5 represent a simple device for attachment to ordinary pen holders, to enable a common pen to be used in drawing straight lines without danger of smearing the edge of the ruler with ink. The attachment consists of a simple narrow ring, which encircles the pen holder and supports the guide rod which slides in contact with the edge of the ruler as shown in the engraving.



1. Moran's Oil Can.—2 and 3. Griffin's Scroll Saw.—4 and 5. Hoffman's Ruling Attachment.—6 and 7. Eggers & Pierce's Projectile for Throwing Lines.—8. Pearson's Metallic Postal Envelope.

SOME RECENT AMERICAN INVENTIONS.

In Figs. 6 and 7 are shown a gun and projectile for throwing lines. It is especially designed for use in cases of shipwreck. The gun is of common construction, but it is of quite large bore. The projectile is a hollow cylinder, closed at one end by a plug, B, and arranged to contain the line, C, which is secured to an eye in the plug and is coiled compactly in the cylinder. The butt of the projectile is stopped and packed by a suitable wad. When the gun is discharged the projectile, in its flight, pays out the line. Should the distance through which the projectile travels exceed the length of line contained in it, a relay line, which is connected with the line, C, supplies the deficiency.

Fig. 8 shows a novel postal envelope, which is made so that it may be easily opened to admit of examining its contents. It consists in a box spun or stamped from sheet metal, having the top and bottom made flaring for the double purpose of receiving packing, and protecting the screw threads by which the two parts are secured together.

Great Testing Machine.

The great testing machine designed by Mr. Albert Emery, for the United States Commission for testing iron and steel, which has been in process of construction for three years past at the Watertown (Mass.) Arsenal, is now completed. Some experimental tests made with it in the presence of the Commissioners are thus described in the Boston *Traveler*:

"The merit of this new testing machine is its great power united with its mathematical accuracy. In illustration of this a few of the interesting results it has reached in the course of the recent experiments may be cited. A five inch bar of iron was pulled apart, and the strain registered in doing it was 722,000 lbs. To attest its minute exactness, a horse hair was next submitted to the strain, and it yielded to a registered force of 2 lbs. Again, a pine block of four inches thickness and two feet in length was taken and pressed into a board of two inches thickness.

"Then to again ascertain its refinement of accuracy, a hen's egg was taken and inclosed in plaster of Paris, with two small holes at each end, and, the pressure being applied, the contents were forced out of these small apertures at a strain of 32 lbs., and such is the command over the action of the machine that the pressure was stopped in an instant, and the yolk ceased to be expelled, the shell of the egg remaining unbroken. A nut was also cracked by the machine without crushing the kernel.

"No such nicety of regulated pressure, combined with such an enormous range of power and absolutely exact registration of the strain exerted, has ever before been attained. The cost of the machine to the government, under the contract, is $31,000, but Mr. Emery has expended over $100,000 in perfecting it."

How Wooden Shoes are Made.

An industry that cannot last many years more, thanks to the rapid cheapening of leather shoes by means of machinery, is the manufacture of wooden shoes, still the only wear of thousands of French peasantry. A writer in *Chambers' Journal* pleasantly describes the manner in which this industry is carried on. The surroundings are certainly picturesque. An encampment has been formed in the beech woods, and suitable trees are selected and felled. Each will probably give six dozen pairs of wooden shoes. Other kinds of wood are spongy and soon penetrated with damp, but the beech sabots are light, of close grain, and keep the feet dry in spite of snow and mud, and in this respect are greatly superior to leather.

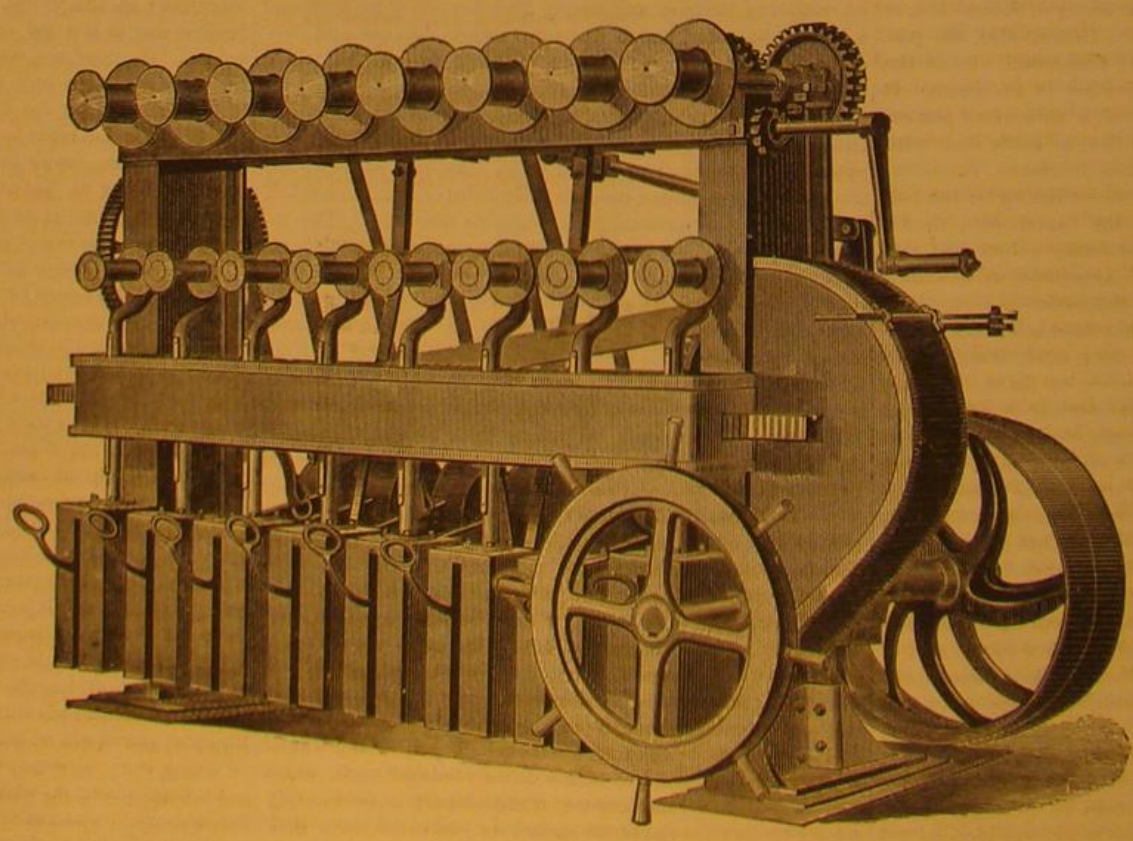
All is animation. The men cut down the tree; the trunk is sawn into lengths, and if the pieces prove too large they are divided into quarters. The first workman fashions the *sabots* roughly with the hatchet, taking care to give the bend for right and left; the second takes it in hand, pierces the hole for the interior, and scoops the wood out with an instrument called the *cuiller*.

The third is the artist of the company; it is his work to finish and polish it, carving a rose or primrose upon the top if it be for the fair sex. Sometimes he cuts an open border around the edge, so that a blue or white stocking may be shown by a coquettish girl. As they are finished they are placed in rows under the white shavings; twice a week the apprentice exposes them to a fire, which smokes and hardens the wood, giving it a warm, golden hue. The largest sizes are cut from the lowest part of the bole, to cover the workman's feet who is out in rain from morning to night. The middle part is for the busy housewife, who is treading the washhouse, the dairy, or stands beside the village fountain. Next come those of the little shepherd, who wanders all day long with his flock, and still smaller ones for the school boy. Those for the babies have the happiest lot; they are seldom worn out. As the foot grows the mother keeps the little sabots in a corner of her cupboard beside the baptismal robe.

MACHINE FOR SOFTENING SILK.

The accompanying engraving represents an improved machine employed by French manufacturers to soften and polish silk after dyeing. The skeins of silk are hung over bobbins, the lower ones being slightly raised for that purpose. The support being withdrawn, the slotted weights suspended from the lower bobbins come in play and stretch the silk.

An ingenious mechanism gives an oscillating motion to a horizontal rack engaging the vertical bars which support the lower bobbins, and the skeins are thereby twisted and untwisted while revolving, every part of the silk being brought in turn under the desired manipulation by the slower revolution of the upper bobbins. In this way the silk is softened and given a glossy finish. The machine takes up but little room, and is said to do its work in a superior manner.



MACHINE FOR SOFTENING SILK.

A Promising Experiment.

Some remarkable experiments in wheat cultivation have been tried in Michigan. Under the supervision of a committee appointed for the purpose, 68 lbs. of seed to the acre were sown in drills 16 inches apart, and the grain was cultivated with a horse hoe once in the fall and twice in the spring. For comparison, another plat of ground was sown with wheat drilled in, in the usual way, 90 lbs. to the acre. The committee reports that the average yield was 69½ per cent greater in the 16 inch drills than in the 8 inch, and while the former did not lodge or crinkle the latter did so badly.

[From *Harper's Magazine* for March, 1879.]

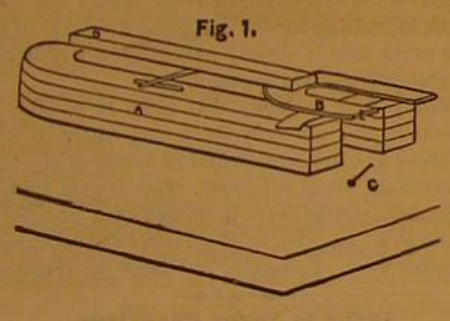
GARY'S MAGNETIC MOTOR.

With an ordinary horseshoe magnet, a bit of soft iron, and a common shingle-nail, a practical inventor, who for years has been pondering over the power lying dormant in the magnet, now demonstrates as his discovery a fact of the utmost importance in magnetic science, which has hitherto escaped the observation of both scientists and practical electricians, namely, the existence of a neutral line in the magnetic field—a line where the polarity of an induced magnet ceases, and beyond which it changes. With equally simple appliances he shows the practical utilization of his discovery in such a way as to produce a magnetic motor, thus opening up a bewildering prospect of the possibilities before us in revolutionizing the present methods of motive power through the substitution of a wonderfully cheap and safe agent. By his achievement Mr. Wesley W. Gary has quite upset the theories of magnetic philosophy hitherto prevailing, and lifted magnetism out from among the static forces where science has placed it to the position of a dynamic power. The Gary Magnetic Motor, the result of Mr. Gary's long years of study, is, in a word, a simple contrivance which furnishes its own power, and will run until worn out by the force of friction, coming dangerously near to that awful bugbear, perpetual motion.

The old way of looking at magnetism has been to regard it as a force like that of gravitation, the expenditure of an amount of energy equal to its attraction being required to overcome it; consequently its power could not be availed of. Accepting this theory, it would be as idle to attempt to make use of the permanent magnet as a motive power as to try to lift one's self by one's boot straps. But Mr. Gary, ignoring theories, toiled away at his experiments with extraordinary patience and perseverance, and at last made the discovery which seems to necessitate the reconstruction of the accepted philosophy.

To obtain a clear idea of the Gary Magnetic Motor, it is necessary first to comprehend thoroughly the principle underlying it—the existence of the neutral line and the change in polarity, which Mr. Gary demonstrates by his horseshoe magnet, his bit of soft iron, and his common shingle-nail. This is illustrated in Fig. 1. The letter A represents a compound magnet; B, a piece of soft iron made

Fig. 1.



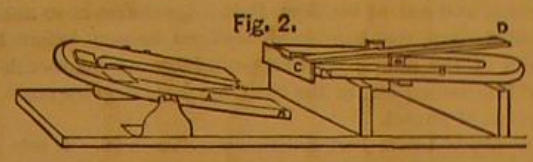
fast to a lever with a pivoted joint in the center, the iron becoming a magnet by induction when in the magnetic field of the permanent magnet; C, a small nail that drops off when the iron, or induced magnet, is on the neutral line. By pressing the finger on the lever at D, the iron is raised above the neutral line. Now let the nail be applied to the end of the induced magnet at E; it clings to it, and the point is turned inward toward the pole of the magnet directly below, thus indicating that the induced magnet is of opposite polarity from the permanent one. Now let the iron be gradually lowered toward the magnet; the nail drops off at the neutral line, but it clings again when the iron is lowered below the line, and now its point is turned outward, or away from the magnetic pole below. In this way Mr. Gary proves that the polarity of an induced magnet is changed by passing over the neutral line without coming in contact. In the experiment strips of paper are placed under the soft iron, or induced magnet, as shown in the figure, to prevent contact.

The neutral line is shown to extend completely around the magnet; and a piece of soft iron placed upon this line will entirely cut off the attraction of the magnet from anything beyond. The action of this cut-off is illustrated in Fig. 2. The letters A and B represent the one a balanced magnet and the other a stationary magnet. The magnet, A, is balanced on a joint, and the two magnets are placed with opposite poles facing each other. The letter C is a piece of thin or sheet iron, as the case may be, made fast to a lever with a joint in the center, and so adjusted that the iron will move on the neutral line in front of the poles of the stationary magnet. By pressing the finger on the lever at D the iron is raised, thus withdrawing the cut-off so that the magnet, A, is attracted and drawn upward by the magnet, B. Remove the finger, and the cut-off drops between the poles, and, in consequence, the magnet, A, drops again. The same movement of magnets can be obtained by placing a piece of iron across the poles of the magnet, B, after the magnet, A, has been drawn near to it. The magnet, A, will thereupon immediately fall away; but the iron can only be balanced, and the balance not disturbed, by the action of the magnets upon each other when the iron is on the neutral line, and does not move nearer or farther away from the magnet, B.

It may not be found easy to demonstrate these principles at the first trials. But it should be borne in mind that it took the inventor himself four years after he had discovered the principle to adjust the delicate balance so as to get a machine which would go. Now, however, that he has thought out the entire problem, and frankly tells the world how he has solved it, any person at all skillful and patient, and with a little knowledge of mechanics, may soon succeed in demonstrating it for himself.

The principle underlying the motor and the method by which a motion is obtained now being explained, let us examine the inventor's working models. The beam movement is the simplest, and by it, it is claimed, the most power can be obtained from the magnets. This is illustrated in Fig. 3. The letter A represents a stationary magnet, and B the soft iron, or induced magnet, fastened to a lever with a joint in the center, and so balanced that the stationary magnet will not quite draw it over the neutral line. The letter C represents a beam constructed of a double magnet, clamped together in the center and balanced on a joint. One end is set opposite the stationary magnet, with like poles facing each

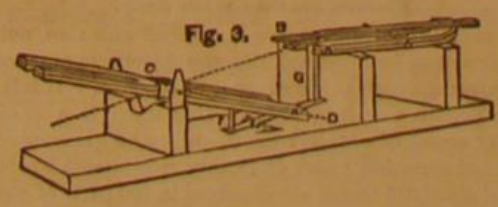
Fig. 2.



other. The beam is so balanced that, when the soft iron, B, on the magnet, A, is below the neutral line, it (the beam) is repelled down to the lower dotted line indicated by the letter D. The beam strikes the lever, E, with the pin, F, attached, and drives it (the lever) against the pin, G, which is attached to the soft iron, B, which is thus driven above the neutral line, where its polarity changes. The soft iron now attracts the beam magnet, C, to the upper dotted line, whereupon it (the soft iron) is again drawn down over the neutral line, and its polarity again changing, the beam magnet, C, is again repelled to the lower line, continuing so to move until it is stopped or worn out. This simply illustrates the beam movement. To gain a large amount of power the inventor would place groups of compound stationary magnets above and below the beam at each side, and the soft iron induced magnets, in this case four in number, connected by rods passing down between the poles of the stationary magnets. A "pitman" connecting the beam with a fly-wheel to change the reciprocating into a rotary motion would be the means of transmitting the power. With magnets of great size an enormous power, he claims, could be obtained in this way.

One of the daintiest and prettiest of Mr. Gary's models is that illustrating the action of a rotary motor. There is a peculiar fascination in watching the action of this neat little contrivance. It is shown in Fig. 4. The letter A represents an upright magnet hung on a perpendicular shaft; B, the horizontal magnet; C, the soft iron which is fastened to the lever, D; E, the pivoted joint on which the lever is balanced; and F, the thumbscrew for adjusting the movement of the soft iron. This soft iron is so balanced that as the north pole of the upright magnet, A, swings around opposite and above the south pole of the horizontal magnets, B, it drops below the neutral line and changes its polarity. As the magnet, A, turns around until its north pole is opposite and above the north pole of the magnets, B, the soft iron is drawn upward and over the neutral line, so that its polarity is changed again. At this point the polarity in the soft iron, C, is like that of the permanent magnets, A and B. To start the engine the magnet, A, is turned around to the last-named position, the poles opposite like poles of the magnets, B; then one pole of the magnet, A, is pushed a little forward and over the soft iron. This rotary magnet is repelled by the magnets, B, and also by the soft iron; it turns around until the unlike poles of the permanent magnets become opposite; as they attract each other the soft iron drops below the neutral line, the polarity changes and becomes opposite to that of the magnets, B, and like that of the magnet, A; the momentum gained carries the pole of A a little forward of B and over the soft iron, which, now being of like polarity, repels it around to the starting point, completing the revolution. The magnets, A and B, now compound or unite their forces,

Fig. 3.



and the soft iron is again drawn up over the neutral line; its polarity is changed, and another revolution, is made without any other force applied than the force of the magnets. The motion will continue until some outside force is applied to stop it, or until the machine is worn out.

The result is the same as would be obtained were the magnets, B, removed and the soft iron coiled with wire, and battery force applied sufficient to give it the same power that it gets from the magnets, B, and a current changer applied to change the polarity. The power required to work the current changer in this case would be in excess of the power demanded to move the soft iron over the neutral line, since no power is required from the revolving magnet under these circumstances, it being moved by the magnets compounding when like poles are opposite each other, three magnets thus attracting the iron. When opposite poles are near together, they attract each other and let the iron drop below the line. The soft iron, with its lever, is finely balanced at the joint, and has small springs applied and adjusted so as to balance it against the power of the magnets. In this working model the soft iron vibrates less than a fiftieth of an inch.

The rotary motion is intended for use in small engines where light power is required, such as propelling sewing machines, for dental work, show windows, etc.

When Wesley Gary was a boy of nine years, the electric telegraph was in its infancy and the marvel of the day; and his father, who was a clergyman in Cortland county, New York, used to take up matters of general interest and make them the subject of an occasional lecture, among other things, giving much attention to the explanation of this new invention. To illustrate his remarks on the subject he employed an electro magnetic machine. This and his father's talk naturally excited the boy's curiosity, and he used to ponder much on the relations of electricity and magnetism, until he formed a shadowy idea that somehow they must become a great power in the world. He never lost his interest in the subject, though his rude experiments were interrupted for a while by the work of his young manhood. When the choice of a calling was demanded, he at first had a vague feeling that he would like to be an artist. "But," he says, "my friends would have thought that almost as useless and unpractical as to seek for perpetual motion." At last he went into the woods a-lumbering, and took contracts to clear large tracks of woodland in Western and Central New York, floating the timber down the canals to Troy. He followed this business for several years, when he was forced to abandon it by a serious attack of inflammatory rheumatism, brought about through exposure in the woods. And this, unfortunate as it must have seemed at the time, proved the turning point in his life. His family physician insisted that he must look for some other means of livelihood than lumbering. To the query, "What shall I do?" it was suggested that he might take to preaching, following in the footsteps of his father, and of a brother who had adopted the profession. But this, he said, he could never do; he would do his best to practice, but he couldn't preach. "Invent something, then," said the doctor. "There is no doubt in my mind that you were meant for an inventor." This was really

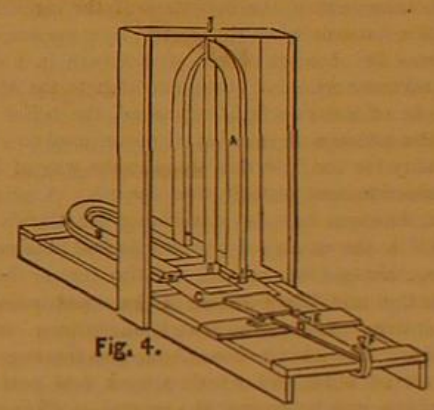


Fig. 4.

said in all seriousness, and Mr. Gary was at length persuaded that the doctor knew him better than he did himself. His thoughts naturally recurring to the experiments and the dreams of his youth, he determined to devote all his energies to the problem. He felt more and more confident, as he dwelt on the matter, that a great force lay imprisoned within the magnet; that some time it must be unlocked and set to doing the world's work; that the key was hidden somewhere, and that he might find it as well as some one else.

At Huntingdon, Pa., Mr. Gary made his first practical demonstration, and allowed his discovery to be examined and the fact published. He had long been satisfied, from his experiments, that if he could devise a "cut-off," the means of neutralizing the attractive power of a stationary magnet on another raised above it and adjusted on a pivot, unlike poles opposite, and so arrange this cut-off as to work automatically, he could produce motion in a balanced magnet. To this end he persistently experimented, and it was only about four years ago that he made the discovery, the key to his problem, which is the basis of his present motor, and upsets our philosophy. In experimenting one day with a piece of soft iron upon a magnet he made the discovery of the neutral line and the change of polarity. At first he gave little attention to the discovery of the change of polarity, not then recognizing its significance, being absorbed entirely by the possibilities the discovery of the neutral line opened up to him.

Here was the point for his cut-off. For a while he experimented entirely with batteries, but in September, 1874, he succeeded in obtaining a movement independent of the battery. This was done on the principle illustrated in Fig. 2. The balanced magnet, with opposite poles to the stationary magnet, was weighted so that the poles would fall down when not attracted by the stationary magnet. When it was attracted up to the stationary magnet, a spring was touched by the movement, and thus the lever with the soft iron was made to descend between the two magnets on the neutral line, and so cutting off the mutual attraction. Then the balanced magnet, responding to the force of gravitation, descended, and, when down, struck another spring, by means of which the cut-off was lifted back to its original position, and consequently the force of attraction between the magnets was again brought into play.

In June, the following year, Mr. Gary exhibited this continuous movement to a number of gentlemen, protecting himself by covering the cut-off with copper, so as to disguise

the real material used, and prevent any one from robbing him of his discovery. The publication in the local newspapers of the performance of the little machine, which was copied far and wide, excited much interest. But the inventor was by no means satisfied. He had succeeded in securing a continuous motion, but not a practical motor. He had invented a unique plaything, but not a machine that would do man's work. So he made further experiments in one direction and another, using for a long time the battery; and it was not until some time after he moved to Boston (which was about two years ago) that he was convinced that the points in the change of polarity, with which he was so little impressed when he first hit upon them along with his discovery of the neutral line, were the true ones to work upon. Thereafter his progress was most rapid, and in a little while he had constructed working models, not only to his own satisfaction, but to that of those experts who had the fairness to give them a critical and thorough examination, clearly demonstrating his ability to secure motion and power, as they had never before been secured, from self-feeding and self-acting machines. His claim, as he formally puts it, is this: "I have discovered that a straight piece of iron placed across the poles of a magnet, and near to their end, changes its polarity while in the magnetic field and before it comes in contact with the magnet, the fact being, however, that actual contact is guarded against. The conditions are that the thickness of the iron must be proportioned to the power of the magnet, and that the neutral line, or line of change in the polarity of the iron, is nearer or more distant from the magnet according to the power of the latter and the thickness of the former. My whole discovery is based upon this change of polarity in the iron, with or without a battery." Power can be increased to any extent, or diminished by the addition or withdrawal of magnets.

Mr. Gary is forty-one years old, having been born in 1837. During the years devoted to working out his problem he has sustained himself by the proceeds from the sale of a few useful inventions made from time to time when he was forced to turn aside from his experiments to raise funds. From the sale of one of these inventions—a simple little thing—he realized something like ten thousand dollars.

The announcement of the invention of the magnetic motor came at a moment when the electric light excitement was at it height. The holders of gas stocks were in a state of anxiety, and those who had given attention to the study of the principle of the new light expressed the belief that it was only the question of the cost of power used to generate the electricity for the light that stood in the way of its general introduction and substitution for gas. A prominent electrician, who was one day examining Mr. Gary's principle, asked if in the change of polarity he had obtained electric sparks. He said that he had, and the former then suggested that the principle be used in the construction of a magneto-electric machine, and that it might turn out to be superior to anything then in use. Acting on this suggestion, Mr. Gary set to work, and within a week had perfected a machine which apparently proved a marvel of efficiency and simplicity. In all previous machines electricity is generated by revolving a piece of soft iron in front of the poles of a permanent magnet. But to do this at a rate of speed high enough to produce sparks in such rapid succession as to keep up a steady current of electricity suitable for the light, considerable power is required. In Mr. Gary's machine, however, the piece of soft iron, or armature, coiled with wire, has only to be moved across the neutral line to secure the same result. Every time it crosses the line it changes its polarity, and every time the polarity changes, a spark is produced. The slightest vibration is enough to secure this, and with each vibration two sparks are produced, just as with each revolution in the other method. An enormous volume can be secured with an expenditure of force so diminutive that a caged squirrel might furnish it. With the employment of one of the smallest of the magnetic motors power may be supplied and electricity generated at no expense beyond the cost of the machine.

The announcement of the invention of the magnetic motor was naturally received with incredulity, although the recent achievements in mechanical science had prepared the public for almost anything, and it could not be very much astonished at whatever might come next. Some admitted that there might be something in it; others shrugged their shoulders and said, "Wait and see;" while the scientific referred all questioners to the laws of magnetic science; and all believers in book authority responded, "It can't be so, because the law says it can't." A few scientists, however, came forward, curious to see, and examined Mr. Gary's models; and when reports went out of the conversion of two or three of the most eminent among them, interest generally was awakened, and professors from Harvard and from the Massachusetts Institute of Technology called, examined, and were impressed. More promptly than the scientists, capitalists moved; and before science had openly acknowledged the discovery and the principle of the invention, men of money were after Mr. Gary for the right to use the motor for various purposes; one wished to use it for clocks, another for sewing-machines, others for dental engines, and so on.

It is as yet too soon to speculate upon what may result from the discovery; but since it produces power in two ways, both directly by magnets and indirectly by the generation of unlimited electricity, it would seem that it really might become available in time for all purposes to which electricity might long ago have been devoted except for the great expense involved. Within one year after the invention of the telephone it was in practical use all over the world, from the United States to Japan. And it is not incredible that in 1880 one may be holding a magnetic motor in his pocket, running the watch which requires no winding up, and, seated in a railway car, be whirling across the continent behind a locomotive impelled by the same agency.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although only approximate, they will enable the ordinary observer to find the planets.

M. M.

POSITIONS OF PLANETS FOR MARCH, 1879.

Mercury.

On March 1 Mercury rises a little before seven in the morning, and sets at 5h. 30m. P.M. Its course is so nearly that of the sun, that it probably will not be seen before the middle of the month. After the middle of the month it should be looked for, in the twilight, some degrees north of the point of sunset.

Mercury is in its best position on March 29. It sets on the 31st at 8 P.M., about a degree south of the point at which Venus sets.

Venus.

Venus will be more and more conspicuous, in the west, during the whole month of March. It sets on March 1 at 7h. 28m. P.M., and on the 31st at 8h. 41m. P.M.

Venus and Saturn will have nearly the same apparent position on the evening of March 2, and with a small telescope, can probably be seen in the field of view at the same time.

Mars.

Mars is not likely to be seen, as it is visible only in the early morning hours. Mars rises on March 1 at 4h. 9m. A.M. far south of east, and sets at 1h. 12m. P.M.

On March 31 Mars rises at 3h. 26m. A.M., and sets at 1h. 3m. P.M.

Jupiter.

Jupiter's path is so nearly that of the sun, that it cannot be seen until the latter part of the month, and at that time for only a short interval before sunrise. On March 31 Jupiter rises at 4h. 23m. A.M., far south of east.

Saturn.

Saturn is now so far from us, and sets so soon after the sun, that only its larger satellites can be seen, even with a powerful telescope.

On March 1 Saturn rises at 7h. 40m. A.M., and sets at 7h. 33m. P.M. On March 31 Saturn rises at 5h. 50m. A.M., and sets at 5h. 54m. P.M. On March 2 Saturn and Venus approach; Saturn will be south of Venus.

Uranus.

Although Uranus has passed its point of opposition, it is still in good position for evening observers.

On March 1 Uranus rises at 4h. 56m. P.M., and sets at 6h. 20m. A.M. of the next day. On March 31 Uranus rises at 2h. 52m. A.M., and sets at 4h. 19m. P.M.

Uranus comes to the meridian at 10 P.M. on March 25, at an altitude (in lat. 42°) of 60°. It is then nearly between Regulus and Rho Leonis, 3° east of Regulus. A telescope of two inches aperture will show the planet with a disk, and it is sometimes seen with the eye. With a powerful glass Uranus appears as a small bluish-white planet, unmarked by spots. Its satellites are not easily found; very rarely are more than two seen.

The Zodiacal Light.

The zodiacal light is a column of soft white light seen after sunset and before sunrise. It has been unusually bright during February, its cone-shaped figure resting upon the horizon; its apex has been seen near the Pleiades. On February 12, at 7 P.M., it was so brilliant that the rest of the sky seemed to be thrown into darkness. The southern boundary was decidedly brighter than the northern. It can probably be seen on any moonless night in March. It is most easily traced by looking a little north of west, and therefore seeing it by oblique vision.

Electro-plating with Zinc.

The so-called galvanized iron is covered with zinc, not by galvanic action, but mechanically, the object being to protect it by galvanic action at the expense of the zinc. If it is desired to deposit a uniform layer of zinc upon iron or other metal by means of a battery the following bath is employed: 10 parts of alum and 1 part of freshly precipitated hydrated oxide of zinc (still moist) are dissolved in 100 parts of water. This bath can only be used cold. The article to be plated is cleaned in an acid bath, attached to the negative pole of a battery, and immersed in the above bath. A large plate of cast zinc is connected with the positive pole. The current need not be very strong, and the zinc is deposited equally well upon all metals. If copper which has been zinc plated in this way is heated, a beautiful and thin layer of brass is produced on the surface. When iron is coated in this way the strength of the coating increases upon warming the article, and the iron is completely protected from rust. The thickness of the coating, of course, is proportional to the time it is left in the bath. It must be borne in mind, however, that the zinc is poisonous, and such vessels should never be used either for culinary purposes or to hold drinking water, which objection does not hold in regard to the more expensive, but likewise more durable, nickel plating. For ornamental and architectural work and some parts of machinery zinc will prove a cheap and useful substitute.

Wise Industrial Legislation not Impossible.

Discussing the memorial with reference to the establishment of a national industrial bureau, lately presented to Congress by Senator Davis, of Illinois, a writer in the Newark *Advertiser* says:

Confessedly the greatest difficulty environing this subject lies in our inability to mobilize labor, so that when any special industry becomes overcrowded, its muscle and brain may be speedily transferred to other employments. If a part of the sad toilers of the coal mines could have been suddenly moved off and transformed into agriculturists at the time of the decline of the iron trade, a long story of privation would have remained untold. But they were miners and miners only, and, mostly of foreign origin, they lacked that transmutability which is peculiar to the American mechanic and laborer, who is usually enough of a jack of all trades to try his hand at something new whenever his present resource has failed him. It is from this latter class that the agriculture of the West has been so amazingly recruited within the last five years, so that Kansas and other trans-Mississippi States have grown in wealth and population while all was idle and retrograde at the East. Still another difficulty is that the trades are now so subdivided that few mechanics know more than some one specialty of their avocation, and the intrusion of a pegging machine breaks up a whole "gang" of shoemakers. The first influence of the introduction of machinery is always to depreciate the value of handiwork. It takes some time to adapt the two so that they can work in harmony, as they always do at last.

That it is not altogether Utopian to look to legislation for some remedy of this evil, is plain in the one fact we have referred to of the vast growth of agriculture during our recent period of depression of trade and commerce. Had it not been for homestead legislation almost thirty years ago this exodus of labor from the East to the West and from the shop to the field would have been impossible. Had it not been for a system of legislation far older than the Homestead act, as it is also more recent because it has been continuous, the new settlers at the West would not have found a School Fund already provided and waiting for them. Given good lands and good schools as a free gift, poverty is inexcusable, and that at least legislation has done for labor. It has done far more. It has given to the emigrant the shelter of established order, the protection of the law, an organized government based on the experience of older States, and put them all at work in waiting for the oncoming flood tide of population. So much then is already proved to be within the easy scope of statesmanship to accomplish.

This achievement suggests that more is possible in the same direction, and not only those who suffer in idleness, not only those who are sentimental philanthropists, but careful and cautious social scientists, who reason calmly and from facts, believe that there is enough of a possible Providence, even in a Congress, to afford cheer and encouragement in the further work of adapting our labor to civilization.

Advice to Young Physicians.

At the thirty-eighth annual Commencement of University Medical College, held at the Academy of Music in this city a few evenings since, Chancellor Howard Crosby performed the duty of conferring the degree of M.D. upon 205 young men, composing the largest medical class ever graduated in America.

The Chancellor afterward delivered an address to the graduating class, which contained much good advice, and was received with great applause.

Among other good things, which we have not room to give, the Chancellor said: The same Faculty who have counted you worthy to receive the Degree of Doctor of Medicine have counted me worthy to address you with words of counsel on this occasion, and if I respect their decision in the one case I am obliged as a reasoning mortal to respect it in the other. Whenever I enter the medical college a new sense of my ignorance bursts painfully upon me, accompanied by a profound feeling of awe, to conceal both of which I have to summon all of my powers of hypocrisy and to appear very knowing and perfectly at my ease. So I walk around the museum and delightedly examine the bottled diseases that ornament that instructive department, and if Dr. Darling is near I drop a Latin phrase of admiration; then I mount to the microscopic apparatus and put histological questions, whose answers, wholly indigestible, I nevertheless swallow with apparent gusto, after which I am thoroughly prepared to visit the Styx, Acheron, and Pyriphlegethon, the region of *monstra horrenda quibus lumina adempta*, a region which, strange to say, in that wonderful edifice occupies the highest story. I descend to the Faculty Chamber, and there serenely talk with men who, I know, look right through me, and see my liver and my diaphragm as plainly as they see my nose. Nor does my presence of mind leave me here; my faith is encouraged to rise to a sublime height, and so when Dr. Thomson tells me that the heat of the healthy body never rises above 98°, I believe him, although I have been baked under an Arabian sun with the mercury about 150°; and when Dr. Arnold tells me that the teeth are not bones, I believe him, while I inwardly wonder what they are if they are *not* bone.

"A rolling stone gathers no moss," which I suppose may be also read, "An itinerant doctor gets *no* practice." There are some men in this world so impatient that they dodge their opportunities. Their opportunities come along and find them gone. If they had waited the tide would have turned or the wind would have blown from a different quar-

ter. A professional man starting in life will be sorely tempted to this recklessness, wearily. Waiting for clients or patients, it is so very natural to think, "This cannot be the spot: I ought to be in another part of the city, or in another town," but it *is* the spot, only he isn't the *man* quite. He will be when he has become longer known in the neighborhood, when acquaintance has ripened into confidence, and confidence into experience of his professional ability. Great names, gentlemen, were once very small names, and large fortunes began with a dollar. Identify yourself with one place, and in due time you'll become as well known and well used as the penitentiary.

"The early bird catches the worm." I know malevolent wit has from this wholesome saw drawn an unhealthy conclusion about the stupidity of early worms, but you will not, I'm sure, be misled by those triflers. The adage means promptness, and promptness means self-denial, and self-denial is ugly. For it means getting out of a warm bed in the middle of a cold night to breast the storm for a mile or two; it means letting that smoking dinner go untouched; it means giving up that ride with your sweetheart just as you were going to be so comfortable in the buggy; it means, in short, everything, however disagreeable, when duty calls. If you are ever ready on call, people will be ready with their calls. They always count the prompt doctor the best doctor. Your skill will be of small avail without promptness to use it.

"Pleasant words are health to the bones," which may be also read, "A doctor's cheerfulness is often as good as his physic." I wish some one of you gentlemen would take the leisure of the next year—while you are waiting for patients—in studying the curative properties of cheerful manners in the sick room, and then publish your discoveries in a manual for Dr. Thomson to use with his classes. I don't suppose you could do much with scarlet fever or smallpox; but what a vast array there is of nervous diseases to which pleasant words would be like the breath of spring and the oxygen of the mountain top! Cheer up your patient, and you'll rectify the circulation; cheer up your patient, and you'll augment his nerve power; cheer up your patient, and all the tissues will revive. Medicine must sometimes be disagreeable, but doctors never. A physician's face should be like sunshine and his voice like wedding bells.

"Take care of the pennies, and the pounds will take care of themselves." Now, don't think I am going to preach pecuniary carefulness to you. No. I have quoted the proverb for quite another purpose. It is of time, not money, I would use it. Your whole life is to be given to science; to one of the noblest departments of scientific research and activity. You are therefore to grow in scientific knowledge. Your learned professors have only started you in the paths of exploration. But while you are to study, you are also, I trust, to be very busy in your practice. Of course, then, you cannot sit down and say, "I'll devote this week or this day to study." There's a sore throat over the way, and an erysipelas five miles off, that knock that pretty design in the head. You will have no long delicious sails on the sea of medical learning. But you will have scraps of time, five minutes here and a quarter of an hour there, coming along very tantalizingly, but nevertheless coming along between two calls or between sawing the wood and holding the baby. Now, these scraps of time are your very fortune. Add up the minutes and you are astonished that they amount to whole days, and many of them. Have a valuable treatise on some branch of your profession always open on your table or desk, with your open note book and pencil by its side. Drop into your seat and catch at least one idea. The five minutes are gone and away you go, but you have caught and fastened a new idea. Go on in that way and you'll have a mountain of them in a year. Use diligently your scrap time. Don't lounge. Don't think fifteen minutes are so short that there is no use in applying one's self to anything in particular. Save up these pennies of time, and then hurrah for the pounds.

"*Obsta principiis*," which good old Matthew Henry translated by an English proverb, "Nip mischief in the bud." Begin your medical career with a careful avoidance or abandonment of bad habits, especially such as would harm your standing in the esteem and regard of your patients. A man whose clothes are saturated with stale tobacco smoke is not an agreeable visitor in a sick room. Nor is it reviving to a delicate organization to have stimulants applied through the physician's breath. Neatness in personal apparel and delicacy in manipulation may seem to be small matters, but I can assure you that their neglect may have a weighty influence toward failure.

Now, gentlemen, don't be proud because you are the world's benefactors. Beneficence can afford to be modest because its rank is so high. The real nobility need not be particular about publishing its titles. It leaves self-praise to quacks and mountebanks. Do your full duty as physicians, and you will have all the respect and praise that are your due without any effort to put feathers in your own cap.

THE LURAY CAVERN.

BY H. C. HOVEY.

(Continued from page 58.)

Stalactitic distortion is a new and fascinating study. The grotesque results have been repeatedly described, but the causes have been overlooked.

Consider, first, the normal growth of a stalactite. It is tubular and cylindrical. A drop of lime water, on evaporation, deposits a ring of its own diameter. The next drop makes a second ring exactly equal to the first, and cemented to it. Ring follows ring, in a continually lengthening tube, through which the water drips, never able to lay down its burden of carbonate of lime until it reaches the air. Myriads of these white and fragile tubes are to be seen thickly crowded together, from an inch to a foot in length, and sometimes extending for several feet from roof to floor.

When the flow of water exceeds the capacity of the tube, or the orifice is closed up, a series of layers will be formed by the overflow, thicker above than below. Thus the cylinder is transformed into an elongated cone. The distortion of these simple shapes cannot be due to fluctuations of the air, as in the case of icicles; nor to varied resistance of the medium penetrated, as in roots piercing the soil; nor to parasitic punctures, as in vines and stems, although simulating all these abnormal growths. Such causes are not in operation here. What agencies, then, have produced these extraordinary results?

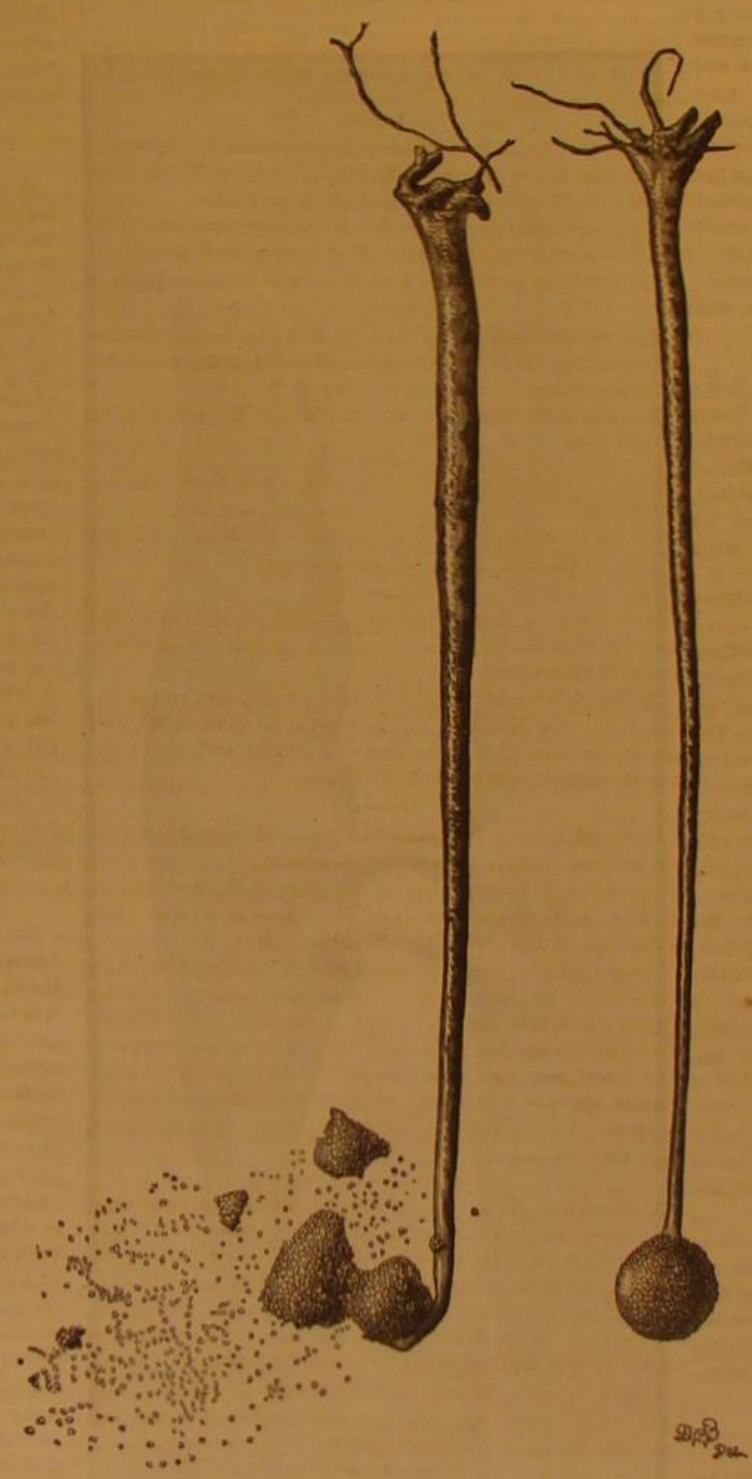


Fig. 1.—MUCOR STALACTITIS.—FROM LURAY CAVERN.

Crystallization is one of the causes sought. A delicate tassel is often formed on the tip of a stalactite; it sometimes envelops the entire tube. The same growth also shoots up from blocks of limestone and nodules of flint, and from its resemblance to petrified moss, it is generally so called. But each pointed leaf is really a brown, yellow, or white crystal of aragonite, occasionally prismatic in shape, and more rarely rounded like delicate fruitage. The indications pointed to a temporary submersion, at some time, of the substance to which the clusters were attached.

On a renewal of stalactitic growth, the fresh deposit would, of course, be exterior to these increments, causing many curious distortions. The tassel, by incrustation, becomes a bulb. The enlargement is often so great as to inwrap contiguous stalactites, whose primary tubes appear, by a transverse section, like pipe stems piercing the excrescence.

Uncouth expansions grow wherever crystals having shot forth are afterwards coated with layers of carbonate of lime. Fungi also play an important and hitherto unnoticed part in stalactitic distortion. Our attention was called to numerous fine, elastic bristles growing on stalactites and other kinds of dripstone in all parts of the cavern. Each carries a little ball at its extremity, usually enveloped by a globule of water. We further observed that the conditions often favored a thin deposit of the carbonate of lime on these bristles, so that their shape remained after the substance had decayed. Many of these black setæ and white filaments were examined by the microscope, and the gradations were traced from the finest hairs up to great knots and tangled outgrowths.

This fungus is a new species of *Mucor*, to which I have affixed the specific name of *Stalactitis* (see Fig. 1), with the following botanical description, namely:

MUCOR *stalactitis*.—Sporangia, globose, membranaceous, dehiscent by a fissure, terminating threads; sporidia, subglobose and separating; flocci, tubular, indistinctly partitional, sometimes branching at the base, but never at the apex. Specific marks: sub-solitary threads; sporangia simple; height, one tenth to one half an inch; color, dark olive green; found on stalactites and other formations in caves; locality, Luray, Page county, Virginia.

My thanks are due to Professor D. C. Eaton, of Yale College, for aid in examining this beautiful fungus; and also to W. H. Miller, M.D., of Luray, for help in collecting specimens.

Among many examples of lateral outgrowths having fungi for starting points, a single one must suffice for description, selected as exhibiting an extraordinary result of this kind of interference. (See Fig. 2, reduced to one fourth natural size.) The distortion is so symmetrical as to argue design. From a large stalactite two tendrils have grown, which we are sure, from careful examination, did not originate with crystals, but with fungi. The trickling lime water was arrested by them in its descent along the surface, and made a thin deposit, which was increased until the projections caught calcareous drippings falling directly from the roof of the cave. A structure was thus built up, of considerable magnitude compared with its slender support, and in which the ordinary relations of stalactite and stalagmite are interchanged, the stalagmite being uppermost.

Luray Cavern continually yields new discoveries of surprising beauty as the reward of perseverance. Explorations have been lately pushed through a long corridor, having a central row of stalagmites running through its entire length, leading from Stonewall Avenue into a splendid hall, about 100 feet in diameter and equally high. It is located, according to our topographical examination, under a sink observed about 100 yards southwest of the mouth of the cave, and within 200 yards of the entrance to Ruffner's Cave at the summit of the hill. We daily expect to hear of the discovery of some communicating passage between these two caverns. There are proofs that the Indians explored these hidden recesses by some other means than the present entrance.

One day we mounted the huge masses of dripstone, near the Double Column, by means of a ladder. Then creeping a long distance, unwinding a ball of twine as a clew by which to return, and breaking hundreds of delicate stalactites that it seemed a pity to disturb, but that barred our way, we emerged on an eminence, whence with some difficulty we descended into a deep ravine. This locality was thought to be the furthest point from the entrance, so far as known. And there, by digging with our knives in the dry bed of an old torrent, we unearthed an arrowhead and a quantity of charcoal. At a later day a party found moccasin tracks near the Double Column, covered by shallow water and incrusted by a thin coating of lime.

In a gulch near the Imperial Spring human bones are visible, including a jaw with three tooth sockets, the femur, the tibia, and the ribs, the latter fractured. The remainder of the skeleton is concealed under dripstone, for whose formation several centuries must have been required.

The conclusion that these are Indian remains would no doubt be confirmed by skillful exhumation, especially should any weapons or ornaments be thus brought to light. The unlucky adventurer, apparently a youth less than 18 years of age, is supposed to have lost his way amid the darkness, and to have fallen from the cliff at whose base his bones now lie entombed in alabaster.

We found in all parts of the cave vestiges of former occupants of the humbler forms of life, and especially observed thousands of tracks once made by rats, rabbits, raccoons, and wolves. In one locality we pursued bear tracks to a spot where bruin had left long scratches on a stalagmite not yet healed over. All these impressions looked fresh, but could not have been so, for it is years since any wild beasts have appeared in the vicinity. Marks in the tenacious clay might remain unchanged for centuries.

Various layers of excrementitious matter were noticed, and also many small bones of mice and bats, along with casts of

worms. A few large bones have been gathered up, but not yet identified. We recognized the skeleton of a squirrel, the jaw of a raccoon, the jaw and teeth of a large carnivore (possibly a panther), the skull of a wolf, and the skull of a deer that was probably dragged in from above, as it was gnawed by rodents. All the animal remains thus far met with are geologically recent, although the cavern itself must be older than the Tertiary period.

Scientific cave digging has not yet been begun at Luray. This would require a thorough breaking up of the stalagmitic floor down to the solid limestone, followed by an exhaustive examination of the contents in vertical slices. The process need not injure objects of general interest, if limited to portions not now open to the public; and it would almost certainly be rewarded by valuable archæological discoveries.

The list of living fauna is meager, including one rabbit, twenty bats, and numerous small black spiders. The latter were probably brought in with the lumber and other material used in making walks and stairways.

It was taught by Agassiz, and has long been the popular notion, that the various forms of aquatic life existing in caverns were originally created within the limits over which they now range and with the structural peculiarities now belonging to them. But it is doubtful if there is more variability than can be explained by supposing simple retardation through successive generations. For example: the well-known *Amblyopsis spelæus* has congeners enjoying perfect vision. Cave rivers contain fish with eyes, with sightless eyes, with mere protuberances instead of eyes, and finally those destitute of even rudimentary visual organs. Gradations of color and osseous structure correspond. It is certain, moreover, that subterranean streams feed open rivers, with which many of them are so connected, at high water, as to be easily replenished by familiar fluviatile forms.

Were the old hypothesis correct, we ought to find living objects in the pure and wholesome waters of the Luray Cavern. But, so far as we could learn, those beautiful basins, transparent as air, and lined with white crystals, so that every portion is clearly visible, are totally uninhabited, however broad and deep; and the sole assignable cause for such remarkable barrenness is their isolation from outer streams.

Only six very small gravel-cut domes were found. They are located in Stebbins Avenue, and they seem but copies, on a greatly reduced scale, of those lofty domes of the Kentucky caves that cut clear through from the soil to the drainage level. Yet the cavern floors are traceable, and we satisfied ourselves of the existence of four distinct tiers. The vertical distance from the highest gallery to the lowest pit is about 220 feet. Basins are found at every altitude; all filled by percolation. Our visit was just after very heavy rains, and the walls were everywhere dripping, but no running streams appeared, although dry torrent beds are common. These all belong to the ancient history of the cave.

There is an extraordinary rift near Brodus Lake. We traced it for over 500 feet. Its width varies from 1 to 2 feet, and it seems to have been caused by the settling of the rocks in consequence of having been undermined. Interiorly it slants at an angle of 30° from the perpendicular. Campbell, who is a daring climber, had already, as he informed me, descended by the aid of a rope 50 feet long till the end of it was reached, without touching bottom. In my company two other trials were made at more favorable points, and without a rope; but in each instance the edge of a pit was reached, whose depth was not ascertained, but was thought to be not more than 20 or 30 feet.

Could this lowest floor of all be reached, which must in the nature of the case be nearly down to drainage level, we anticipate the discovery of running streams containing fish, crustacea, and fresh water algæ; and we confidently predict that, allowing for retardation, they will be found to resemble species now existing in the Shenandoah river and its tributaries.

SOME RECENT INVENTIONS.

An improved process of hardening, toughening, and increasing the homogeneous character of metal castings and alloys, has been patented by N. W. Williams, of Philadelphia, Pa. It consists in applying to the surface of the molten metal pieces of horn or other analogous material.

A barbed wire or cable for fences, having a new form of double or interlocked barb, invented by Mr. Joseph Winterbotham, of Joliet, Ill., has double pointed barb sections, bent in a peculiar manner and combined with a duplex cable, so that the barbs cannot loosen or become detached.

An improvement in rubber horseshoe pads, patented by William A. Taylor, of Washington, D. C., has a beveled flange that projects down inside of the shoe to avoid balling, and it is capable of being expanded to suit the size of the hoof.

An improvement in suspenders, which provides for supporting both pantaloons and drawers, or pantaloons and overalls, invented by Mr. William A. Miller, of Martinsville, Ill., is contrived so that both garments will be supported properly without liability to disarrangement.

An improved roofing tile, in which provision is made for rendering the joints secure, has been patented by Mr. Edwin Bennett, of Baltimore, Md. This tile is diamond-shaped, and has marginal ribs at its two upper edges, and is provided with downwardly projecting ribs at its two lower edges for engaging the upper ribs of the adjacent tile; it also has a channel which constitutes a rib seat, and is entirely covered by the tile which overlaps it.

A simple and sure fastening for hames has been patented by Mr. Joseph Frank, of New York city. It consists in the combination of hook plates and a lever for throwing one of the plates into engagement with the other, and a spring-action catch for retaining the lever.

What to Do in Cases of Diphtheria.

From the Circular of the Massachusetts State Board of Health.

In the first place, as diphtheria is a contagious disease, and under certain circumstances not entirely known, very highly so, it is important that all practical means should be taken to separate the sick from the well. As it is also infectious, woolen clothes, carpets, curtains, hangings, etc., should be avoided in the sick room, and only such materials used as can be readily washed.

All clothes, when removed from the patient, should be at once placed in hot water. Pocket-handkerchiefs should be laid aside, and in their stead soft pieces of linen or cotton cloth should be used, and at once burned.

Fig. 2.—CURIOUS STALACTITE GROWTH.—FROM LURAY CAVERN.

Disinfectants should always be placed in the vessel containing the expectoration, and may be used somewhat freely in the sick room; those being especially useful which destroy bad odors without causing others (nitrate of lead, chloride of zinc, etc.). In schools there should be especial supervision, as the disease is often so mild in its early stages as not to attract common attention; and no child should be allowed to attend school from an infected house, until allowed to do so by a competent physician. In the case of young children, all reasonable care should be taken to prevent undue exposure to the cold.

Pure water for drinking should be used, avoiding contaminated sources of supply; ventilation should be insisted on, and local drainage must be carefully attended to. Privies and cesspools, where they exist, should be frequently emptied and disinfected; slop water should not be allowed to soak into the surface of the ground near dwelling houses, and the cellars should be kept dry and sweet. In cities, especially in tidal districts, basins, baths, etc., as now connected with drains, should never communicate directly with sleeping rooms.

In all cases of diphtheria, fully as great care should be taken in disinfecting the sick room, after use, as in scarlet fever. After a death from diphtheria, the clothing disused should be burned or exposed to nearly or quite a heat of boiling water; the body should be placed as early as practicable in the coffin, with disinfectants, and the coffin should be tightly closed. Children, at least, and better adults also in most cases, should not attend a funeral from a house in which a death from diphtheria has occurred. But with suitable precautions, it is not necessary that the funeral should be private, provided the corpse be not in any way exposed.

Although it is not at present possible to remove at once all sources of epidemic disease, yet the frequent visitation of such disease, and especially its continued prevalence, may be taken as sufficient evidence of insanitary surroundings, and of sources of sickness to a certain extent preventable.

It should be distinctly understood that no amount of artificial "disinfection" can ever take the place of pure air, good water, and proper drainage, which cannot be gained without prompt and efficient removal of all filth, whether from slaughter houses, etc., public buildings, crowded tenements, or private residences.

Manufacturers' Troubles in England.

A correspondent writes to the *Kidderminster Shuttle* the following account of great ingratitude on the part of some weavers employed at one of the carpet manufactories in Stourport. An important order was received by a firm for immediate execution, and a short time before Christmas information was received that the carpets ordered were urgently wanted. The manager saw the weavers engaged on the order, and urged them to lose no time in the completion of the work, and asked them to work overtime. The men informed the manager that it was against the rules of the association of which they were members to work overtime; and, as there appeared no possibility of the order being completed by the time required, the manager set several young men on some looms to work overtime, and by this means the order was duly executed. The firm, with the view of preventing any bickerings among the men, allowed the weavers engaged on the order to charge full price for all the carpet woven by the young men, while the firm paid the youths handsomely for all the overtime made by them. A few days after the men had received the money earned by the youths a deputation of weavers waited upon the principal of the firm, and protested against the employment of the youths on the looms, and, in addressing his employer, one of the deputation urged that if the person ordering the carpets wanted the order executed in such haste, he should have distributed the order among the several firms in the town!

Large Libraries.

By far the largest library in the world is the National Library at Paris, which in 1874 contained 2,000,000 printed books and 150,000 manuscripts. Which the next largest is, it is difficult to say, for the British Museum and the Imperial Library of St. Petersburg both had in 1874 1,100,000 volumes. After them comes the Royal Library of Munich with its 900,000 books. The Vatican Library at Rome is sometimes erroneously supposed to be among the largest, while in point of fact it is surpassed, so far as the number of volumes goes, by more than sixty European collections. It contains 105,000 printed books and 25,500 manuscripts. The National Library at Paris is one of the very oldest in Europe, having been founded in 1350, while the British Museum dates from 1753, or a time more than 400 years later. In the United States the largest is the Library of Congress at Washington, which in 1874 contained 261,000 volumes. The Boston Public followed very closely after it with 260,500 volumes, and the Harvard University collection came next with 200,000. The Astor and Mercantile, of New York, are next, each having 148,000. Among the colleges after Harvard's Library comes Yale's with 100,000. Dartmouth's is next with 50,000, and then come in order Cornell with 40,000; the University of Virginia with 36,000; Bowdoin with 35,000; the University, of South Carolina, with 30,000; Ann Arbor, 30,000; Amherst, 29,000: Princeton, 28,000; Wesleyan, 25,500; and Columbia, 25,000.

Australian Letters.

E. C. H., Sydney, N. S. Wales, writes: It would be well for all American correspondents to know that unless their letters, etc., addressed to Australasia are marked "via San Francisco," they are sometimes sent by other routes, causing much trouble and annoyance to the recipient. E. C. H. knows several cases where circulars in a sealed envelope have been charged from 40 to 60 cents on delivery in Sydney, because they were received "via Brindisi," no route being marked on the envelope.

The Egg Trade.

The traffic ir eggs in this country is estimated by competent authorities to equal $180,000,000 a year. The barreled eggs received yearly at New York reach over 500,000 barrels, valued at $9,000,000, and this is but one branch of the trade. It is said that Philadelphia consumes 80,000 dozen eggs a day. The receipts in Boston for the year 1878 were over 6,500,000 dozen. Between 5,000,000 and 6,000,000 dozen are annually exported from the country. The millions of dozens consumed throughout the country without passing into dealers' hands, it is impossible to estimate.

TO INVENTORS.

An experience of more than thirty years, and the preparation of not less than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly, the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent complete—including the model—to the Patent Office the same day the papers are signed at our office, or received by mail, so there is no delay in filing the case, a complaint we often hear from other sources. Another advantage to the inventor in securing his patent through the Scientific American Patent Agency, it insures a special notice of the invention in the SCIENTIFIC AMERICAN, which publication often opens negotiations for the sale of the patent or manufacture of the article. A synopsis of the patent laws in foreign countries may be found on another page, and persons contemplating the securing of patents abroad are invited to write to this office for prices, which have been reduced in accordance with the times, and our perfected facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN.

Business and Personal.

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

Steam Tug Machinery, Engines, Boilers, Sugar Machinery. Atlantic Steam Engine Works, Brooklyn, N.Y.

Valves and Hydrants, warranted to give perfect satisfaction. Chapman Valve Manuf. Co., Boston, Mass.

Jarvis Patent Boiler Setting, same principle as the Siemens process for making steel; burns screenings and all kinds of waste fuel, without blower. A. F. Upton, Agent, 48 Congress St., Boston, Mass.

The new fragrant Vanity Fair Cigarettes. New combinations of rare Old Perique and Virginia.

Save Fuel by using Steam Boiler Damper Regulator. National Iron Works, New Brunswick, N. J.

Walworth Mfg. Co., Boston, Mass., make Pipe Fittings under Patent No. 196,875.

Artificial Stone.—Wanted to buy receipt for making. Address Wm. A. Morrison, Alton, Ill.

New Gear Cutting Attachment for Lathes. Lace Leather Cutter. Something new. Send for lists. Jackson & Tyler, Baltimore, Md.

Oval Spools.—L. F. Beals, of Marquette, L. S., Mich., wishes to correspond with parties who make them.

Brass Tubing Dealers please send address to L. N. Chapin, New Lisbon, N. Y.

Outfits for Nickel and Silver Plating, $5 to $200. Union Silver Plating Company, Princeton, Ill.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

Hand Fire Engines, Lift and Force Pumps, for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N.Y., and 93 Liberty St., N. Y. city, U.S.A.

Send for Circulars of Indestructible Boot and Shoe Soles to H. C. Goodrich, 40 Hoyne Ave., Chicago, Ill.

Wanted—Pattern Maker and Wood Worker. Address Red Wing Iron Works, Redwing, Minn.

Our Imp. Steam Governor is far in advance of all others; prices reduced. Huntoon Gov. Co., Lawrence, Mass.

An Electrician of ten years' practical experience, engaged in manufacturing electrical apparatus, desires a situation as superintendent or electrician for some telephonic exchange. Address H. W., Carrier 38, Cin., O.

For Sale.—Brown & Sharpe Universal Milling Machine; 4 horse; Baxter Engine. W. E. Lewis, Corry, Pa.

For Sale.—One Putnam Gear Cutter, Brown & Sharp Miller, Screw Machines, and other good second-hand machinery. E. P. Bullard, 14 Dey St., New York.

Kinney Bros.' New Cigarette, Sweet Caporal, fine, mild, and sweet, are becoming extremely popular everywhere.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Circulars for Inventors and Manufacturers. Pamphlets on machinery, price lists, etc., written, illustrated, and printed; estimates furnished. Park Benjamin, Ph. D., Editor Appleton's "Cyclopædia of Applied Mechanics," 37 Park Row, New York.

Two of the handsomest and best Guns ever brought to this country, but little used, for sale for less than half their cost. One a double-barreled breech-loading shotgun, and the other a double express rifle. A rare chance to procure two valuable weapons. See advertisement on back page.

A Cupola works best with forced blast from a Baker Blower. Wilbraham Bros., 2,318 Frankford Ave., Phila.

Shaw's Noise Quieting Nozzles and Mercury Pressure Gauges. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

For Steam Pumps send to Dean Bros., Indianapolis, Ind.

Little Giant Screw Plates, Adjustable Dies, Taps, etc. Wells Bros., Greenfield, Mass.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Vertical Burr Mill. C. K. Bullock, Phila., Pa.

Corliss Engines. Watts, Campbell & Co., Newark, N.J.

Case Hardening Preparation. Box 73, Willimantic, Ct.

H. Prentiss & Company, 14 Dey St., N. Y., Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

Needle Pointed Iron, Brass, and Steel Wire for all purposes. W. Crabb, Newark, N. J.

Belcher & Bagnall, 25 Murray St., N.Y., have the most economical Steam Engines, Boilers, Pumps, in market; also improved wood and iron working machinery.

Hydraulic Elevators for private houses, hotels, and public buildings. Burdon Iron Works, Brooklyn, N. Y.

Bevins & Co.'s Hydraulic Elevator. Great power, simplicity, safety, economy, durability. 94 Liberty St. N.Y.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Alcott's Turbine received the Centennial Medal.

Parties furnishing Machinery for making Truck or Plain Barrels cheaply, address P. O. Box 3234, N.Y. city.

Safety Linen Hose.—New machinery enables us to offer this Hose lower than ever. Greene, Tweed & Co., New York.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

Galland & Co.'s Improved Hydraulic Elevators. Office 206 Broadway, N.Y., (Evening Post Building, room 22.)

The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are to be sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Walrus Leather, Walrus Wheels; all kinds of Polishing Supplies, in quantities to suit. Greene, Tweed & Co., New York.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Special Planers for Jointing and Surfacing, Band and Scroll Saws, Universal Wood-workers, etc., manufactured by Bentel, Margedant & Co., Hamilton, Ohio.

Steel Castings true to pattern, of superior strength and durability. Gearing of all kinds. Hydraulic cylinders, crank shafts, cross heads, connecting rods, and machinery castings of every description. For price list and circular, address Chester Steel Castings Company, Evelina St., Philadelphia, Pa.

Mill Stone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., N. Y.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Machine Cut Brass Gear Wheels for Models, etc. (new list). Models, experimental work, and machine work generally. D. Gilbert & Son, 212 Chester St., Phila., Pa.

"Vick's Floral Guide" contains a colored plate, 500 illustrations, 100 pages, descriptions of the best flowers and vegetables, and how to grow them; all for 5 cents; in English or German. Add. James Vick, Rochester, N.Y.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St. Wm. Sellers & Co.

Excelsior Steel Tube Cleaner. Schuylkill Falls, Phila., Pa.

Deoxidized Bronze. Patent for machine and engine journals. Philadelphia Smelting Co., Phila., Pa.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Pittsburgh Steel Casting Company, Pittsburgh, Pa.

Self-feeding upright Drilling Machine of superior construction. Drills holes from ⅛ to ¼ in. diameter. Pratt & Whitney Co., Manufs., Hartford, Conn.

Best Power Punching Presses in the world. Highest Centennial Award. A. H. Merriman, W. Meriden, Conn.

Mellen, Williams & Co., 57 Kilby St., Boston, Mass. Wiegand Sectional Steam Boiler. Ætna Rocking Grate Bar

Howard Patent Safety Elevators. Howard Iron Works, Buffalo, N. Y.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in Scientific American of this week.

Inventors' Models. John Ruthven, Cincinnati, O.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

NEW BOOKS AND PUBLICATIONS.

GREAT INDUSTRIES OF GREAT BRITAIN. Vol. 1. Illustrated. London and New York: Cassell, Petter & Galpin. $3.

A handsome volume, devoted mainly to the popular description of the industries based on cotton, hemp, flax, jute, wool, and worsted, iron and steel, and shipbuilding, with well written descriptions of the leading English establishments devoted to each. In addition the well known biographer Robert Smith tells the life story of several eminent English manufacturers; Mr. Fox Bourne discusses the conditions and prospects of foreign rivalry with English mining and manufacturing industries; Dr. Gordon Hogg, late Senior President of the Royal Medical Society of Edinburgh, has three papers in relation to health and disease in industrial occupations; and Mr. James Henderson, assistant inspector of factories, discusses the factory system and other phases of industrial legislation. Though prepared especially for English readers this work will be found instructive as well as entertaining to all interested in great industries everywhere.

THE BRITISH JOURNAL PHOTOGRAPHIC ALMANAC for 1879.

This excellent little annual is now before us, brimful of valuable information for the photographer and all who are interested in the progress of this most useful art. All the new photo processes and improved formulæ brought to light during the past year are here given together with hundreds of recipes, hints, diagrams of new instruments, scientific information concerning light-colors, illumination, and many other appropriate subjects. Edited by J. T. Taylor. New York. E. & H. T. Anthony, Broadway, New York.

Notes & Queries

(1) R. J. F. writes: 1. I have some carbons and porous cups of an old Leclanche battery. What shall I do to prepare them for use in a bichromate battery? A. Soak them a day or so in warm water. 2. In the SCIENTIFIC AMERICAN SUPPLEMENT of February 8, No. 192, on page 2577, there is described an electric light under this head, "No. 29, A Simple Electric Light." Please give me the size of the carbon used. A. One sixteenth inch diameter, three quarters inch long 3. How shall I reduce the size of a piece of carbon if it is too large? A. File it or grind it. 4. It was also stated under that head that the person used 3 or 4 cells of a bichromate battery. How many cells of a Watson battery would be needed to do the work? A. 12 probably.

(2) J. H. P. writes: I am building a steam yacht after plans taken from your paper, and I wish to ask of what quality of iron should the boiler be made to stand the Government inspection. A. The rule of the United States Inspectors is as follows: "Every iron or steel plate intended for the construction of boilers to be used on steam vessels, shall be stamped by the manufacturers in the following manner, namely: At the diagonal corners, at a distance of about four inches from the edges, and also at or near the center of the plate, with the name of the manufacturer, the place where manufactured, and the number of pounds tensile strain it will bear to the sectional square inch."

(3) R. G. asks: 1. Can you give me the best method of setting buggy axles? A. You should consult some good treatise on the subject, as any instructions that we could give you in our limited space would be of little service. 2. Give a good mixture for welding plowshares. A. Mix the powdered borax with 8 or 10 per cent of finely powdered quartz sand or flints, or what is better, dry powdered water glass—silicate of soda—and a little powdered charcoal, lampblack, or argol.

(4) C. W. L. writes: 1. I have a small engine, and wish to use a cast iron or rather an iron casting 8½ inches diameter by 9 inches height, three sixteenths of an inch thick. How much pressure would you risk to the square inch? A. If, as we suppose, you refer to a boiler, we would not be inclined to take any risk with one of that kind. 2. Describe a small pump to feed above with. A. You do not send sufficient data. 3. If I use a small round dish of iron lined with asbestos, and saturate it with kerosene, is there any danger of explosion while burning? A. With ordinary care, no. 4. Do all the small yachts and propellers used by private individuals for pleasure, etc. (the same as one would use his horse and buggy, not kept for hire or used as a money making concern), have to be inspected by the United States Inspectors, carry a full complement of life preservers, buckets, etc., and have their men licensed? A. Yes.

(5) S. writes: 1. The area of a pipe is 0·010 foot, what is the diameter of same in inches? A. 1·354 inch. 2. Give formula for reducing the area of circles in feet to the diameter in inches. A. Divide the area by 0·7854, and multiply the square root of the quotient by 12.

(6) J. R. L. writes: We want to put up a steam engine on the table land, 40 feet from the brow of the hill. The spring from which we must get water to supply the boiler is about 40 feet below, at an angle of 45 degrees. What is the best method and machinery to raise the water that height and distance? A. If you have enough water, you can use a hydraulic ram. But if this is impracticable, use a steam pump, or place a force pump at the foot of the hill and drive it with a wire rope.

(7) W. H. F. asks: What is the horse power of an engine with 9 inches cylinder, 14 inches stroke, 100 lbs. mean pressure, making 350 revolutions per minute? Working by a rule given in the AMERICAN of January 4, I find it to be 157 horse power. Am I right? A. Your answer is correct.

(8) C. R. G. asks: What is the best material for covering a 2½ inch steam pipe and a 1¼ inch return pipe, each about 100 feet long, passing through a cold cellar to a radiator in the room above? Would there be any saving of steam in having them covered? A. You will effect a saving by covering both pipes. There are numerous coverings in the market that answer well. We refer you to our advertising columns.

(9) I. W. S. asks who was the inventor of the Monitor. A. The question is in dispute, but the credit is usually given to a Mr. Timby.

(10) "Engine" asks: Can I acquire a knowledge of mechanical engineering by home study, and what books and time are required to accomplish it? A. We think it is very doubtful whether you can become proficient without some practical experience in the shops and elsewhere.

(11) E. L. W. asks: What is the best thing to put on a steam boiler to make it look well and prevent rusting? A. A black varnish made from petroleum.

(12) "Reader" asks whether the car wheels made of *papier maché* have a metallic tire? A. Yes.

(13) J. W. asks: What is the average weight of English locomotives, also the heaviest used there? A. They are made as heavy as 70 tons or more. Average weight, between 40 and 50 tons.

(14) J. H. asks: What is the pressure of lake water to the square inch at a depth of 25, 50, 100 feet, etc. A. The pressure is about 0·433 lb. per square inch for each foot of depth. 2. How many cubic feet of air must an iron box or chest, weighing 3 tons or 60,000 lbs., and closed on all sides, contain, in order to keep one sixth of its bulk floating above water and five sixths submerged below water? A. The data are insufficient. The box will float as specified, when it has such dimensions that five sixths of its volume will displace an amount of water equal to the total weight of the box. 3. Where may I obtain an account of the various kinds of diving armor and appliances used in submarine work? A. You will find accounts of some of the appliances in any good encyclopedia, but you can probably obtain full particulars by addressing manufacturers.

(15) G. C. E. writes: I use a 2½ inch stream of water for condensing purposes, but as I take it from a brook, in the summer months I do not get the condensing power necessary on account of the temperature. How can I reduce the temperature to about 35° or 40° in the summer? Would running it through pipes in an ice house reduce it to the required temperature? If so about what length of pipe? Iron or wood pipes? A. Use iron pipes. You do not send sufficient data to enable us to give the amount of pipe, but it would probably be sufficient if it encircled the ice house once or twice. Unless you have abundance of ice, however, we do not think this plan is advisable.

(16) M. B. asks: 1. What thickness of granite should be used in a bank vault to make it fireproof? The building is a two story brick, situated on a corner. A. From 18 to 24 inches. 2. Is there any other stone that furnishes more fireproof protection than granite? If so, what is it? A. We think not.

(17) A. C. G. asks how India rubber hand stamps are manufactured. A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 83.

(18) S. B. G. asks: 1. How is it determined whether snakes can hear? A. By observation. 2. If they can hear, do they heed? A. Yes. 3. It is said that the birds of the northern climate go south in the fall; if they do, are there not more birds in the south in the winter than in the summer? A. Yes. 4. Which is proper, eighteen hundred and seventy-nine, or eighteen hundred seventy-nine? A. Both.

(19) H. J. B. asks: What kind of black paint is on the ordinary tin thermometers, and how is it put on? A. Asphaltum, one half pound; melt, then add hot balsam of copaiba, 1 pound; thin with turpentine oil, apply with a soft brush, and bake for some time in a japanner's oven. Repeat the operation several times if necessary, and finally rub with a soft cloth and a trace of oil.

(20) B. F. M. asks for a formula for preparing a good mucilage for pasting papers. Can you recommend anything better than gum arabic mucilage for pasting manifests and way bills into scrap books made of manila paper? A. Rice or starch paste is better. The following is well recommended: 4 parts (by weight) of fine glue are allowed to soften in 15 parts of cold water, and then moderately heated until the solution becomes quite clear; 65 parts of boiling water are now added, with constant stirring. In another vessel 30 parts of starch paste are stirred up with 20 parts of cold water, so that a thin, milky fluid is obtained without lumps. Into this the boiling glue solution is gradually stirred, and the whole kept at a boiling temperature for a short time. After cooling, a few drops of carbolic acid are added to the paste. This paste is exceedingly adhesive, and may be used for leather as well as for paper and cardboard. It should be preserved in corked bottles to prevent evaporation, and in this way will keep good for years.

(21) E. R. T. writes: I use an Argand burner, and though the wick fits apparently tight, when I suddenly turn it up or down, while burning, a blue blaze appears in the bowl of the lamp, though no explosion has ever occurred. This happens when the lamp is half full. I never allow it to get any lower. By moving the lamp backward and forward quickly, the oil extinguishes the blaze, though I consider this a dangerous experiment. Sometimes the blaze will shoot out the top of the chimney, and at the same time go down the wick into the bowl of the lamp, on turning it down quickly. A. From your statements it would appear that the oil used is not safe. Place the bulb of a good thermometer in a small cup nearly filled with a sample of the oil, and suspended in a large vessel containing water. Gradually heat the water, apply a lighted taper to the oil, and note on the thermometer at what degree the oil flashes (*i. e.*, the temperature of the oil at the moment it begins to give off inflammable vapors). Good oil under these conditions should not flash below 120° Fah.

(22) N. O. M. asks: 1. Which of the various "Stubs" or "Stubbs" firms is the standard one, as there seem to be at least two or three concerns of that name? I would like to know the "original." A.—P. S. Stubs, we believe. 2. Also, what will remove paint or varnish stains from ground glass doors? A. Warm concentrated alcoholic solution of caustic potash will quickly soften paint or varnish so that it may be readily removed by washing with warm water. Remove as much of the paint as possible with the knife blade before applying the alkali. The latter must not, of course, be allowed to come in contact with the woodwork or hands.

(23) A. M. D. asks: 1. For an easy and cheap way of tracing patterns for scroll or net work, without using a pencil. A. Place carbon paper between the pattern and the wood, and trace the design with a stylus. 2. Also to prevent the fret saws from breaking easily when working in the machine. A. Use a good machine, good saws, and exercise care.

(24) F. W. I. asks: Does a rapidly moving train cause a greater strain on a bridge than one moving slow. If so, why? A. Yes, because the motion of a train produces a series of blows on the rails.

(25) A. N. M. writes: I am preparing to construct a dynamo-electric machine according to the drawings in No. 161, SCIENTIFIC AMERICAN SUPPLEMENT. Will you answer the following questions, namely: 1. Should the brass caps at the ends of the armature play just within the electro-magnets, or just without? A. Just without. 2. What amount of each of the Nos. 14, 16, and 18 wire will be needed? A. 2 or 3 feet of No. 14, about 5 lbs. of No. 16, and ½ lb. of No. 18. 3. Should the vulcanite for the commutator be hard, or soft and yielding? A. It should be hard. 4. Can the electro-magnets be wound with separate wires and the wires united with a joint, or should they be wound with the same wire without a break? A. You can wind the two parts of the magnet separately, and unite them after they are fixed to the base. 5. Again, what is the force of the word "excess" as used in chemistry and medicine? I consider that it means a little more than enough of an acid to neutralize an alkali, or the reverse. Am I correct? A. Yes. 6. What is the meaning of gtt. of ss and A in medicine or chemistry? A. Gtt. or gtt., gutta or guttæ, drop or drops; ss., semis, half; A or ā, Ana (Greek ἀνά), of each the same quantity. The expressions are not used in chemistry, but in medicine.

(26) W. N. C. asks what there is (other than sal soda) that can be held in solution with water,

which will prevent small threaded articles of bright iron or steel wire from rusting or turning in color, by immersing therein, when the finished surface of said articles are broken. A. Try water glass or borax.

(27) N. Q. P. asks: How many ways are there for propelling water vessels? What is meant by screw steamer? A. Screw propellers, immersed paddle wheels, partly or wholly under water, water jets, paddles, oars, and their equivalents, have been used. A screw steamer is one that is fitted with a screw propeller.

(28) G. N. F. asks: 1. Can I make a permanent earth battery to supply a current of electricity for an electric light equal to that of two kerosene lamps? A. An earth battery is not suited to the electric light. 2. Will you give me the name of some good works on physics? A. Ganot's Physics is a good elementary work. 3. Are there any books published, containing lectures on various subjects, such as would do to read at a lyceum? A. You may obtain such books as you require from any of the dealers who advertise in our columns.

(29) A. B. P. writes: I am making a shocking machine: 1. Can I use iron wire in making induction coil? A. Not to advantage. 2. What size wire must I use for making the little magnet for breaking the current? A. The same as you use for your primary, probably No. 18 would answer. 3. Is it necessary for the U to be hollow? A. No. 4. Must the current be broken between the battery and the induction coil? A. Yes. 5. Will 3 or 4 quart jars, of zinc and copper and sulphuric acid, be strong enough? A. Yes. 6. Can I use charcoal and zinc for making a battery? Would it be better than copper and zinc? A. Copper and zinc are the best.

(30) M. V.—For ink receipts see SCIENTIFIC AMERICAN SUPPLEMENT, No. 157.

(31) J. H. S.—You will find an explanation of the wagon wheel problem, on p. 394, of vol. 39, SCIENTIFIC AMERICAN.

(32) J. J. asks for a formula for silver solder. A. Fine—Silver, 66·6; copper, 23·4; zinc, 10. Common—Silver, 66·6; copper, 30; zinc, 3·4. See soldering in SCIENTIFIC AMERICAN SUPPLEMENT, No. 20.

(33) E. F. K. writes: I intend to erect works which need a chimney 55 or 60 feet high, the draught of which must be quite strong. A brick chimney costs much more than an iron one. Will the draught of the brick chimney be the strongest? A. Yes, but there will not be a great difference. 2. How long will the iron chimney last, the heat but no fire reaching it? A. A number of years, if properly painted and cared for.

(34) D. J. C. writes: 1. In a little volume entitled "Familiar Science" I notice the following question and answers: "Q. Why does the sun, in shining upon a fire, make it dull, and often put it out? A. Because the air (being rarefied by the sunshine) flows more slowly to the fire; and 2d, even that which reaches the fire affords less nourishment; and 3d, sunshine also produces some chemical effect upon the air and fuel detrimental to combustion." What is your opinion of the above? A. We do not think sunlight ever put out a fire. Its superior brightness will undoubtedly make the fire look dull. The difference in the heat of a fire with and without sunlight must be infinitesimal, if anything.

(35) J. R. asks: 1. Do iron shipbuilders use cast iron rivets to rivet the outside plates on vessels? A. No, the best wrought iron is used. 2. What is the correct focal distance for the lens of a camera, the distance from the lens to the back being fourteen inches? A. 14 inches.

(36) G. L. G. writes: 1. I have my house and another (¼ mile distant) connected with the Bell telephone, which works without a battery. Is there any kind of arrangement that will increase the sound? A. If the telephones are well made and properly adjusted, we know of no way to increase the sound. 2. I have made a microphone according to directions, Fig. 5, SCIENTIFIC AMERICAN, No. 20, vol. 39, but cannot make it work. A. If carefully made according to description it should work.

(37) J. R. D. asks: What power would be required to run a vertical sawmill, say in sawing an oak log 2½ feet through, feeding ¼ inch? What speed, in strokes per minute, would be most profitable? What power is required to saw the same log with a circular saw? What would be the effect if an 18 inch circular saw were run at a rate of 10,000 revolutions per minute, not considering the liability of bursting? Would it cut? A. Running either saw so as to cut the same amount of lumber in a given time, there would probably be little difference in the power required, but as the saws are usually run, you could do good work with the vertical saw, 150 to 200 strokes a minute, with from 10 to 15 horse power, when you might require from 20 to 30 horse power for the circular saw. The circular saw would cut well at the speed stated.

(38) A. E. J. asks: What is meant by squaring the circle? A. Finding the side of a square whose area is exactly equal to that of the circle: in other words, doing what is impossible.

(39) G. C. M. writes: Please inform me of the greatest depth that a diver was ever known to go down at sea in a bell or diver's suit, also the depth that they generally like to go. A. The ordinary depth is from 30 to 40 feet, but the greatest diving feat which we have seen recorded is that of a diver named Hooper, who, in removing the cargo of the ship Cape Horn, wrecked off the coast of South America, made 7 descents to a depth of 201 feet, and at one time remained down for 42 minutes.

(40) J. N. M. writes: Suppose a loaded wagon should be weighed on scales in perfect balance, then the empty wagon weighed on same scales, would the net weight of the load be the same if the scales had been out of balance? A. No, as we understand your meaning.

(41) D. J. asks: 1. What is the average expansion per degree C. of soft brass rod or wire from 32° to 50°, from 50° to 70°, and from 70° to 100°? A. Brass expands lengthwise 0·000018782, for each degree between 0° and 100° centigrade. 2. A current from a galvanic battery traverses a wire to other apparatus 100 feet distant and return. If the wires to and from the remote apparatus be properly covered and insulated, and then united together in a single cable, will the effect of the battery on an electro-magnet be materially less than when the two wires are separated from each other? A. No.

(42) R. S. asks: 1. Will mercury put in melted zinc volatilize? A. The mercury will volatilize. 2. Would the fumes be liable to salivate a person? A. Yes. 3. How is galvanizing (so called) done? A. The metal to be galvanized is first cleaned by pickling in dilute sulphuric acid, and scouring with sand if necessary, passed through a strong slightly acid bath of zinc chloride, and from this directly into and through the bath of melted zinc, covered with sal ammoniac.

(43) J. A. F. writes: I have a thrashing engine of the following dimensions: Cylinder 7 inches in diameter, stroke 10 inches, speed 200 revolutions per minute, cutting off at four fifths stroke, using steam at 60 to 80 lbs., size of steam pipe 1¼ inch, size of exhaust pipe 1½ inch, size of blast nozzle 1 inch, slide valve, Pickering governor. Dimensions of fire box, 36 inches long, 19 inches wide, to 31 inches high, boiler 24 inches waist, with 26 2-inch flues 66 inches long, with locomotive smoke stack 7⅝ inches in diameter, fitted with disk and screen spark arrester. I am running a thrasher with the above engine, with 36 inch cylinder, and 51 inches separator, and some of the time am short of power. I have consulted boiler makers in regard to lengthening the fire box about 8 or 10 inches. Would the flues and smoke stack be sufficient? Could I improve it by using a smoke stack 8 or 10 feet long (present stack 3½ feet long)? How much gain in power would there be by covering the boiler with some good material? Is the engine using steam economically, and are the proportions proper to get the best results? A. The engine seems to be fairly proportioned. You might make a saving of between 5 and 10 per cent by covering the boiler. If the draught is good, there would be no material gain realized by raising the smoke stack. Instead of increasing the length of fire box, it would be better, if practicable, to change the point of cut off to half stroke, and increase the speed of the engine. You do not send sufficient data to enable us to form an opinion in regard to the economy of performance.

(44) C. C. D. asks (1) for the best method of softening iron to be used in making electro-magnets. A. A good quality of soft bar iron does not require annealing for ordinary electro-magnets. Iron may be annealed by heating it cherry red and plunging it into powdered quicklime and allowing it to remain until cool, or it may be thrown on a fire and allowed to cool as the fire dies out. 2. What is the best No. of covered wire to use in making an electro-magnet? A. It depends on the battery power to be used, and upon the purpose to which the magnet is applied. If you use it merely for experimental purposes, No. 18 will probably answer.

(45) A. E. S. asks: What is understood by soft iron core for magnets? Is it wrought or cast iron? A. It is the portion around which the helix is wound. It is usually of wrought iron, but soft gray iron castings are often used.

(46) A. H. S. asks: Does the gas of coal or coke injure steel when heated in the flame so as to prevent a fine spring temper. If so, which is better? A. For fine work a charcoal fire is better than an anthracite or coke fire.

(47) M. F. H. asks: Why do axes break more frequently in cold weather than in warm? Is there frost in the steel, or is the wood harder to cut? A. Steel is rendered more brittle by cold, and the wood, if green, is undoubtedly harder to cut when frozen.

(48) E. A. H. asks: What is a good receipt for dyeing woods black to imitate ebony? A. See SCIENTIFIC AMERICAN, vol. 39, p. 411 (2).

(49) Engineer asks if brass or bronze shafts will run as well in cast iron bearings as cast iron shafts will run in brass or bronze bearings; that is, will the wear and friction be the same, and will they be equally good at work—in neither case to be overloaded? A. Yes.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. H. B.—It is stibnite—a sulphide of antimony, which affords nearly all the antimony of commerce. Antimony is quoted in New York at 12 cents. This ore contains nearly 70 per cent of the metal.—C. K.—No. 1. A siliceous limestone. It will probably make a fair hydraulic lime. The small fragment is quartz. No. 2. Chiefly lime carbonate. No. 3. Calciferous sandstone containing much iron.—W. S. B.—Clay slate, mica schist, and iron pyrites—iron sulphide—not valuable.

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The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

On Aerial Navigation. By F. B.
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HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Many of our correspondents make inquiries which cannot properly be answered in these columns. Such inquiries, if signed by initials only, are liable to be cast into the waste basket.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

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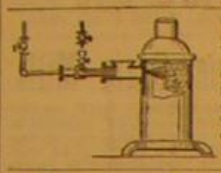

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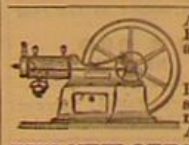

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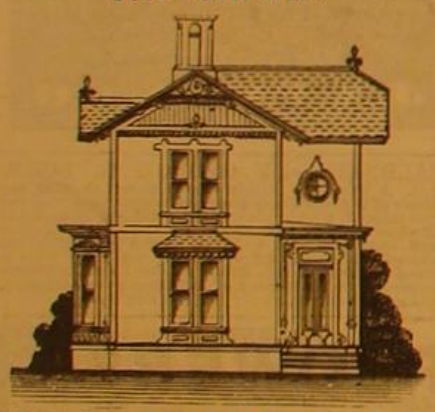

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Vol. XL.—No. 11. [NEW SERIES.] NEW YORK, MARCH 15, 1879. [$3.20 per Annum. [POSTAGE PREPAID.]

AMERICAN INDUSTRIES.—No. 8.

ALE BREWING,

As conducted at P. Ballantine & Sons' Brewery.

Beer was known to the Egyptians, and it is probable that the Greeks learnt from them the art of brewing. The Romans obtained their knowledge of beer from the Gauls, and like them, called it *cerevisia*. In Germany the brewing of beer has been carried on for many centuries, the fact being mentioned by Tacitus. As long as the malt required was prepared in each house the beer industry remained comparatively undeveloped; but when the monasteries began to brew on a larger scale it attained considerable perfection. The monks were the first to make a distinction between "double beer" and "single beer." The use of hops in brewing dates from the ninth century. White beer was first brewed in Nüremberg, in 1541. The brewing of ale and porter—which are species of beer—dates only from the eighteenth century. Until within the present century brewing was empirical, but modern research has placed it on a truly scientific basis.

To bring before our readers some facts relative to the brewing of ale, we give engravings illustrative of the industry as at present carried on by Messrs. P. Ballantine & Sons, of Newark, N. J.—this establishment being the largest and one of the oldest of its kind in the United States. It has been in existence for more than forty years, and has been located in Newark since 1840.

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[*Continued on page* 162.]

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Scientific American.

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NEW YORK, SATURDAY, MARCH 15, 1879.

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The Silk Industry of Northern Italy. By E. T. BLAKELY, F.R.S. The vast proportions of the silk industry. The Chinese the first silk makers. The commercial and the cellular system of producing eggs. The complaint among the silk worms, and consequent distress among the peasantry. Cultivation of the mulberry; the various species. When the period of activity of the silkworm occurs. The five stages of the silkworm's life. Treatment of the cocoons. Treatment of the raw silk. Spinning organzine. Statistics of silk manufacture.
How to Make Photo-Printing Plates. By T. BOLAS, F.C.S. The Swelled Gelatine Method. English Oak Stain for Bottoms of Boots and Shoes.—The Mirror of Japan, and its magic quality.
The Paris Exhibition. Flora and Cefiro. Painting by Bougereu. 1 large engraving.

III. CHEMISTRY AND METALLURGY.—The Ore Deposits of Leadville, Colorado. By CARL HENRICH, E.M.—Metallic Chromium.—Malleable Brass.

IV. ELECTRICITY, LIGHT, HEAT, ETC.—The Electric Light. By J. T. SPRAGUE. With 4 figures.—Salt Mine Illuminated by Electric Light.—An Economical Arrangement of the Calland Battery. By JOHN MORGAN.—Monchot's Engine, worked by the heat of the sun. 1 figure.—A Condenser of Variable Capacity.

V. MEDICINE AND HYGIENE.—Cure of Facial Neuralgia. Interesting dental operation; Philadelphia Dental College. Resection of inferior dental nerve, with 1 figure.
Dentition. A lecture delivered before the medical class of the University of Pennsylvania, by RICHARD A. F. PENROSE, M.D. Normal dentition a painless process. The local and constitutional symptoms of abnormal dentition. The period of dentition one of much danger. Dr. James W. White on pathological dentition. The deciduous teeth and the order of their appearance. The amount of irritation generally in direct relation to the number of teeth appearing. The process of dentition an interrupted one. Management of the infant during teething. All diseases more difficult to treat during dentition. Lancing in some cases a necessity; the arguments against it considered. The popular prejudice against lancing. The lecturer's rule. Results of injudicious lancing.

VI. NATURAL HISTORY, GEOLOGY, ETC.—The phylloxera. By Professor C. V. RILEY. The complete history of the insect, with 10 engravings. The wingless sedentary female. The migratory female, both illustrated. The sexed phylloxera, with 4 views. The most favorable opportunity to destroy the insect, and a recipe for an insecticide mixture.—Sponge Borings in Marble.—The Apple Tree Borer Remedy.—Fertilization of the Queen Bee. By T. B. MINER.—The Largest Flower in the World, Conophallus Titanum. 1 figure.—The Pith Plant.—The Walled Lake in Iowa.

VII. AGRICULTURE, HORTICULTURE, ETC.—Cows and their Butter. How to select dairy stock. Care of cows. Proper temperature of milk and for churning. Hints on working the butter. Being a description of actual practice. The superiority of the Jersey breed for butter. Bone meal for cows.

SCIENCE TO SOLVE INDUSTRIAL PROBLEMS.

In a recent address to the Workingmen's Lyceum, at Cooper Institute, Parke Godwin said that society presented many problems—war, crime, pauperism, intemperance, and a thousand others—but the profoundest of all was that which related to the condition and prospects of labor. After reviewing the conditions of labor and of laboring men in the past and at present, the speaker said that the real social problem was to maintain the freedom of labor, and with it the equilibrium of the industrial forces, and of their results. Many solutions to this problem have been offered, chief among them these three: the moral solution, the political solution, and the economic or social solution—all important, but only one efficient.

The moral solution failed for two reasons: it could not reach the object of its solicitude—individuals; while the evils to be remedied were many of them organic, and could be cured only by organic remedies.

The political solution was but the old form of state intervention, another name for despotism. Not a government on earth can take charge of itself, much less the people; all of them are bankrupt. The people must take care of themselves. The duty of government is to maintain the conditions of liberty, justice, and progress, but there to stop; every step beyond is either toward anarchy or tyranny.

There is but one way of meeting the evils of society, the speaker went on to say, and that was to learn scientifically the laws of social phenomena, and to apply them to all social arrangements and procedures. Do such laws exist? Who can doubt it that has studied statistics, or watched the uniformity of social results? Because man is a being of free will, he is none the less a source and subject of law. His processes, especially the action of large numbers acting together, are not wholly arbitrary and capricious. They can be counted on generally with as much confidence as we count on the rise of the tides or the revolutions of the stars. Because these phenomena are more complicated than natural phenomena, we know less about them; but we shall know more of them in time. How many great minds and noble hearts are now at work to find the key of social science, to unravel its mysteries, to bring the seeming chaos into order? Something has been done in this direction, but much more remains to be done. The publicists and the economists have given us glimpses of the field—the scientists will soon open it to the husbandman and his golden harvests.

ECONOMY IN GAS BURNING.

True economy in gas burning implies the use of burners capable of developing as nearly as possible the full illuminating power of the gas consumed. Judged by this standard, it is safe to say that the great majority of those who think they are most economical in the use of gas are really the most wasteful. In the majority of New York houses the burners used are old and small. When new such burners were not capable of developing half the actual illuminating power of the gas that passed through them, and, worn and rusted as they are in the average house, it is a question whether it would not be an overstatement to say that they get one third as much light from the gas they burn as proper burners would give. In other words, multitudes who are constantly complaining of the magnitude of their gas bills are simply wasting twice as much gas as would suffice to light their apartments. Properly burned, the gas they pay for would give them three times the light they now have; or the same amount of light could easily be got from one third the quantity of gas that passes through their burners. When the burners are inclosed in old-fashioned globes with narrow openings at the bottom, the illumination is still more reduced.

A few weeks ago, Dr. William Wallace, F.R.S.E., read before the British Society of Arts a long paper, giving the results of some hundreds of careful tests of all the leading burners in the English market, under varying conditions of pressure and quality of gas, proving most conclusively that the light obtained depended not so much upon the quantity of gas consumed as upon the conditions under which it was burned.

For example, with 26 candle gas and a series of fish tail burners of the same pattern but of differing sizes, Mr. Wallace obtained the best results with the largest burner at a comparatively low pressure. With this burner and a pressure of half an inch, 7·1 cubic feet of gas gave an illuminating effect of 40·63 candles, or 28·6 candles for 5 cubic feet. The smallest burner of the series, burning 2 cubic feet of gas at 1½ inch pressure, gave an illuminating effect of 3·21 candles, or 8 candles for 5 cubic feet.

Thus, with burners of the same type, a difference in size with difference in pressure may enable one burner to develop three and a half times as much light as another from a given amount of gas. With precisely the same burner, twice as much light was got from a given volume of rich gas at the pressure of ½ inch, as at the pressure of 1½ inch. With common gas the difference was found to be still more remarkable, in some instances only one fourth the obtainable illumination being developed. This with approved burners in good condition. With poor burners out of condition, such as we commonly see in this city, the waste of illuminating power must be much greater.

In his experiments with rat-tail burners, under the most favorable conditions of size and pressure, Mr. Wallace failed to secure more than 60 per cent of the illuminating power of the gas consumed. Fish-tail burners did much better, though those of the bat's-wing type showed greater economy on the whole. A great variety of German and English bat's wings, with tips of various material, was tested, the results ranging between 18·35 candles and 25·56 candles, with 26 candle gas under varying conditions of size and pressure. A number of Argand burners gave results ranging between 17·80 to 25·61 candles, with a 26 candle gas.

Experiments were also made in order to ascertain the loss of light resulting from the use of globes of different kinds and of various shapes. The loss is always considerable, in many cases excessive, and it results partly from the absorption of light from the material of the globe, and partly from the draught caused by the ascension of the heated air in the confined space. As regards material, a piece of clear window glass, held in front of a gas flame, diminishes the light to the extent of about 10 per cent; but in the case of a clear globe it is, in some cases, less, owing to the reflection from the surface furthest from the photometer. Globes frosted or ground all over, technically known as "moons," absorb about 25 per cent of the light when well shaped, and opal or "cornelian" globes, 40 to 50 per cent, according to the thickness and quality of the glass. The following results were obtained with globes of different sizes ground all over, and show the effect of increased draught in diminishing the light.

	Per Cent.
6 inch globe caused a loss of.....	25
7½ " " "	27½
10 " " "	38

All these globes had the usual opening at bottom, 1¾ inch in diameter. In another series of experiments, to determine the effect of the opening of the globe on the amount of light made available, clear 7½ inch globes were employed, giving the following results, the same burner being used at uniform gas pressure:

	Candles.	Per Cent.
The naked flame gave a light of	16·8	
With clear globe, opening below 2¾ in.,	15·4;	loss 8·3
" " " 2½ "	15·2;	" 9·5
" " " 2 "	13·6;	" 19·0
" " " 1½ "	13·0;	" 22·6
" " " 1 "	12·0;	" 28·6

With openings less than two inches the light was unsteady; at one inch it was practically useless. The best results were obtained with globes having a four inch opening at bottom.

EMIGRATION AND MIGRATION.

The annual report of the New York State Commissioners of Emigration for the year 1878 shows there came to this port from foreign ports during the year 121,369 persons, of whom 75,347 were aliens who had never before entered the United States. These figures show a large and unexpected increase, and indicate for the whole country an immigration of not less than 150,000.

During the same year there was an unprecedented movement of population within our national borders, a heavy migration taking place from the East to the South and West. On the basis of information obtained from government reports and a large amount of special inquiry the *Tribune* gives the following table of land sales during recent years:

Year.	Government Sales for Fiscal Years ending June 30.	Railroad Sales for Calendar Years.	Sales in Texas, Calendar Years.	Immigration, Calendar Years.
	Acres.	Acres.	Acres.	
1872	7,124,725	1,000,000	1,500,000	449,483
1873	6,288,264	980,000	1,500,000	437,004
1874	5,610,243	1,060,000	Not known.	277,593
1875	3,712,420	850,000	Not known.	209,036
1876	4,364,544	1,160,000	Not known.	182,027
1877	3,338,479	1,800,000	3,000,000	130,000
1878	7,592,246	2,950,000	3,500,000	145,000

Of the immigrants of 1878 about 80,000 went West; during the same period the westward migration of Eastern people, was, according to the *Tribune's* calculation, at the least 520,000.

"The heaviest migration took place from New England, the Middle States, and Virginia. These regions have been the most troubled with a surplus of unemployed labor, and they have been of late the scene of active canvassing for emigrants by Western land agents, who, while advertising their own lands, have also done much good by calling attention to the fertility and cheapness of the government lands, a thing they did not care to do particularly, but which was one result of their operations. Private advices received by the *Tribune* report that these persons, who have gone West and South, are in general citizens of intelligence and some small means, and mostly men of families. Many of them are thrifty farmers. A large proportion are mechanics, who, being out of work, have drawn their deposits out of the banks, and, rather than stay in the East and eat up their accumulations, have taken their money and furniture West and begun the world anew. They have gone out on the prairie, broken up the virgin soil, so rich as not to need fertilizing, planted crops and groves of timber, and made themselves independent of all the vicissitudes of labor and fortune in the East. They are all, like their predecessors in that region, in a fair way to make a competence.

"The regions to which they have principally gone are Texas, Kansas, Dakota, Nebraska, Minnesota, and California, in the order named; but some have gone to Florida, Arkansas, Colorado, Iowa, New Mexico, and the regions beyond the Rocky Mountains."

Back Numbers and Volumes.

Subscribers to the SCIENTIFIC AMERICAN will be entered on our books to commence at the date the order is received; but those desiring the back numbers to the commencement of the year will be supplied on their signifying a wish to have them. Volumes of previous year may be had in sheets by mail at regular subscription price, namely, $3.20.

THE CANARY FISHERIES.

For a number of years it has been known that the sea about the Canary Islands was well stocked with cod and other desirable varieties of fish; but it is only recently that the real value of those fishing grounds has begun to be appreciated. A late number of the *Journal of the Society of Arts* contains some very important information on this subject, from which it appears that under proper management the Canary fisheries might be made extremely valuable. Mr. Berthelot, late French consul, reports that the quantity of fish caught by one man in the Canaries is equal to that caught by twenty-six men in Newfoundland. All evidence tends to show that the quantity caught is very great, and that the supply is inexhaustible. And yet neither the native fishermen nor the commercial community of the islands have endeavored to turn this immense field of wealth to any advantage, being satisfied thus far with confining their operations almost exclusively to the supply of the local consumption. The largest fish banks are said to be from the Island of Fuerteventura to Cape Blanco. The vessels fish down to the latter point, and the larger ones sometimes go very near to Cape de Verd.

Until our fish commission succeeds in restocking our coast with cod, American fishermen may find the Canary field worth cultivating, particularly as the best season there is during the winter months.

THE IRON OCEAN PIER AT LONG BRANCH.

Work upon the great pier and breakwater, which are to convert Long Branch into a sea port and an accessible summer resort for New Yorkers, is progressing rapidly.

For the benefit of our distant readers, we will say here, that Long Branch is a favorite seaside resort for the wealthy citizens of New York and Philadelphia. It lies on the New Jersey coast twenty-eight miles south of this city; and the only obstacle to its becoming as noted and popular a bathing place as Coney Island or Rockaway, on the southern shore of Long Island, has been the lack of a landing place. This want is now to be supplied by building a pier straight out into the Atlantic, a distance of 660 feet, and in front of its outer end a breakwater 225 feet long and 50 feet wide. The breakwater is to consist of three lines of iron piling so interlaced with chain work as to form a sort of sieve, through which the first breakers are expected to pass, losing their force thereby and their power to damage the boats made fast to the pier. The cost of the sea wall (to protect the cliff), the pier, and the breakwater is estimated at $200,000. The sea wall is already finished. Work on the pier was begun February 4, and it is expected that the entire structure will be completed in time for the summer's demands. The pier is to be formed of three lines of tubular iron piles, strongly interlaced with iron girders, the deck to rise fifteen feet above high water. As the sea bottom is sand the sinking of the piles is an easy matter. The method adopted for sinking them is as simple as it is effective. At the lower end of each pile is placed a "shoe" shaped like a sugar loaf, and having in its point an inch hole. The pile being held in position by ropes, a stream of water is forced through it by a steam engine or a float, the water cutting away the sand and allowing the pile to sink.

The first result of the improvement will be to make the trip to Long Branch a delightful sail, costing less than half the amount hitherto charged. This, in addition to the attractions of the place, is counted on to divert to it a considerable share of the patronage secured by Coney Island last summer, a patronage rising as high as 70,000 visitors a day.

HONEY SUGAR.

The Bee-Keepers' Association desire to return good for evil. While dishonest men are striving to spoil the honey market by selling imitation honey made of glucose and artificial flavorings, the bee-keepers are anxious to furnish an unquestionably wholesome substitute for the glucose used by cooks, confectioners, and brewers. Accordingly they have offered a prize for the discovery of a method of converting honey into a form of crystalline sugar. California honey already sells for seven cents a pound at wholesale; and whoever will succeed in producing a honey sugar will give a great impetus to an already profitable and rapidly growing industry. It is needless to add that he will also win a prize to which the bee-keepers' offer will be only an earnest.

THE USE OF COLD WATER IN COLD WEATHER.

It should not be forgotten, says the *Lancet*, that in cold weather the sole use of cold water is to stimulate the organism to increased activity. A great mistake is made when any part of the body is immersed in cold water, and left to part with its heat without any guarantee that the energy of heat production, so severely taxed, can respond to the requirement. It may easily happen that the internal calorific force will be exhausted, and if that occurs harm has been done. The obvious principle of health preservation is to maintain the circulation in its integrity; and while the error is avoided of supposing that clothing can do more than keep in the heat generated within, it is not the less needful to guard against the evil of depriving the body of the heat it has produced. The furnace should be well provided with suitable fuel—that is, nutritious food. The machinery of heat production (which takes place throughout the organism, not in any one spot or center) should be kept in working order, and nothing conduces to this end more directly than the free use of the cold douche and the shower bath; but the exhibition of these popular appliances, in all or any of their forms, ought to be restricted to a few seconds of time; and, unless the evidences of stimulation—redness and steaming of the surface—are rapidly produced, the affusion should be laid aside.

The use of cold water in cold weather is a practice which must be governed by rules special to each individual case; and it is with a view of warning the public against the recourse to general recommendations that the subject is alluded to. Whether the practice recommended be that of plunging the feet in cold water before going to bed to procure sleep—a reckless prescription, founded on a physiological fallacy—or any other use of cold water, the only safe course is to seek the counsel of a medical man conversant with the patient's peculiarities; and this precaution should be particularly observed in the cases of children.

GUATEMALA INDIGO.

The catalogue of objects exhibited by the Republic of Salvador at the recent Paris Exhibition contains the following contribution to the history of the cultivation and preparation of indigo in Salvador: This species of indigo is known to American and European commerce as "Guatemala indigo." In Salvador it is called by the native name of "Iiquilite," and is considered the most important agricultural crop of the entire republic. The plant grows wild, but is cultivated in properly prepared ground. Both the crops and produce vary according to the geological composition of the soil. Thus at the base of the volcano of San Salvador the yield of dye is sometimes about half a pound per load of leaves, while at Santa Barbara and Santa Cruz, situated at some distance from the sea, thirteen or fourteen ounces are obtained. Indigo is grown over nearly the whole of Salvador, forming extensive fields, and furnishing one of the most valuable products to its agricultural industry. The localities in which the plants are grown are called "manchones."

The workmen, who are styled "sacateros," cut the plants with a small sickle, and make them up into sheaves of from 50 to 60 pounds weight. The plants, after being cut, are thrown into vats filled with water; they are here allowed to soak for a period of from twelve to seventeen hours, the time varying according to the temperature and quality of the water. When the liquid is in a state of fermentation the coloring matter is drawn off into another vat, where it is beaten, or kept in motion by means of wooden wheels, and then the dye is precipitated by the sap contained in the bark of the "tihuilate," of the "platanillo," or of the "cuaja tinta." The first named bark is referred to a species of *Ionidium*, the second to *Canna indica*, while of the third no clew is given as to the scientific name of the plant. All these plants have an acid reaction. When once the dye is precipitated it is allowed to remain during the night, and the next day it is boiled, filtered, pressed, and lastly dried in the sun. Each bale, or "suron," contains 150 pounds, and the different qualities of grades of the indigo are specified by numbers—from four to six ordinary quality, or "cortes;" from seven to nine, fine or superior, or "sobresalientes."

The usual annual produce of indigo in Salvador amounts to about 2,400,000 pounds, the annual exports being between 14,000 to 15,000 "surons," of 150 pounds each, representing an approximate value of 1,721,378 piastres or dollars. The superior quality indigo is sold at the country fairs at about 8 reals per pound. In the American and European markets the prices vary, of course, according to the supply from other countries.

LIGHT AND LIFE.

During the last few years quite a number of investigations have been made in order to determine the question as to how living organisms are affected by the different colors of the spectrum, the subject of plant life having more especially received the attention of observers. The results of two independent series of researches—one by M. Paul Bert on plants, and the other by M. Young on the eggs of animals—have lately been communicated to the French Academy, and it is interesting to compare them.

M. Bert kept certain plants in a glass trough inclosure, containing an alcoholic solution of chlorophyl, and exposed them thus to a good diffused light. The chlorophyl solution, which was very weak, and in a very thin layer, intercepted little more than the characteristic region of the red in the spectrum. This excluded part, then, was proved to be the indispensable element of white light, for the plants at once ceased to grow, and soon died. It is in this red region (as has been shown by M. Timirigzeff, recently) that the greatest reduction of carbonic acid takes place. If red rays are withheld from the leaf the plant is no longer able to increase its weight, but is reduced to consuming its own reserves previously stored up; and so, gradually exhausting itself, it at length dies. This part of the spectrum, however, although necessary, is not sufficient. Plants can, no doubt, live for a long time behind red glass, but they become under such conditions extremely elongated (or, as gardeners would say, grow "spindly") and pale in color. This is due to the absence of the blue violet rays. So we find, then, that each region of the spectrum contains parts that play an active rôle in the life of plants.

Let us now turn to M. Young's recent experiments on animals, and which we find noticed in the current number of *La Nature*. This gentleman's observations, made in the laboratory of Roscoff, and extending over a period of three years, have had for their object to discover the effect of the different colors of the spectrum on the development of the eggs of the common edible frog, of the trout, and of the fresh water snail. He found that violet light favored the development to a remarkable degree; that blue light comes next in this respect; and is followed by yellow light and white light (these two giving nearly similar results). On the contrary, red and green were found to be positively injurious, for it was impossible to make the eggs develop completely in these two colors. Darkness does not prevent development, but, contrary to what has been affirmed by some, retards it. Tadpoles of the same size, and subjected to the same physical conditions previous to experiment, died more quickly of inanition when deprived of food in violet and blue rays than in the others, because life was more active therein, and consequently the expenditure of life force was greater. In was in the green and red lights that animals were found to live longest.

NEW INSTRUMENT TO DETERMINE THE PRESENCE OF METALS IN ORES.

At a recent meeting of the Philadelphia Academy of Natural Sciences, Professor George A. Koenig, of the University of Pennsylvania, exhibited his recently invented "chromometer," an instrument designed for the purpose of making exquisitely delicate determinations of the presence of certain metals in ores. It is based upon the optical fact that complementary colors will extinguish each other if mingled in proper proportions; for instance, if to a green solution a red solution be added, the liquid, if the proper conditions be complied with, will become colorless. The speaker had applied this principle to the colors which certain metals, as iron, manganese, copper, etc., produce when fused with borax, which is the only chemical used in this method of analysis. He prepares such glasses or beads containing known quantities of a metal in one hundred parts, and observes how thick a glass of the complementary color must be to produce extinction. To accomplish this the instrument is furnished with a glass wedge of a green or red color, cut at an angle of about one degree. By moving this wedge before the glass bead, with the help of a suitable rack movement, a scale moves at the same time, and when the point of extinction of color is arrived at, the reading of the scale refers to a table showing the percentage of metal contained in the examined substance. By this method of analysis a correct determination of manganese in an iron ore can be made in fifteen minutes, which is not more than one third the time required by the usual methods of analysis.

Mr. Edward Goldsmith exhibited a specimen of asphaltum found sixteen feet below the surface in a bed of cretaceous marl near Vincenttown, N. J. In the same bed and within a few feet of the asphaltum was found a yellow mineral resin of the nature of krantzite (first described by Bergeman as occurring at Nienberg, Germany), a species of amber, and containing small white crystals, believed to be succinellinite. This is the first time that either of these minerals has been found in New Jersey.

The Bradley Jig tried on Bituminous Coal.

It is well known that a machine was wanted to thoroughly wash and clean bituminous coal, and at the same time take out the slate and sulphur. No good coke can be made of stock in which is slate, dirt, or pyrites. Many efforts have been made to effect this, and the great development of the iron interests in the bituminous coal regions of the South and West has made good pure coke a necessity. The owners of the Bradley Coal and Ore Jig, which has been so successfully introduced into the anthracite coal regions (where it has entirely changed the old methods of cleaning coal) have lately tried their machines on bituminous coal with the best results, producing good work with a small expenditure of power and a limited quantity of water. Those who need a machine to thoroughly wash and clean fine bituminous coal may obtain full information by addressing Howell Green, Superintendent, Jeansville, Luzerne County, Pa.

The Scientific American Catalogue for 1879.

We now have ready for delivery a catalogue of many of the important papers published in our SUPPLEMENT for some time past. These papers are by eminent writers in all the various departments of science. News agents and others who desire copies of this catalogue can obtain the same free by addressing the publishers, Munn & Co., 37 Park Row, New York.

Louisiana Rock Salt.

The Maryland Academy of Sciences has received a large block of very pure rock salt from the island of Petit Anse. The island comprises a tract of 2,000 acres, near the Gulf of Mexico, rising out of a salt marsh to a height of 170 feet. The shallowness of the approach to the island requires the construction of a causeway to deep water before this remarkable salt mine, which has been opened into the pure salt rock to a depth of 60 feet, can be economically worked. The quantity of underlying salt is estimated as at least 15,000,000 tons. This is, however, but guesswork, but the quality of the salt is shown by analysis to be 99 66-100 of purity, the best Liverpool salt testing but about 98 per cent pure.

THE gas wells of East Liverpool, Ohio, it is said, furnish a continual supply of light and heat to the town, and as the gas costs nothing the street lamps are never extinguished. It is used almost exclusively for fuel, being conducted into the grates and stoves by pipes. For twenty years this has been going on, and there are no indications that the supply of gas is giving out.

ALE BREWING.

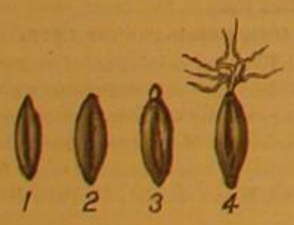
[*Continued from first page.*]

seven acres of ground, has a frontage on the Passaic river of 600 feet; this, in conjunction with the railway lines on the opposite side of the premises, afford the most extensive facilities for receiving and shipping materials and products.

The raw materials used in brewing are barley, hops, yeast, and water.

By letting the barley pass through the process of an interrupted germination an unorganized ferment, diastase, of the nature of the ptyalin of the saliva, is formed, which has the property of changing the starch of the kernel into grape sugar (glucose) and dextrine. To induce germination the grain has to be supplied with moisture, heat, and oxygen, and upon the proper regulation of the three depends the success of malting. The barley is steeped in water until it has absorbed about 50 per cent of the liquid, and then spread on cemented floors. The kernels soon commence to grow and to absorb oxygen, which causes a slow combustion and the generation of carbonic acid gas and heat. By turning and spreading, the heat of the grain is equalized and regulated. The growing is interrupted when the roots have reached the length of 1 1-3 to 1 2-3 of the kernel, and when the cotyledon has advanced 1-2 or 2-3 into it. If the germination be allowed to go on, both starch and diastase would be used up by the young plant to construct its cellular tissue.

The annexed engraving shows the grain during the several stages of germination, Fig. 1 representing the natural grain; Fig. 2, the grain swelled by moisture; Fig. 3, the starting of the germ; and Fig. 4 shows the condition of the grain when germination is arrested by drying. By transferring the grain from the malting floor to the malting kilns (shown on this page) the germination is arrested. Here it is submitted to the currents of hot air generated in the furnaces below. If carefully dried the malt retains its properties for a number of years and may be used in brewing at any time.



BARLEY GRAINS.

Malting and brewing are separate and distinct businesses and may be conducted independently of each other.

In the brewery, the malt is freed from the sprouts, crushed in mills, and mixed with hot water in the "mash tub," shown in the left hand view on this page. By the action of the diastase the starch of the malt is changed into glucose and dextrine. The latter two together with a quantity of albuminates are dissolved and drawn off through the perforated bottom of the mash tub, while the husk of the malt and some unconverted starch remain.

The saccharine liquor, called wort, is conveyed into kettles, one of which is shown in the upper left hand view on the front page, where it is charged with hops and boiled for a number of hours. From the kettles it passes through strainers, called "hop jacks," which retain the hops and coagulated albumen, to the coolers and refrigerators.

When cooled to the required temperature the wort enters the fermenting tubs, shown in the upper right hand view in the larger engraving, to be yeasted. Here the fermentation takes place. Through the action of the yeast a part of the saccharine matter is decomposed into alcohol, which remains, and carbonic acid gas, which escapes into the air.

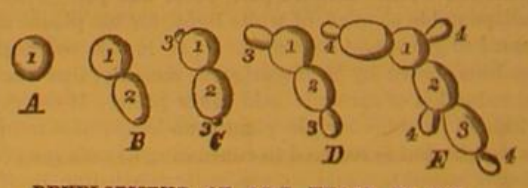
The attack of the yeast upon the beer manifests itself by the reduction of its specific gravity, the alcohol being lighter than the glucose, which it replaces. By observing the changes in that respect it is ascertained whether the progress of the fermentation is to be checked or increased. What is known as stormy fermentation may reduce the density too much, while too slow a fermentation might leave too much of the glucose unchanged.

As soon as the fermentation is finished the beer is transferred to the racking tubs, shown in the lower portion of the title page engraving, where, after having settled, it is drawn into barrels.

It is a peculiarity of ale that, unlike sugar or distilled liquors, it can never be corrected if once spoiled, and that it has and retains the character of the material from which it is made. By additional labor and cost a marketable sugar or liquor may be obtained from poor raw material, but a good ale can only be made from perfect malt and hops, however complete the method of brewing may be. On the other hand the finest malt will turn out a poor ale if the manufacture is trusted to mere guesswork or "rule of thumb."

Brewing, from malting to fermenting, forms one continuous line of the most complicated chemical processes, and it requires a full acquaintance with the nature of these processes to keep them under control, to distinguish the important from the unimportant, and to make use of new discoveries. Any changes of the water or temperatures in malting or mashing alter the chemical composition of the wort. The proportions between glucose, dextrine, albumen, and phosphates become disturbed and an ale of a different character will result.

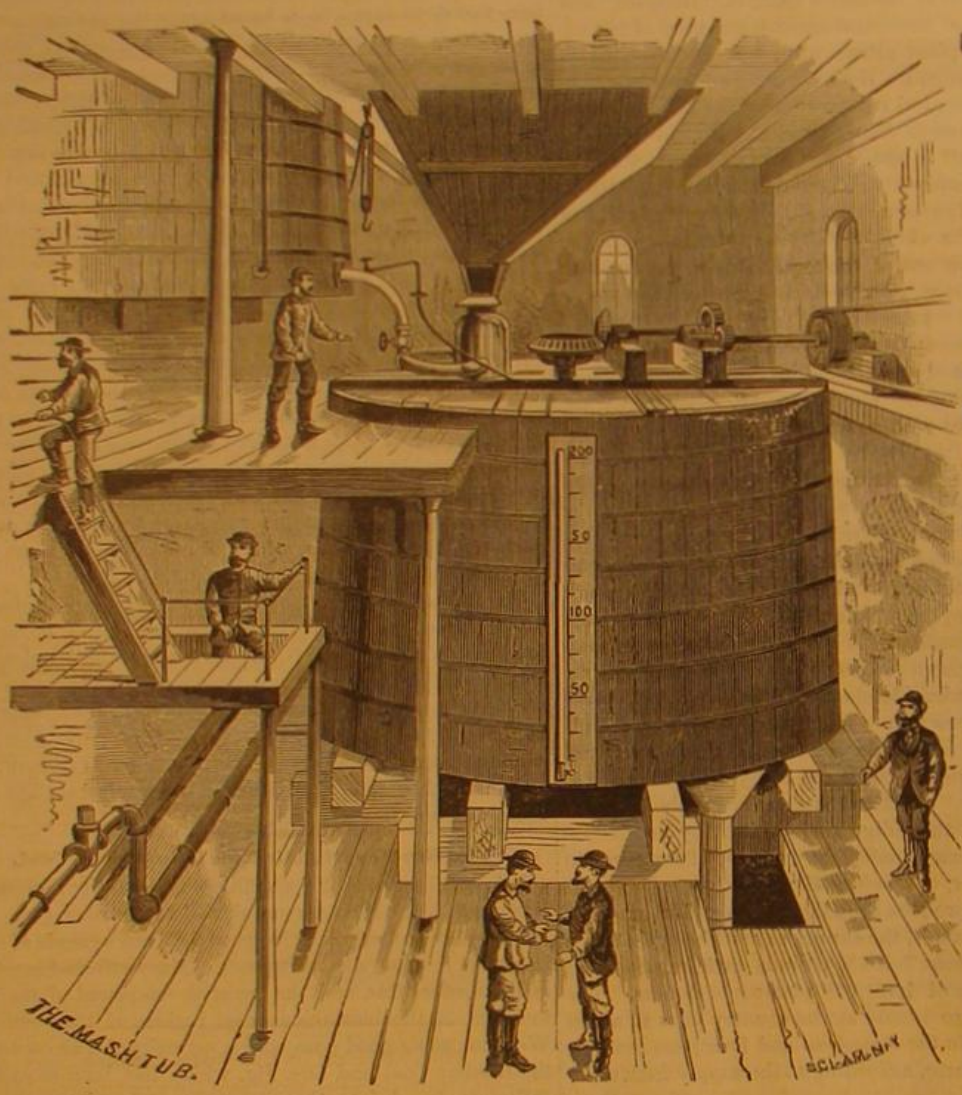
The development of the delicate yeast cell is affected by the slightest change of temperature, and, like other plants, it is subject to degeneration and parasites.

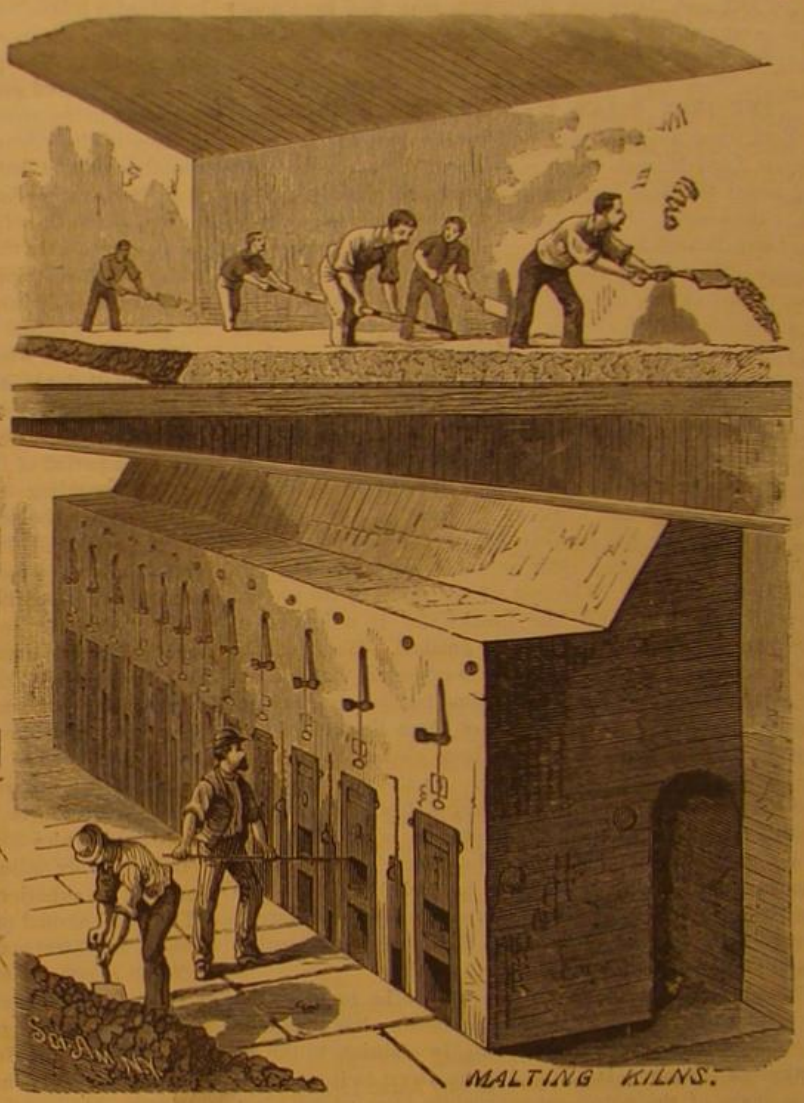


DEVELOPMENT OF THE YEAST PLANT.

The great progress which Messrs. Ballantine & Sons have made in the manufacture of ales is solely due to their steadily pursued efforts to place their business upon a true scientific basis by making the best use of the discoveries and researches (into fermentation, etc.) of Cagniard-Latour, Liebig, and Pasteur.

M. S. MESINIER has made mixtures of iron and nickel chlorides, reduced by hydrogen at a red heat, yield well defined alloys, sometimes admirably crystalline, and closely analogous to the meteoritic alloys of iron and nickel.





THE MASH-TUB AND MALTING KILNS.

Sugar in the Northwest.

Several promising experiments have been made during the past season with the early amber sugar cane, which is said to thrive as far north as Massachusetts and Minnesota. The chemist to one of the largest sugar refineries of St. Louis, Mr. Henry Studniczka, says that Minnesota is especially suited for the cultivation of this plant.

An acre of land will readily produce eleven tons of cane, and a ton of cane will give from 85 to 95 gallons of juice by the use of a sixteen horse power mill.

The juice contains 16 per cent solid matter, 13 parts of which are crystallizable sugar, and the remaining 3 parts being invert sugar and organic matter. An acre of cane will safely produce 130 to 150 gallons of sirup of 80 per cent density.

Out of the 130 to 150 gallons of sirup per acre there can be made, by using proper machinery, 1,000 pounds of sugar, and what is left, about 60 gallons, will be a fine article of molasses.

Mr. Bowen, of Litchfield, Ill., cultivated 80 acres of the amber cane last season.

The cane grows from 10 to 11 feet tall, and each stalk, stripped and headed, weighs from 2 to 3 pounds. A man can, with ease, cut 2 acres per day. Two boys, each using a common lath, can strip an acre per day. A team can haul it up in the same time.

For a mill grinding 3 acres in twenty-four hours, will be required three men and a horse, besides two or three boilers.

From the mill the juice should pass into large settling vats, where impurities are taken from it. From here the juice passes into the large clarification pans, where the necessary chemicals for purifying can be applied. When well heated and skimmed, the juice passes into the evaporating pan, from which, if it is desirable to make sugar, it is turned into wooden coolers for crystallization. When crystallized the sugar can be separated from the sirup either with a centrifugal machine or by drainage.

The outfit for a six horse power mill, grinding about 3 acres per day, is 2 or 3 clarification pans, about 12x3 feet and 8 inches deep, and 1 evaporator for finishing. Another filtering of the juice, as it passes from the clarification pans to the finishing evaporator, is of great advantage. Skimmings can be made use of in fattening hogs. The skimmings of the finishing evaporator produce a fine quality of vinegar.

The seed of the amber cane is a good article of food for stock.

The refuse should be composted and returned to the soil, as the sugar in the cane is a product of the atmosphere, containing oxygen, carbon, and hydrogen in equal proportions. Thus the farmer will return to the soil all which the cane takes from it, and consequently this crop will prove far less exhaustive to his land than wheat or other grain.

THERE is to be a grand National Exhibition held in Moscow, Russia, in 1880, which will be accompanied by festivities of no ordinary kind. It coincides in point of time with the 25th anniversary of the Emperor Alexander's accession to the throne.

NEW AGRICULTURAL INVENTIONS.

A novel air blast regulator for the blowers of thrashing machines has been patented by Mr. Jacob Hunsinger, of Metamora, Ind. In this device an ordinary centrifugal governor is employed to open and close the air supply valves of the blower.

A harrow, which is capable of adjustment as to width, and will accommodate itself to inequalities of the ground, and which may be readily separated into two parts for convenience in loading, is the invention of Mr. W. D. Fink, of Strasburg, Ill.

Mr. Albert D. Blanchard, of Hutchinson, Kan., has invented an improved wheel plow, in which the plow beam is pivoted to a long slotted lever, and is raised or lowered by an eccentric lever pivoted to an elongated vertical plow standard. The eccentric lever is provided with a pawl and ratchet for holding it in position.

An improved tobacco hoisting apparatus, patented by L. W. Brewster, of Canton, Ky., consists of a standard upon which slides a sleeve, that may be raised or lowered by means of a rope running over a pulley in the upper end of the standard. The sleeve carries an arm which is provided with hooks for receiving the sticks of tobacco.

An improved grain separator, patented by Mr. Henry H. May, of New Albin, Iowa, is capable of separating oats, cockle, chaff, etc., from the wheat, and to deliver them each separately. It will also clean seed wheat and remove shrunken and broken grains.

A churn, which forces the cream back and forth through a foraminous plate while it is exposed to a column of compressed air, has been patented by Mr. Wm. A. Reich, of Salem, N. C.

Mr. David Crowell, of Florence, Ontario, Canada, has patented a mowing machine which is remarkable for its simplicity. The driving mechanism consists of a single cam wheel placed on the axle, and a lever actuated by the cam wheel and connected with the sickle bar.

A plow adapted for heavy or wet land, and which may be adjusted for depth and width of furrow without changing the clevis or harness, is the invention of Mr. L. E. Woodward, of Waco, Texas.

Edward Walker, of New York city, has patented an improvement in plows. The plow carries a curved plate, which opens a channel for receiving potatoes or other seed as the plow advances.

How Some English Cottons are Loaded.

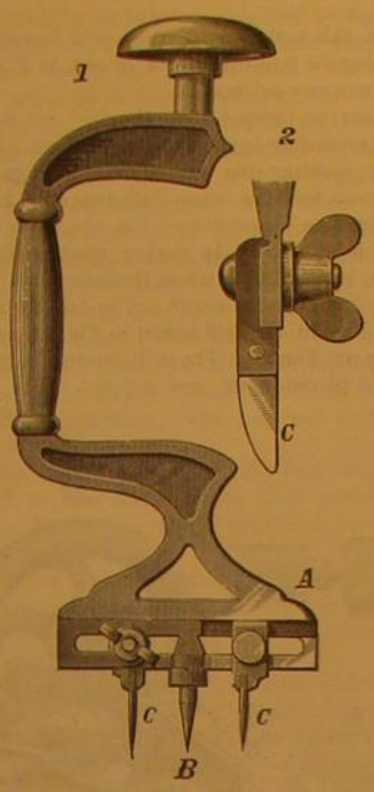
Mr. Albert D. Shaw, United States Consul at Manchester, England, has sent to the Department of State the report of a trial involving the manner of manufacturing and packing of English cotton goods for the Chinese market. A contract was made for the sale of 48,000 pieces of gray shirtings, which were properly packed and shipped to Shanghai. On being opened at that port more than half of the packages were found to be affected by "mildew." It was contended that this "mildew" was not caused by any exterior influence, but by the nature of the sizing used by the manufacturers to make the cloth heavier and thicker. This sizing is composed in part of chlorate of magnesia, chlorate of zinc, glue, and china clay. Originally a flour composite was used.

But improvements have been discovered. Tallow, oil, or paraffine, mixed with starch, removes any harsh feeling the cloth may have. By degrees the manufacturers found that other ingredients could be added. The cloth was not sold by the yard—only by weight, 4 lbs. of cotton being made to weigh 8¼ lbs. by this process of sizing. Moisture being necessary to increase the weight, salt was added. It was contended that the "mildew" was caused by the use of salt in the sizing. Some manufacturers say they have added an ingredient, in the form of an antiseptic, which removes the danger from dampness. In the case before the court the "mildew" was found in the center of the packages and not on the outside, as in packages badly packed.

The press report of Mr. Shaw's communication speaks of the subject as one worthy of attention by American manufacturers. We trust the writer did not mean to hint that our cotton makers might follow the British example with profit. The art of sophisticating cotton goods has not been cultivated here, and the prospects of our cotton trade at home and abroad are all the better for the lack of it.

AN IMPROVED WASHER CUTTER.

The accompanying engraving represents a novel washer cutter recently patented by Mr. Alfred J. Palmer, of Carlton, N. Y. It consists in a fixed central point, B, and adjustable cutters, C, attached to a body, A, which is similar to an ordinary bit stock. A detail view of one of the cutters is shown in Fig. 2.



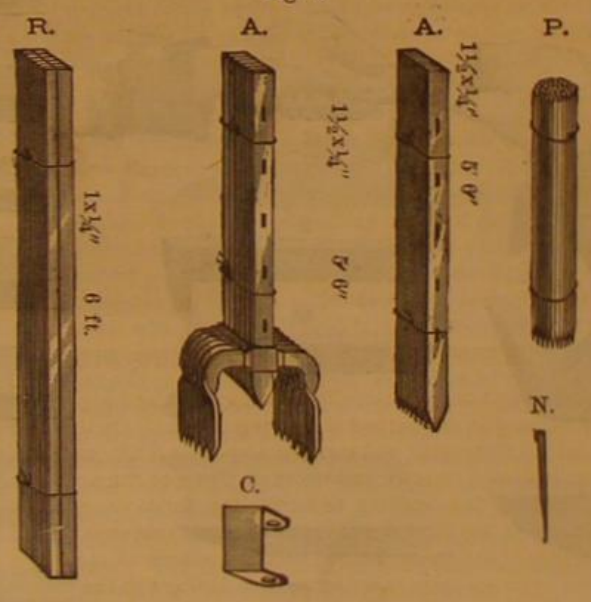
PALMER'S WASHER CUTTER.

This tool is designed for cutting washers of various sizes from leather, one of the knives, C, cutting the outside, and the other the inside of the washer.

A NEW HURDLE FENCE.

English hurdle fences have been in use for forty years or more, yet they show no signs of decay. The durability and desirableness of this kind of fence having been demonstrated, it remained for an American inventor to cheapen and perfect

Fig. 2



it, and to simplify its construction and facilitate its transportation and erection.

The accompanying engravings represent this improved fence, Fig. 1 showing it complete in several different forms; Fig. 2 showing it packed ready for shipment. The fence is composed of flat iron bars and posts, alternate posts being provided with prongs or anchors. The horizontal rails are grooved longitudinally to afford a seat for the nail or key, which is driven into the mortise to hold the rail. Wherever the rails lap, the mortise in the post is enlarged. When iron pickets are used, as shown at Nos. 4 and 5, in Fig. 1, the clips, C (Fig. 2), are employed to hold them. The picket passes through the holes in the clip, and the latter is fastened by a key or nail driven in between it and the grooved side of the rail.

Fig. 2 shows at A the posts, at R the rails, and at P the pickets as they appear when packed for shipment. Although the inventor prefers to make the fence entirely of flat bars, he has shown us round and square bar rails adapted to posts with round or square holes.

To insure great strength and steadiness the posts are placed but three feet apart. The fence has a light appearance, but not too light, being readily seen by horses and cattle, besides it is very stiff and strong. It has no barbs to injure stock, neither does it require straining posts or pillars. The rails and posts are sufficiently rigid to be self-sustaining. The fence can be graded or curved to suit any inclination. As to the matter of cost it will compare favorably with a wooden fence, but when its durability is considered it is found to be far cheaper.

Further information may be obtained by addressing the patentee, Mr. J. B. Wickersham, No. 913 Cherry street, Philadelphia, Pa.

German International Exhibition of Milling Machinery.

An international exhibition of milling, baking, and confectionery machinery is to be held in June next, under the auspices of the German Millers' Association, in Berlin. The exhibition will consist of all kinds of motors and machines used in mill work, such as steam engines, turbines, wind motors, and waterwheels, either in their working shape or in model. All parts necessary to the internal operation of mills, transmission contrivances, frameworks, millstones, roller mills, cleaning, dusting, mixing, decorticating, and dressing machines, as well as dressing tools of all kinds, and all implements and contrivances necessary for high and low milling, are also eligible for exhibition. The milling exhibits are intended to include those relating to oil, sawing, paint, rice, bone, and cloth mills, as well as to grain milling; and implements used in pastry making and baking are to be comprehended in the exhibition, as also lighting and lubricating contrivances, fire engines and their appurtenances, articles used for packing, including bags, weighing machines, and carriages used in transport. All the products of the mill and the bakery are also to be included in the exhibition. As the latter takes place at the time when an exhibition of the Berlin industries is to be held, there will be a large influx of visitors to the Prussian capital from all parts, and the exhibition will form a good opportunity for the milling engineers and mill furnishers of this country for bringing their productions before the notice of Continental millers.

Applications for space, etc., will be received by the President, Mr. J. van de Wyngaert, 95 Potsdamerstrasse, Berlin, up to March 1, 1879.

Shipbuilding in the United States.

The following statistics show that the shipbuilding industry is not quite extinct in this country:

During the fiscal year ending June 30, 1878, 32 iron vessels were built, with a tonnage of 25,960·29 tons. This record is second to the best record the country has yet made, which was in 1874, when the tonnage aggregated 33,097 tons. The next best record in tonnage was in 1873, when it amounted to 26,548 tons. The number of iron vessels built during the past year was greater than in any other year, the year which most favorably compares with it being 1873, when 26 were built. Of the vessels built during the past year, 9 were ocean propellers, varying in tonnage from 1,156 tons to 3,548 tons; 1 was a lake propeller of 306 tons; 1 was a stern-wheel river steamer of 1,028 tons; 7 were side-wheel river steamers, ranging from 128 to 1,285 tons; 13 were steam tugs, the largest of which measured 180 tons; and the remaining vessel was a yacht. The current year promises to surpass the last considerably in its additions to our iron shipping.

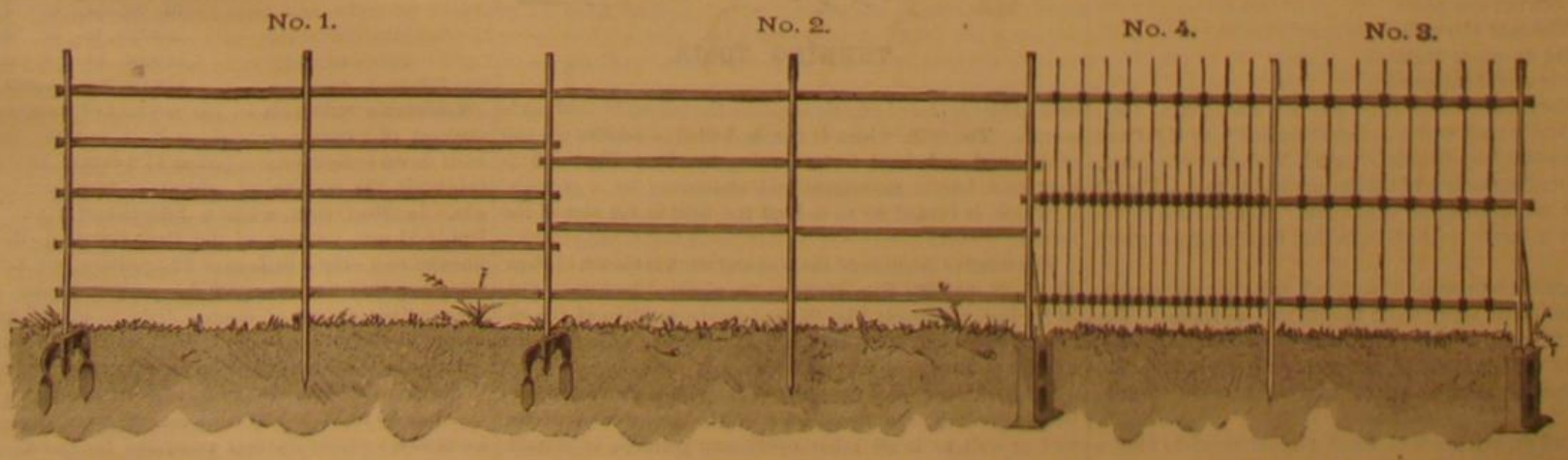


Fig. 1.—AMERICAN HURDLE FENCE.

AMATEUR MECHANICS.

METAL TURNING.

In selecting a lathe an amateur may exercise more or less taste, and he may be governed somewhat by the length of his purse; the same is true in the matter of chucks; but when he comes to the selection or making of turning tools he must conform to fundamental principles; he must profit as far as possible by the experience of others, and will, after all, find enough to be learned by practice.

Tools of almost every description may be purchased at reasonable prices, but the practice of making one's own tools cannot be too strongly recommended. It affords a way out of many an emergency, and where time is not too valuable, a saving will be realized. A few bars of fine tool steel, a hammer, and a small anvil, are all that are required, aside from fire and water. The steel should be heated to a low red, and shaped with as little hammering as possible; it may then be allowed to cool slowly, when it may be filed or ground to give it the required form. It may now be hardened by heating it to a cherry red and plunging it straight down into clean cool (not too cold) water. It should then be polished on two of its sides, when the temper may be drawn in the flame of an alcohol lamp or Bunsen gas burner; or, if these are not convenient a heated bar of iron may be used instead, the tool being placed in contact with it until the required color appears. This for tools to be used in turning steel, iron, and brass may be a straw color. For turning wood it may be softer. The main point to be observed in tempering a tool is to have it as hard as possible without danger of its being broken while in use. By a little experiment the amateur will be able to suit the temper of his tools to the work in hand.

In the engraving accompanying the present article a number of hand turning tools are shown, also a few tools for the slide rest. These tools are familiar to machinists and may be well known to many amateurs; but we give them for the benefit of those who are unacquainted with them and for the sake of completeness in this series of articles.

Fig. 1 is the ordinary diamond tool, made from a square bar of steel ground diagonally so as to give it two similar cutting edges. This tool is perhaps more generally useful than any of the others. The manner of using it is shown in Fig. 23; it is placed on the tool rest and dexterously moved on the rest as a pivot, causing the point to travel in a circular path along the metal in the lathe. Of course only a small distance is traveled over before the tool is moved along on the rest. After a little experience it will be found that by exercising care a good job in plain turning may be done with the tool.

Fig. 2 shows a sharp V shaped tool which will be found useful for many purposes. Fig. 3 is a V shaped tool for finishing screw threads. Figs. 4 and 5 are round-nosed tools for concave surfaces; Fig. 6, a square tool for turning convex and plane surfaces. The tool shown in Fig. 7 should be made right and left; it is useful in turning brass, ivory, hard wood, etc. Fig. 8 is a separating tool; Fig. 9 is an inside tool, which should be made both right and left, and its point may be either round, V shaped or square. Fig. 24 shows the manner of holding an inside tool. Fig. 10 is a tool for making curved undercuts. Fig. 11 is a representative of a large class of tools for duplicating a given form.

These figures represent a series of tools which may be varied infinitely to adapt them to different purposes. The user, if he is wide awake, is not long in discovering what angle to give the cutting edge, what shape to give the point, and what position to give the tool in relation to the work to be done.

Having had experience with hand tools it requires only a little practice and observation to apply the same principles to slide rest tools.

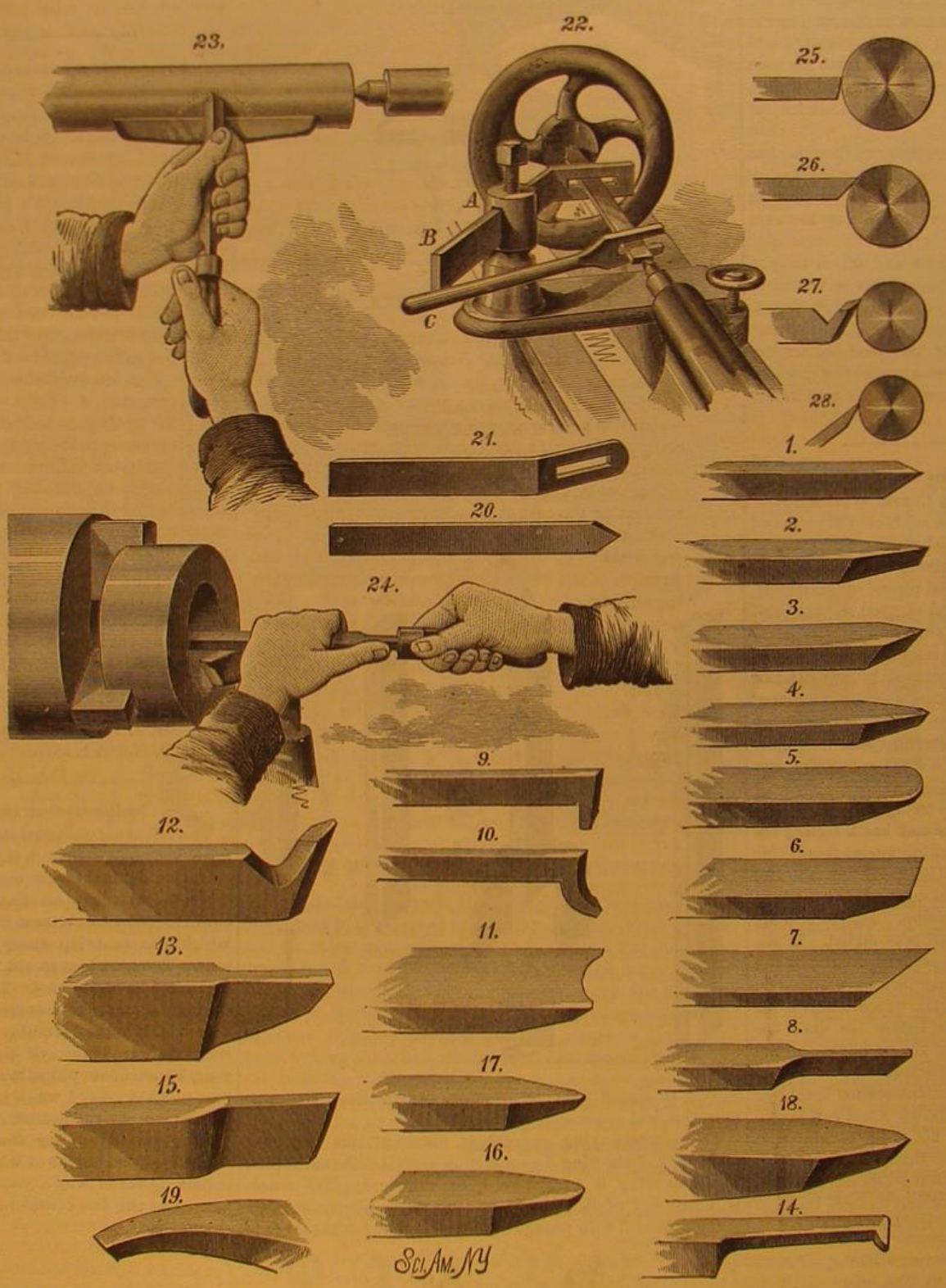
A few examples of this class of tools are given. Fig. 12 is the ordinary diamond pointed tool, which should be made right and left. The cutting edge may have a more or less acute angle, according to the work to be done, and the inclined or front end of the tool may be slightly squared or rounded, according to the work. Fig. 13 is a separating tool, which is a little wider at the cutting edge than anywhere else, so that it will clear itself as it is forced into the work.

For brass this tool should be beveled downward slightly. By giving the point the form shown in Fig. 3 it will be adapted to screw cutting.

Fig. 14 shows an inside tool for the slide rest, its point may be modified according to the work to be done. Fig. 15 is a side tool for squaring the ends of shafts; Figs. 16, 17, 18, and 19 represent tools for brass; Fig. 16 is a round nosed tool for brass, Fig. 17 a V-shaped tool, Fig. 18 a screw thread tool, and Fig. 19 a side tool. In boring, whether the object is cored or not, it is desirable, where the hole is not too large, to take out the first cut with a drill. The drill for the purpose is shown in Fig. 20, the drill holder in Fig. 21, and the manner of using in Fig. 22. The drill holder, B, is held by a mortised post placed in the rest support. The slot of the drill holder is placed exactly opposite the tail center and made secure. The drill, which is flat, is drilled to receive the tail center, and it is kept from turning by the holder, and is kept from lateral movement and chattering by a wrench, C, which is turned so as to bind the drill in the slot of the holder.

The relative position of the tool and work is shown in Figs. 25, 26, 27, and 28; Fig. 25 shows the position for brass; Fig. 26 for iron and steel; Fig. 27 the relative position of the engine rest tool and its work; and Fig. 28 the position of the tool for soft metal and wood.

In all of these cases the point of the tool is above the center of the work. In the matter of the adjustment of the tool, as well as in all other operations referred to, experiment is recommended as the best means of gaining valuable knowledge in the matter of turning metals. M.



TURNING TOOLS.

The Cost of Electric Lighting in Paris.

The report of M. Cernesson to the Municipal Council of Paris, relative to the experiments that have there been made in electric lighting, gives the first authoritative statement of the cost of lighting by the Jablochkoff system. Inasmuch as the figures given by M. Cernesson are accepted as correct, not only by the corps of city engineers and the engineers of the Paris gas company, but also by the engineers of the Paris Electric Light Company, they can be safely received as not far out of the way. Three sources of expense are involved in electric lighting: the power, the dynamo-machine, and the lamp.

The engines employed in the Paris experiments were each of 20 horse power, driving Gramme generators. Each engine was found capable of running 16 Jablochkoff candles; or, in other words, each candle required for its successful operation a force equivalent to 1·25 horse power. Four engines and Gramme generators were necessary to the illumination of the Avenue de l'Opéra. The unit of illuminating power adopted was the light produced by a Carcel lamp consuming 42 grammes of pure oil per hour. It was first ascertained that 10 gas burners, each using 140 liters of gas per hour, are equivalent to 11 Carcel lamps, while a single Jablochkoff candle is equal to 30 Carcels. But, as it was found necessary to the diffusion of the latter to shade it with an opaline globe, its illuminating power was, practically, considerably below this standard, being equal to only 18 or 20 Carcels when the horizontal rays were tested, and to only 10 or 12 when the oblique were under examination—a very meager result, indeed, when compared with the actual light generated. The ultimate comparative result arrived at was that one Jablochkoff candle is practically equal to 11 gas jets of the ordinary caliber used for street illumination. But a comparison of the figures of cost showed that the amount of gas used might be so increased as to give an equivalent light without incurring a fully equivalent expense.

When a burner consuming 200 liters of gas per hour was used, it required only 7 to equal 1 electric candle. Electricians hope to diminish the waste consequent upon the use of opaline globes, and M. Clemandot's invention (that of using two globes, the one fitting loosely into the other, and filling the space between the surfaces with powdered glass) has favorably impressed the scientific men of Paris. The particles of the thin layer of powdered glass appear to exercise a wonderfully diffusive influence without materially reducing the illuminating power. The cost per hour of running the 63 candles used upon the Avenue de l'Opéra is thus stated by Levy, a competent engineer:

	Francs.
Motive force.....	3·20
Coal	6·64
Oil for lubrication.....	1·23
Cost of superintendence	3·20
Sixty-two candles.....	31·00
Total.....	45·27

A calculation upon this basis shows the cost per hour of running one Jablochkoff candle to be 73 centimes (about 14 1-3 cents). The electricians count upon a considerable reduction in the amount of motive force and the cost of candles—enough, at least, to bring the cost per hour down to 60 centimes (about 11·8 cents). But even upon this basis, the economical advantage rests manifestly with gas. In effect, then, while a Jablochkoff candle is equivalent to 11 gas burners of the Paris standard, these 11 gas burners cost only a little over 23 centimes per hour—something less than 5 cents. At the present figures, therefore, the relative expense of electric light to that of gas, illuminating powers being equal, is as 73 to 23, and were the cost reduced to the limit urged by electric engineers as possible under existing circumstances, the proportion would still stand as 60 to 23, a very wide margin to be overcome. M. Cernesson's report further compares the questions of relative convenience, liability to get out of order, etc. Each electric lamp (*foyer*) being supplied with four candles, each

burning 100 minutes, the whole provision has to be renewed every seven hours, while with gas no such renewal is necessary. He finds that from May 30 to October 10 there were 60 extinctions in all on the Avenue de l'Opéra, lasting from merely a minute or two to 15, 30, 35, and even 45 minutes.

Correspondence.

Chemistry at Columbia College, New York.

To the Editor of the Scientific American:

The SCIENTIFIC AMERICAN is in general conducted in a spirit of so commendable fairness that I have observed with some surprise an article in your number for January 11, referring to this institution in a tone which seemed to indicate rather a purpose to disparage than a desire to convey information. The writer says:

"At a time when the value of natural and physical science as a source of mental discipline is beginning to be acknowledged, and science itself to be respected and honored here as elsewhere, it is somewhat remarkable to see one of our oldest colleges abolish the study of chemistry in her regular course. Yet this is what Columbia College has really done. True, the name of chemistry still appears in her list of studies, but it is studied no longer. It is but an outward pretense, a sham, an empty name, a skeleton without flesh, a shell without contents."

Now, whatever might be the facts of the case, there can be no mistaking the animus which inspires language like this. But the fact is that the opportunities afforded to the undergraduate students of Columbia College for pursuing the study of chemistry were never, since the foundation of the institution, so ample as they are at present. We have thought it judicious, as many other colleges have done, to make the extent to which the subject of chemistry is studied dependent, in some degree, upon the option of the student; but the obligatory portion of our chemical course is larger than that of Harvard, where optional supplementary instruction is provided in several different forms; and equal to that of Yale or Williams, where no optional instruction on this subject is given. Our sophomore class attend weekly lectures in elementary general chemistry throughout the year. Deducting the time given to vacations and examinations, the academic year contains about thirty working weeks. At Harvard University the freshman class attend twenty exercises in chemistry, and this is all that the obligatory course embraces in that institution. At Yale College chemistry is studied during one term of the junior year, out of two that the year embraces; and at Williams, during one term out of three—the number of exercises per week not being stated in the catalogue.

During the senior year at Columbia a course of theoretic chemistry is open to the student, of three exercises per week throughout the year.

As to the further strictures of the article in question, they are hardly worth attention. A writer who regards spectroscopic analysis and the mechanical properties of bodies as essential parts of elementary chemistry would do well to understand what he is talking about before he returns to the subject.

I am, sir, respectfully, etc.,
F. A. P. BARNARD,
President of Columbia College.

Columbia College, February 19, 1879.

Fall of a Meteor in Michigan.

To the Editor of the Scientific American:

This morning at 2 (?) I saw a most magnificent spectacle. The world (E.N.E.) was on fire. There was a pyramid of red light, 60° at the base and 30° high. It lasted 6 or 8 seconds, too long to be an electric phenomenon. Was it a meteoric stone? Where did it fall? Possibly into Lake Michigan, 70 or 80 miles away. If it was an aerolite it must have been the most magnificent one ever (?) seen.

(REV.) WM. M. RICHARDS.

Princeton, Green Lake county, Wis., Jan. 28, 1879.

The phenomenon observed by our correspondent was, without doubt, the meteor which (according to the *Herald*, of Traverse City, Mich.) was seen passing over that region about the hour named. It is described as an immense fire ball, which lighted up the country as bright as noonday. A night watchman at Traverse City says that he saw it explode, and that it flew into minute pieces like star dust. The one thing that all agree upon is the explosion. This was heard with equal clearness and with like effect at Mayfield, 13 miles south of Traverse City, and at Williamsburg, 12 miles east. The effect was of an earthquake shock. The houses were shaken, windows shook, and dishes rattled upon the shelves. A swaying motion seemed to be given to the buildings, as of an upheaval and settling back. If the meteor had not been seen it would have been thought an earthquake shock. Mr. R. S. Bassett, who has a fishing shanty within a few rods of Fouch's dock, at the head of Carp Lake, seven miles northwest of Traverse City, was awake and saw the flash, and was almost immediately deafened by the report of the explosion. The next morning a large hole, 50 feet or more in diameter, was discovered in the ice about 600 feet from shore. The ice was solid in this spot the day before. For a long distance around the surface was cracked and broken, and the ice around the hole itself, being 12 or 15 inches in thickness, had the appearance of being driven down. The water at this spot is only 8 or 10 feet deep and the bottom of the lake is soft and muddy.

SOME NEW POINTS IN THE DIAGNOSIS AND PROGNOSIS OF TYPHOID FEVER.

At a recent clinic held at the Pennsylvania Hospital in Philadelphia, Professor I. M. Da Costa developed some very novel and interesting points in connection with the diagnosis and prognosis of typhoid fever. The case under consideration was that of a sailor, who had enjoyed good health until four days before his admission to the wards, when he was attacked with chilliness, fever, headache, and nausea. His bowels were loose and his nose bled profusely. Upon admission the man's face was singularly flushed and he complained of severe pain in his back. His temperature was 104⅕°, his pulse 92, and his respirations 24 to the minute.

Careful physical examination of the lungs failed to find cause for the heavy flush on the face. Examination of the urine revealed the presence in it of granular hyaline casts and of bladder epithelium.

The patient remained in the same condition with regular morning remissions and evening exacerbations in the fever process. There were a few bronchial râles in the lungs.

On the day after admission profuse epistaxis supervened, and pathognomonic rose colored spots appeared on the abdomen, which grew swollen and tympanitic. The tongue was characteristic, dry, cracked, reddish in spots, and varnished in appearance. The case was undoubtedly one of typhoid fever.

As the disease progressed the face still continued to be flushed, the first sound of the heart grew very feeble, and the throbbing of the carotid arteries at the root of the neck was very marked.

In calling attention to these three symptoms, together with the presence of albumen in the urine so early in the course of the disease, the lecturer was led to remark that the case was a very unusual one.

Speaking first of the albuminuria, which was noticed on the fifth day of the disease, he said that early albuminuria was never present in typhoid fever unless the case was a very grave one; that albumen did not as a general thing appear in the urine until the third week of the disease.

So too with regard to the alteration in the first sound of the heart, which is not usually altered until late in the course of the disease. "When the first sound of the heart is affected early in the course of the disease it becomes a warning."

The flushed face, Dr. Da Costa also considered of unusual significance. When this symptom occurred in typhoid fever, which was but rarely, it always made him suspicious, especially when it was associated with great throbbing of the vessels at the root of the neck. When he noticed this coincidence of symptoms he was in the habit of roughly diagnosticating the case at once as one of typhoid fever before making any further examination. That the present case was without doubt one of much gravity, and that on the strength of the above portentous symptoms he should order the amount of stimulus administered to the patient to be immediately increased.

SAML. M. MILLER.

Weekly Pay Days.

The Springfield *Republican* is vigorously urging upon the New England manufacturers the policy and propriety of substituting weekly for monthly payments of wages to employes. It has been consulting some of the large manufacturing establishments upon the subject, and from the information published we learn that in New England monthly payments are the rule rather than the exception. It is different with us. Of course it is necessary everywhere for great corporations like railroad and steamship lines, which traverse great spaces, and the employes of which are often weeks absent from the place where the payrolls are adjusted, to pay their hands at wider intervals than a week, but with this exception, and excepting also domestic service and farm labor, which are usually hired and compensated by the month, nearly all other wages service in this latitude, and especially that employed in shop and factory, is paid by the week. This is the general rule and practice, and to it there are but few exceptions besides those noted.

The *Republican* observes that those New England employers who have tried the weekly system are not disposed to go back from it, but those who have not tried it see great obstacles to its introduction. They contend that weekly payments require increased clerical force and greater working capital, and that they will encourage an increase in drunkenness among the hands. As the *Republican* truly says: "This conclusion is on the old paternal principle that the laborer cannot safely be trusted with his hire. It is alleged to be a great kindness in the corporation to detain his wages even for a month, although when the fatal pay day comes it is followed by a debauch. If the pay were given oftener, would not the laborer become schooled to a keener sense of responsibility for his own welfare and gradually learn more thrift? If it is wrong to trust him with a week's wages at a time, it must be four times worse to place in his hands a whole month's. There is only one system of labor which is entirely consistent with this theory of the superior intelligence and beneficence of employers, and that is slavery."

Positions of the sort here described, deliberately assumed by the great employers in Massachusetts, go far to teach outsiders that the alleged "undue influences" exerted by corporations upon their workmen to prevent Butler's election may not be without foundation. To refrain from paying weekly wages because it requires an increase of working capital raises another nice question, not simply of propriety, but of morality. General Walker, in his book on wages, shows that one of the greatest hardships of labor is the enormous amount of credit exacted from the working classes by capital. This compels them in their turn to seek credit for the necessaries of life and involves them in continual loss. A manufacturing corporation which pays its hands by the month practically borrows the wages of its hands during three weeks. By what right does it do so? A newspaper which seeks to controvert the Springfield *Republican's* position says that the credit consideration is an important one. If a pay roll comes to $20,000 a month, the corporation or manufacturer gets practically a loan of $5,000 for three weeks, $10,000 for two weeks, and $15,000 for a week, and thinks that this is worth considering in these hard times. To which the *Republican* replies in the following unanswerable way: "Exactly, but whom does this credit belong to? Does it not belong to the employes whose wages are withheld for this time? Is it not 'worth considering in these hard times' in behalf of the man to whom it does belong rather than in behalf of him to whom it does not? Especially when the man to whom it does belong suffers greatly in his position as a buyer in the market for the very lack of that cash which is affording but a very trivial advantage to the employer? As a matter of fact the less a business concern runs in debt to its help, the better is its credit with other people."—*Baltimore Sun.*

California Honey.

The report that California strained honey has been largely adulterated with glucose, and accordingly condemned in English markets, naturally causes some unpleasant feeling among the bee keepers of the Pacific coast. A producer, writing to the *Pacific Rural Press*, offers the following test for detecting adulteration:

"Take a quantity of honey and add one part water, dissolving the honey thoroughly by stirring. Then add alcohol of 80° until a turbidness is formed which does not disappear on shaking. If glucose sirup is present in the honey, soon a heavy deposit of a gummy, milky mass, will form, while with pure honey there will be only a very slight milky appearance observed."

The same writer says that California honey taken in May generally candies in a few days after it is extracted. Later in the season, when the air is less humid, the honey gathered is white, very thick and heavy, weighing 12 to 12¼ lbs. per gallon of 231 cubic inches, and does not candy so readily, as some samples have been kept three years without any symptom of change. A different class of pasturage comes on in August and continues through the fall months, the air becomes more humid as the rainy season approaches, and the honey gathered is thinner, has more color and candies very soon, differing from April and May honey in flavor. In the Atlantic States all honey made through the entire season, candies upon the approach of winter; and a large dealer in Cincinnati says all good honey becomes candied during the winter in that climate.

The San Francisco dealers rule that candied honey is reduced in value from one to three cents a pound; yet of samples of California honey sent to France, complaint was made that it was not candied, as no other could be readily sold there. The magnitude of the California honey trade may be judged from the circumstance that over 300 tons of extracted honey was produced last year in Ventura county alone. A large part of this crop was shipped direct to Liverpool for the English market. Of this shipment the writer above quoted says:

"Knowing our honey to be pure and good, and knowing the character of the shipping merchants who are transacting our business, we have an abiding faith that our product will be allowed to fairly compete in these markets with like product from other parts of the civilized world. We wait with patience the results. We have the climate, the pasturage is abundant, our bee keepers are energetic, industrious, and economical men; are determined to push our products into all the markets of the world; and we warn all men who are engaged in the production of honey elsewhere, that if they cannot produce large quantities of the article that is first-class, and do not put it up in an attractive form, more so than we do, they had better stand aside and admit 'that the survival of the fittest' is a fixed fact."

Masson's Process for Deodorizing Petroleum.

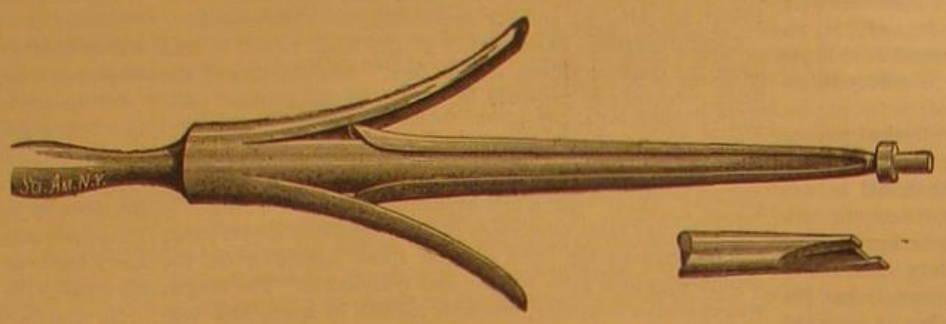
Into a vessel containing 225 lbs. of petroleum are separately introduced, by means of a long funnel, 2 ozs. each of sulphuric and nitric acid, and 1·1 lb. of stronger alcohol are carefully poured upon the surface of the petroleum. The alcohol gradually sinks to the bottom, and when coming into contact with the acids, heat is developed and some effervescence takes place, but not in proportion to the quantity of the liquids. Ethereal products of a very agreeable odor are formed, and the substances thus treated acquire an analogous odor, at the same time becoming yellowish in color. The operation lasts about an hour, after which the liquids are thoroughly agitated for some minutes with water, and, after resting for 8 or 10 hours, the purified petroleum is drawn off. The lower stratum, which is a mixture of the acids, water, and alcohol, may be used in deodorizing the heavy oils of petroleum by agitating them well for 20 minutes, and, after 12 hours' washing the oil with milk of lime, to remove the acids. Petroleum thus purified may be used in pharmacy for many purposes. All the tinctures for external use may be prepared with it, like the tincture of arnica, alkanet, and camphor, and may also be used for dissolving ether and chloroform, like alcohol; and, combined with fats or glycerine, it promises to be of great utility in the treatment of skin diseases, etc.

A NEW FORGING MANDREL.

In forging and welding sucker-rod couplings and other similar articles, consisting of two parallel or nearly parallel straps united at one end, it is customary to insert between the straps a shaping or forging mandrel, so as to secure a suitable and uniform shape and position to such straps. This mandrel is usually inserted by one workman, who forces it in endwise between the strap parts up to the point where such straps are welded together. As the mandrel is thus forced in the straps will be bent or deflected away from the stem of the mandrel, and it is necessary for another workman to grasp the straps in a pair of tongs and bend them down upon the stem, and secure them there by slipping a ring to keep over the ends, when the straps are forged to the desired shape. This operation is performed while the iron to be forged is heated and ready for working, and the delay thus incurred and the services of the helper or additional workman which are required add considerable to the expense of the finished article.

The improved mandrel is designed to overcome these objections. It consists of a mandrel stem, of suitable form, to give the desired interior shape to the straps to be forged. Near the outer end or base of this mandrel stem are secured flaring guides or wings, one on each side. These wings or guides are attached at one end only, and are arranged in line with the mandrel stem and with the flaring or free ends toward its point.

In using this mandrel the coupling, being first properly heated, is laid in such position that the workman may force the mandrel stem endwise between the straps, which he does until the point, guided by the shoulders, reaches the point where the two straps are united. In thus pushing the mandrel into place the ends of the straps come against the inside of the guides, and, sliding along the inner faces of the same, they are bent, sprung, or deflected down upon and held against the stem of the mandrel. The coupling is then manipulated in the usual way, so as to fix the straps and other parts in the desired shape. This mandrel is the invention of Mr. Alker, of Pittsburg, Pa.



ALKER'S FORGING MANDREL.

IMPROVED ICE-MAKING APPARATUS.

One of the most promising of modern industries is the manufacture of ice. It has been the subject of a great deal of research and experiment, and the process has been cheapened so that at the present time ice forms an important article of trade.

The apparatus represented in the accompanying engraving is the invention of Mr. Daniel L. Holden, of Philadelphia, Pa.

This improvement relates to the feature of an ice machine known as the "congealer," or apparatus in which the congelation of the water is effected; more particularly to the form of congealer in which receptacles containing a cold non-gealable liquid are immersed in a tank of pure water, so as to freeze upon the outside of the receptacles blocks of ice without incorporating the impurities of the water.

The invention consists in pivoting the receptacles, C, for the non-congealable liquid at the bottom, and connecting them by flexible pipes with the main inlet and discharge pipes, so that the receptacles may be slightly rocked to one side upon their bottom pivots, to permit the easy removal of the unbroken block of ice formed between any two of the receptacles.

Provision is made for subdividing large blocks of ice, which consists in freezing flat metal blades, D, in the block, and afterward striking a blow upon the blade to divide the block at the desired point. A looped cord is frozen into the block of ice, making a permanent handle.

As the circulation of the non-congealable fluid is kept up by the pumps of the ice machine, the cold fluid, which is below the freezing point, enters each of the receptacles, C, through the flexible pipes, and passing up and down around the baffle plates in close contact with the metal walls, emerges through the pipes upon the other side. The tank, B, being filled with pure water, which surrounds the receptacles, the effect of the cold traversing currents is to freeze upon the outside of the receptacles, C, films of ice, which constantly increase in thickness until the crystallizing outer edges meet in the center and unite to form solid blocks of ice.

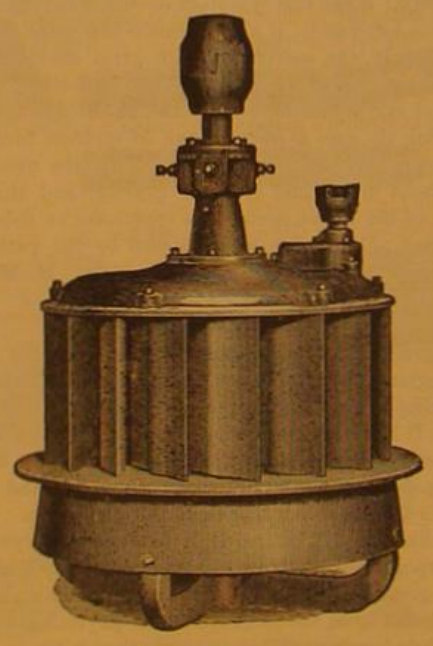
Dissociation of Chloride of Ammonium.

The following experiment is well adapted to class room demonstration. A little chloride of ammonium is placed in a bulb blown in the middle of a glass tube. In the ends are placed small pieces of red and blue litmus paper respectively. The bulb is now heated, while the tube is held in an oblique position, the red litmus paper being uppermost. Soon the latter will be colored blue by ammonia gas rising in the tube, while the blue paper in the lower portion is reddened by descending vapors of muriatic acid. The degree of inclination of the tube must be found by experience, as it depends to some extent on the conditions of the atmosphere.—*Chemiker Zeitung.*

THE VICTOR TURBINE.

The accompanying engraving represents a turbine water wheel, which is remarkable both for its compactness and its efficiency. It is of the "inside gate register class," and has no traps, rods, bolts, or other small parts to get out of repair. This wheel is the result of careful investigations and a long series of thorough tests made by the manufacturers. No statement of its advantages can give emphasis to the results tabulated below.

	Head in Feet.	Revolutions per Minute.	Horse Power.	Cubic Feet of Water.	Useful Effect.
15 in. Victor Turbine Wheel, Tested March 26, 1878.	18·34	323·	29·36	973·75	·8705
	18·10	321·5	29·22	970·39	·8808
25 in. Victor Turbine Wheel, Tested October 28, 1878.	17·80	212·5	67·61	2356·54	·8533
	17·79	205·5	67·72	2362·72	·8530
	17·96	209·	68·62	2356·54	·8584
30 in. Victor Turbine Wheel, Tested October 29, 1878.	11·65	144·5	52·54	2751·87	·8676
	11·73	161·	51·41	2709·94	·8563
	11·66	147·5	51·96	2755·09	·8564



THE VICTOR TURBINE.

This report needs no comment; the useful effect of 88·08 per cent is, we believe, unprecedented among recorded reliable tests of turbines. The most important feature of this wheel is its great capacity in a small diameter, admitting of a reduced first cost for a given power, and diminishing the cost of transportation.

Another advantage gained by the peculiar construction of this wheel is that it is very economical in the use of water at part gate, and it excels in point of durability.

Further information may be obtained by addressing the manufacturers, The Stilwell & Bierce Manufacturing Company, of Dayton, O.

Another Sub-Arctic Trade Route.

Nordenskjöld is not alone in the development of schemes for new lines for northern commerce. What he is doing for Siberia, the Canadian Surveyor General, Colonel Dennis, wants to do for the smaller Siberia in North America. Col. Dennis proposes the establishment of an ocean trade route between Europe and the Saskatchewan valley by way of Hudson's Bay, the course being free from ice during July, August, and September. York Factory, the chief trading post on Hudson's Bay, is about the same distance from Liverpool as New York is; and it could be connected with Prince Albert on the Saskatchewan by a railroad 400 miles long.

This would bring the Saskatchewan valley as near to tide water as Ontario is to tide water at Quebec. For 200 years Hudson's Bay Company's sailing ships have traded between York Factory and Scotland. The straits and bay are clear of ice early in July, closing again at the end of September. Lignite coal is found in abundance at Davis Strait, and a coaling station for the projected steamship line could be established there. The Saskatchewan country contains 257,000,000 acres or 400,000 square miles of available agricultural land. It is watered by the Saskatchewan, Beaver, Peace, and Athabasca rivers, and innumerable smaller streams, and it is believed to be the best wheat growing region on the continent. Wheat of the finest quality grows at Fort Providence, on Great Slave Lake, on the fifty-eighth parallel, the extreme northern point of this vast territory. Colonel Dennis also points out that this scheme would lead to the development of the Hudson's Bay fisheries, and to the enormous pineries extending from the height of land northward of James and Hudson's Bay. He recommends that a steam vessel be fitted out during the coming season to test the practicability of the scheme.

Small Children.

There have been for some time on exhibition in this city two very small children. The larger, "General Mite," is described as 14 years old and weighing 9 lbs. He is well formed and a decided blonde. The smaller, Miss Lucia Zarate, is 10 years old, but weighs only 4¾ lbs. She is very dark, with dark eyes and hair, her parents being Mexican.

RECENT MECHANICAL INVENTIONS.

A novel hub attaching device, invented by Mr. Morris L. Green, of Londonderry, Ohio, consists of a spring hook attached to the axle and a hub, chambered to receive the end of the hook.

In pumping water, especially when two pumps are employed, discharging into the same column, there is always a jar and strain at the end and commencement of the stroke as the valves shut, so that when water has to be lifted a long distance it is not safe to use a high speed pump. Mr. M. B. Brannen, of Shenandoah, Pa., has patented a relief piston for obviating this difficulty. The patent is assigned to himself and Mr. J. L. Williams, of the same place.

An improvement in windmills, which consists mainly in constructing the vanes or blades of sheet metal stretched between two rigid heads, has been patented by Messrs. J. T. Mider and J. T. McClelland, of Wathena, Kan. The improvement also includes a novel governor.

An improved device for transmitting motion, especially adapted to windmills, has been patented by Mr. George H. Russell, of Cheyenne, Wyoming Ter. It consists in an arrangement of two cranks placed at right angles to each other on the shaft of the wind wheel, and two connecting rods which communicate motion to two cranks on the shaft below.

An improved pendulum adjustment for clocks, patented by Mr. Geo. B. Owen, of Winsted, Conn., is arranged so that it will adjust itself readily to the position of the clock without interfering with the regularity of the pulsations.

Mr. Marvin W. Freeman, of Beatrice, Neb., has devised an improved band cutting attachment for thrashing machines, which is capable of cutting straw, cord, and wire bands with equal facility. It consists of a rotating serrated cutter revolving near a stationary serrated cutter placed on the cover of the thrashing machine cylinder.

An improvement in striking mechanism for clocks has been patented by Mr. Wm. Lindon, of Brooklyn, N. Y. In this clock the quarter hours are struck or chimed, and the striking mechanism is operated by the power that actuates the time movement.

HOLDEN'S APPARATUS FOR MAKING ICE.

SPONGE FISHING IN THE ADRIATIC.—ARTIFICIAL SPONGE RAISING.

In the ancient temples of Poseidon, found throughout Greece, pictures have been discovered representing sponge fishers tearing the sponges from the ground in shallow water by means of long forks. Although in modern times various appliances and apparatus have come to the aid of the sponge fishers, there are yet some remote localities in which we can see the ancient Greek method of sponge fishing in all its simplicity. One of these spots, for instance, is the island of Krapano, situated off the Istrian coast. Its population is entirely dependent upon the proceeds of the sponge fisheries, and owns about forty small barks employed for that purpose. The crew of a boat consists of two men only, and, from the early spring till fall, these barks make extended trips along the rocky shores of Dalmatia and Illyria.

When a shallow place of from 12 to 40 feet in depth has

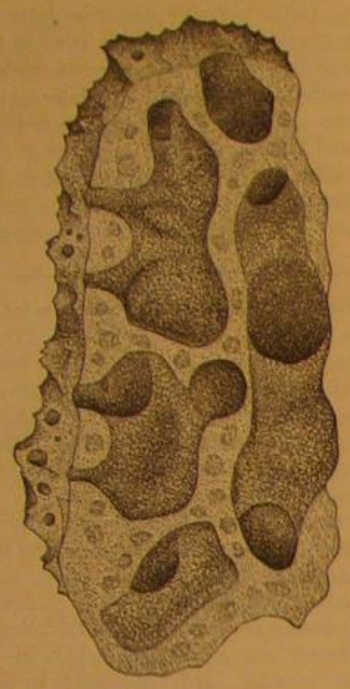


Fig. 2.—SECTION OF SPONGE, SHOWING MASSES OF EMBRYOS.

been reached, the oarsman propels the boat slowly along according to the orders of the fisher, standing in a square opening near the bow, holding a long fork, and looking sharply down to the bottom for the sponges; these appear as large black blotches between the rocks, and are easily recognized. Forks of different sizes are carried on a rack provided on the bark.

Generally the barks go out only in quiet weather, as, when the sea is rough, it is difficult to see the sponges on account of the reflected light. When the water is only slightly rippled by a light breeze, it is quieted by means of oil. For this purpose some oil and a number of small round stones are always carried along in the bark. The stones are dipped into the oil and thrown into the water. The oil adhering to them spreads over the surrounding surface of the water and causes even the slightest ripple to disappear. As the sponges abound on rocky ground, many of them are hidden from view in crevices, and the fisher must find them by feeling around with his fork, being solely guided by the touch.

The sponges are freed from the black protoplasm filling their pores by working them with hands and feet. After being washed several times with warm water, they are dried and ready for sale.

This mode of fishing sponges is very injurious to their quality, as they are frequently mutilated in tearing them from the rock. Another difficulty is that small, valueless sponges are brought up as well as the full grown, thus destroying many of the young sponges.

Sponges develop, during March, April, and May, large quantities of eggs or embryos, which accumulate in masses near the larger osculæ or openings, as indicated in Fig. 2. These embryonic organisms gradually grow and are carried out by the currents. They then swim about for some time, and finally become fixed and grow. As the fishers begin their operations as early as March, it is evident that, year after year, millions of young sponges are killed before separating from the mother sponge. This, together with the causes before mentioned, has resulted in a rapid decline of the Mediterranean sponge fisheries, only the rapid advance in the price of sponges preventing a shrinkage of the value of the annual crops. It is certain that the annual supply of Mediterranean sponges will steadily decrease as long as this disastrous system is adhered to. Thoughtful minds have long ago turned their attention to the artificial raising of sponges.

The celebrated naturalist, Brehm, was one of the first who experimented in this direction. In connection with Mr. Buccich, he procured several hundred of selected live sponges. These he cut into several thousand of small pieces, fastened them separately into perforated cases, which he then towed to the Bay of Socolizza. The small pieces were fastened by nails to a wooden framework, which was lowered at a shady spot to the proper depth. The sponges grew rapidly; in a few months they had attained the size of good natural sponges, and showed also their peculiar pitch-black color. In this way the possibility of raising sponges artificially was fully demonstrated. Brehm opened communications at once with the authorities, but although they looked favorably on the project, they did not succeed in overcoming the obstinacy and ignorance of the fishing population; after the fishers in the neighborhood had recovered from their surprise at Brehm's success, they made a raid one night on Brehm's plantation, destroyed the wooden frames, and carried off over two thousand valuable sponges. Several other attempts made by Brehm and Buccich were frustrated in the same manner, and there the matter has since rested.

The only enemy of the sponge plantation, with the exception of the enraged fishers, was a species of teredo or shipborer, which destroyed the woodwork. He substituted, therefore, for the latter copper wire, with equally good success. He also fastened the pieces of sponge to stones, and found that in a short time they became firmly attached.

In cutting up the sponges, great care must be taken not to squeeze the semi-liquid protoplasm from the pores; the knives, therefore, must be very sharp. When properly treated, about 99 per cent of all the pieces planted will grow, and be in every respect equal to natural sponges.

For different purposes sponges of special shapes are preferred, and it would seem possible, that by giving the desired shape to the pieces to be planted, sponges of any particular form could be obtained.

American sponges are of inferior quality; for our supply of good sponges we rely mainly on Greece.

It is a question whether it would not prove a profitable venture for some of our enterprising citizens to undertake the propagation of fine sponges in American waters.

Uses for Horse Chestnuts.

The common horse chestnut is capable of furnishing several useful products which are regularly manufactured in several localities in Europe. The seeds contain over 36 per cent of starch, which is easily obtained in the same manner as that made from cereals. Two hundred and forty to two hundred and fifty pounds of the seeds yield 100 lbs. of dry starch. Paste made from the latter is extremely adhesive, and is not attacked by insects; it is, therefore, particularly well adapted for the purpose of bookbinders.

This starch is also used for producing certain kinds of

Fig. 3.—SPONGE EMBRYO.

distilled liquors. For this purpose, 50 lbs. of the starch are heated for six hours with 2 lbs. of sulphuric acid and 150 lbs. of water, whereby the starch is converted into sugar; the acid is then neutralized by lime, the liquid decanted, mixed with yeast and fermented, and finally distilled. One hundred lbs. of starch yield 24 lbs. of 55 per cent spirit.—*New Remedies, from Die Natur.*

ROUND THE WORLD IN A HURRY.—The American Consul at Alexandria, in Egypt, Mr. Hars, is said to have traversed the circumference of a great circle of the globe in 68 days. He took 20 days in going from Alexandria to San Francisco, by Brindisi, Paris, London, Liverpool, and New York; 20 days also from San Francisco to Yokohama; 6 days from Yokohama to Hong Kong; 10 days from Hong Kong to Ceylon; and 12 days from Ceylon to Suez. Allowing 1,000 miles for divergencies from a straight course, or 25,000 miles as the total distance, the journey was performed at the average speed, stoppages included, of about 15¼ miles per hour. There must be a mistake in the time stated.

Fig. 1.—SPONGE FISHING.

Natural History Notes.

The Smallest Orchid Known.—Baron Von Mueller has recently announced the rediscovery, after a lapse of twenty years, of a minute creeping orchid, highly remarkable for its extremely small disk like leaves. This little plant, which grows in the vicinity of Richmond river, East Australia, has been described as *Bolbophyllum minutissimum*. Its leaves are orbicular, sessile, flat, horizontal, on a creeping rhizome, and only one eighth or one sixth of an inch in diameter. Thus this orchid has the smallest leaves of all in the whole order. Indeed, on seeing the plant creeping among the mosses the observer might take it for a species of the *Hepaticæ*. The wee red flowers, which are produced singly on peduncles hardly longer than the leaves, measure only one sixth of an inch. While thus East Australia possesses the dwarfest of all orchids known to science, it counts among its plants also the one with the minutest flowers, namely, *Oberonia palmicola*.

Bananas.—Few people who see bananas hanging in the shops of fruit dealers think of them as more than a tropical luxury. The fact is, they are a staple article of food in some parts of the world; and, according to Humboldt, an acre of bananas will produce as much food for a man as twenty-five acres of wheat. It is the ease with which bananas are grown that is the great obstacle to civilization in some tropical countries. It is so easy to obtain a living without work that no effort will ever be made, and the men become lazy and shiftless. All that is needed is to stick a sucker into the ground, and it will at once sprout and grow, and ripen its fruit in twelve or thirteen months without further care, each plant having from 75 to 125 bananas; and, when that dies down after fruiting, new suckers spring up to take its place. In regions where no foot ever reaches bananas are found in all stages of growth, ripening their fruit every day and every month in the year.

Studies on the Polypus.—M. Frederic, after a long course of study on the chemical phenomena which take place in the blood of cephalopods, has at length presented the result of his work to the French Academy of Sciences. He finds that in its oxidized state (corresponding to that of our arterial blood) this liquid is of an intense blue, and that it becomes pale on losing its oxygen. Analysis shows that it contains a substance corresponding with hæmoglobuline, and in which a metal takes the same part that iron does in the blood of the superior animals; but, wonderful to state, this metal is copper. The author calls this blue substance by the expressive name of *hæmocyanine*.

Migration of Carps.—In a letter to M. Raoul Pictet (published in the *Archives des Sciences Physiques et Naturelles*) M. Bartholoni gives an account of a singular migration of fishes observed by him. He was stationed on the banks of Lake Geneva, near a marsh which was generally isolated, but which an irruption of the waters of the Foron, about five months before, had put in communication with the waters of the lake. By the repeated action of the waves caused by violent winds, a beach again formed rapidly and shut off communication with the marsh. It was then that M. Bartholoni observed the carps leaving the marsh and seeking the lake. They took advantage of the reflux of the waves, and even succeeded in moving over the earth and crossing the newly made beach, which was about a meter wide.

The Castor Oil Plant.—Originally a native of Asia, the castor oil plant (*Ricinus communis*) is now naturalized in Africa, America, and the south of Europe. The plant has been known from the remotest ages; its seeds have been found in some Egyptian sarcophagi supposed to be at least 4,000 years old. It is singular that the oil expressed from its seeds should have been used by the ancients, including the Jews, as one of the pleasantest oils for burning and for several domestic uses, though its medicinal virtues were unknown. The modern Jews use the oil, under the name of kiki, for their religious services, it being one of the five kinds of oil their traditions allow them to burn.

A New Deep Sea Crustacean.—A very interesting matter was brought before the French Academy at its session of January 6, in the form of a paper, by M. Milne Edwards, on a crustacean discovered in the deepest part of the Atlantic Ocean. It was found December, 1877, during a scientific expedition of the American steamer Black. It was taken at the north of Yucatan in 1,500 fathoms of water, and sent to M. Milne Edwards by Mr. Alex. Agassiz. The former recognized it as an isopod type of a new family, and named it *Bathynomus giganteus*. The animal was 9 inches long by 4 inches wide. The most striking feature about it is the disposition, entirely new, of the respiratory apparatus, which consists of a numerous series of bronchiæ in the form of knots, placed between the false abdominal legs, and every piece of which, viewed with the microscope, showed itself to be a tube covered with very fine hairs. A highly developed respiratory apparatus of this kind is undoubtedly rendered necessary by the very conditions which obtain at the immense depths inhabited by the animal. One thing that would scarcely be expected in a being thus quartered in the dark regions of the ocean depths is that of power of vision; yet, strange to say, the new crustacean is well endowed in this respect, having eyes very highly developed, each of them being composed of 4,000 facets and situated at the base of the antennæ. According to M. Milne Edwards the bathynomus must live attached to algæ, and its habits are apparently carnivorous, cephalopod mollusks forming its food. It is probable, as the author observes, that a study of animals like this will throw light on the history of fossil crustaceans, and especially upon that of the trilobites.

Sir John Lubbock and his Ants.—The London *World* says that one of the best rooms on the first floor of High Elms (the residence of Sir John Lubbock) is devoted to work, and at the present time contains a menagerie of ants. Between 30 and 40 species are represented by separate nests, placed under glass, carefully shaded from light, and surrounded by water to prevent the interesting insects from escaping and overrunning the house. It is pleasant to see Sir John, arrayed in his working suit of gray stuff, gently uncovering the nests and replacing the screens quickly lest the animals should take alarm at the influx of light, and be thrown into disorganization by the thought that their nest is attacked. It is curious to observe that these tiny creatures have animals with them, which, it may be presumed, are useful to them in some way, as the ants forbear to attack them. They are mostly of the beetle race, and some, like the little *claviger*, are quite blind, possibly from confirmed subterranean habits, and are only found in ants' nests, the proprietors of which take as much interest in them as they do in their own young. Apparently ants have a considerable variety of domestic animals, among which the blind *Platyarthrus* is conspicuous, as well as the *Beckia albinos*, the latter of which was fully described by Sir John Lubbock, who suggests that perhaps these two act the part of the Constantinople dog and the turkey buzzard—making themselves useful as scavengers. A chat with the proprietor of this workroom soon dispels the illusions of the unscientific mind as to the industry of the ant. It is an industrious animal in the main—but there are ants and ants. The large red species found in Central Europe is not industrious at all, being a purely fighting aristocrat and slaveholder. She (the fighting ants are Amazons) makes predatory excursions and carries off the pupæ of another species, and brings them up as slaves. As Sir John Lubbock points out, the slaveholders present a striking instance of the degrading tendency of slavery. They can neither wash nor feed themselves. They have lost the greater part of their instincts; their art of building; their domestic habits (for they take no care of their young); their industry (for they take no part in providing themselves with food); and if the colony changes its nest the rulers are carried to the new one by their slaves. Even their structure has altered; their mandibles have lost their teeth and have become mere nippers, terrible in war, but useless for other purposes. So helpless have they become, except for fighting purposes, that if deprived of their slaves they actually die of starvation. These curious facts, which sound almost like the romance of natural history, have all been verified at High Elms by observations which confirm those of Huber in almost every case.

Amber and its Source.

Amber is a resinous exudation from an extinct species of conifer, called by Göppert *Pinites succinifer*. The source of this substance was long uncertain; by some it was considered a carbonaceous mineral.

Professor Zaddach shows that the trees which yielded the amber must have grown upon the greensand beds of the cretaceous period, flourishing luxuriantly on the marshy coast which then surrounded the great continent of northern Europe. Probably the temperature then was much higher than it is now; and this even at that epoch extended to the now frost-bound Arctic regions, a fact which has been proved by the remarkable plant-remains of temperate climes which have recently been discovered there. The amber flora of the Baltic area under review contains northern forms associated with plants of more temperate zones; thus camphor trees (*Cinnamomum*) occur with willows, birches, beeches, and numerous oaks. A species of *Thuja*, very similar to the American *T. occidentalis*, is the most abundant tree among the conifers; next in abundance, *Widdringtonia*, a great variety of pines and firs, including the amber pine. Thousands of these, it is supposed by the professor, might have perished, and while the wood decayed the resin, with which the stem and branches were loaded, might have been accumulated in large quantities, in bogs and lakes, in the soil of the forest. If the coast at that time was gradually sinking the sea would cover the land, and in due course carry away the amber and masses of vegetable detritus into the ocean, where it was deposited amidst the marine animals which inhabit it. But in the higher districts the amber pine would still flourish, and so amber still continues to be washed into the sea and deposited in the later formed greensand, and still later overlying formation of brown coal. Reboux states that at the eocene epoch the bed of the Baltic Sea was occupied by an immense forest, which spread over nearly the whole northern continent. Dredging carried on at a depth of 64 feet below the sea bottom has brought to light thereby two species of conifers, a poplar, a chestnut, and various other trees. From the conifers, the author thinks, ran the resin which, through being buried in the earth, has become changed into amber.

The largest quantity of the gum appears to have been derived from the *Pinus succinus*. More than two hundred specimens of objects have been found embedded in the fossil gum, including insects, reptiles, plants, leaves, grains, shells, fruit, etc. Amber is harder than most resins, and is susceptible of a good polish. It was known to the ancients by the name of "electron," on account of its electrical susceptibility; it was also engraved and used by them for seals, etc. It occurs abundantly on the Prussian coast of the Baltic, from Dantzic to Memel. It is also found on the coast of Denmark and Sweden, in Galicia, Poland, Moravia, the Ural, Switzerland (near Basle), France (near Paris), near London, in various parts of Asia, and in the greensand of New Jersey, and also in Japan. It is chiefly found in Prussia, however, and is not abundant elsewhere. In the latter country it occurs in the primary deposits of the coast. The amber bearing stratum, which lies partly below the sea level and partly above, is of a bluish green color, and consists of a coarse grained sand, the particles of which have a yellow coating. In this blue earth is found the amber to the amount of 2½ pounds to 20 cubic feet. The pieces of amber found are generally weathered, but have retained their original shape, showing that the sea has had but little action on them. The color is far from constant, being of all shades of yellow and brown. The amber dredging establishment at Schwartzort, on the Curish Haff (near Memel), produces about 80,000 to 90,000 pounds of amber yearly, and is still in the hands of a Königsberg firm, which keeps its transactions very secret. Four steam dredges are employed for the collection of the amber, as well as a considerable number of dredges worked by hand. The amber is found almost uniformly in separate nodules, with lignite, disseminated in the sand, at a depth of from 10 to 12 feet. Work is carried on by night as well as day, by "shifts" of workmen, laboring eight hours each. The work gives employment to about 400 persons. The amber collected is considerable, amounting to about 288 pounds per shift, and for six days work, 51,184 pounds. The sand, after being dredged up, is sent on shore, where it is washed in order to find the amber.—*Commercial Products of the Sea.*

Industrial and Manufacturing Uses of Shells.

The uses to which shells are applied, says the author of the "Commercial Products of the Sea," are more extensive than is generally supposed. The trade is growing year by year into greater importance; and there is ample scope yet for its extension with profit and advantage, alike to the merchant and importer, to the manufacturer and vender, and to the general public who are the purchasers.

The most beautiful shells come from the Pacific and Australian coasts. The sun, by the greater heat that it throws on the seas near the equator, would seem to have some effect in heightening the colors of shells produced in tropical zones, and the nature of the food of the animals probably gives them a luster and a brilliancy which are wanting in those of colder latitudes. It is impossible to enumerate all the purposes to which shells are applied, but some few may be specified. The shells of Strombus, Triton, Dolium, Fusus, Murex, etc., are used for fog horns, trumpets, lamps, vases, and ornamental borders in gardens. Those of Buscyon, Mactra, etc., by Indians for manufacture of implements. Shells of species of Mactra for ladles, spoons, and scoops, by fishermen. Those of Tridacna for vases, fountains, and the manufacture of handles and carvings. The shells of Pecten, Haliotis, Mercenaria, etc., by Indians for trimmings and ornaments. The scallop or Palmer's shell (*Pecten Jacobæus*) was used as a decoration of honor. Other Pectens are used in making pincushions and purses. The painter's muscle (*Unio pictorum*) is used to hold gold and silver colors. The shells of *Placuna placenta* are used in China as a substitute for glass. *Cytherea lusoria*, the painted shell of the Japanese, is used for playing a game. The shells of Cypræa, Rotella, Oliva, etc. (Venetian shells), are mounted as buttons and jewelry, and as shell work for ornamental book covers and frames. Calcined shells are used by dentifrice and porcelain makers. Cuttle fish bone, from *Sepia officinalis*, has various uses. The opercula of some mollusks are used as "eye stones," and polished and set as jewelry. In considering the manufacturing and useful applications of shells, they might be conveniently ranged under the following groups: (1) Nacreous shells, used for making pearl buttons and other useful and ornamental articles. (2) The pearly and iridescent shells, for ornamenting *papier mache* work, making card cases, folios, jewel cases, etc. (3) Various small shells, for making shell flowers, and different fancy articles of grouped shells, and for ladies' bracelets, head dresses, etc. (4) The shells used for carving cameos to set in brooches, bracelets, necklaces, scarf pins, for studs, sleeve links, etc. (5) Shells used for spoons, drinking vessels, lamps, knife handles; for snuff boxes, pipes, etc. (6) For making the purest kind of lime when calcined; for manure in the form of shell sand and shell marl; and for making pottery ware, and a glaze or enamel, when crushed. (7) Shells are also largely used for small monetary payments in North America, India, and Africa, and also as counters in games of chance. Lastly, they serve as studies of design, form, and color, for the sculptor, painter, and art manufacturer.

Milk as a Soporific.

According to the *Pharmacist*, it is a frequent practice in the New York Asylum for Inebriates to administer to the patients at bedtime a glass of milk to produce sleep, and the result is often found satisfactory, without the use of medicine. Medicine is there sometimes prescribed in milk. It has been recently stated in medical journals that lactic acid has the effect of promoting sleep by acting as a sedative, and this acid may be produced in the alimentary canal after the ingestion of milk. Can this, then, be the explanation of the action of milk on the nervous system after a long continued, excessive use of alcoholic drink? Sugar, also, is capable of being converted in the stomach, in certain morbid conditions, into lactic acid; and a lump of sugar allowed to dissolve in the mouth on going to bed will frequently soothe a restless body to quiet and repose.

The Dead Sea to be Utilized.

The water of the Dead Sea has long been known to be rich in mineral substances, the solid parts amounting to from twenty to twenty-seven in the hundred, according to the proximity to the mouth of the Jordan, the season of the year, and other causes. From 10 to 15 parts are chloride of magnesium; from 2 to 3 parts chloride of calcium; from 6 to 8 parts chloride of sodium; and from ½ to 1½ part chloride of potassium. There are also considerable traces of bromide of potassium and magnesium. It is said that a French contractor has just obtained a concession for the extraction of the chloride of potassium from the water of the Dead Sea. Chlorate of potash is used in the manufacture of fulminates, and consumed largely in England as an ingredient of manure. The supply has hitherto been drawn from Germany, and the salt was sold in London for 160 francs per ton. Competition reduced the rate to 130 francs, but the production ceases to be remunerative below 120 francs. The chlorate of potash procured from the Dead Sea can, it is said, be supplied in London at 90 francs, and the quantity obtainable is practically unlimited. The process of producing it will besides furnish other valuable chemical substances, such as the bromide and iodide of potassium.

THE BAWLKIN GREEN THUNDERBOLT.

Science, we are often told, is fatal to poetry and art. With every step toward the exact appreciation of the processes of nature something is lost to the imaginative and poetic faculty—the mystic is sacrificed for hard realism. As men become scientific they lose the childlike reverence for natural phenomena—the capacity to wonder at and enjoy the terrible or the beautiful in nature—which formed so large an element in human life in the unscientific past.

So say a class of critics who seem to know as little of the scientific uses of the imagination, or the marvelous expansion which scientific knowledge gives to all the faculties of the mind, as they do of the real barrenness of the intellectual condition of the common people in the days before science came in to destroy the poetry of appearances.

The accompanying engraving was made just two hundred and fifty years ago. It represents an occurrence which took place in the town of Hatford, England (eight miles from the seat of England's great university of Oxford), on the 9th of April, 1628. It is hardly necessary to add that Oxford was at that time innocent of any efforts in the direction of poetry-killing science.

The picture shows at once the condition of the art of wood engraving at that period, and the beautiful, childlike simplicity of the artist's imagination. There had been a fall of meteorites, more poetically known in those days as thunderbolts, and the chronicler reports that:

"One of them was seene by many people to fall at a place called *Bawlkin Greene*, being a mile and a half from *Hatford;* which *Thunder-bolt* was by one Mistris Greene caused to be digged out of the ground, she being an eye-witnesse, amongst many other, of the manner of the falling."

The heavy-tragedy air of the digger, who is bound to earn his penny notwithstanding the swooning of his companion through fright, is very amusing. The operations above the clouds prettily illustrate the artist's idea of meteorological processes, which science has since so largely reduced to a dreary system of exact knowledge and daily "probabilities." Nowadays the meteorologist deals with storm centers, areas of depression, humidity, barometric changes, and such like statements of prosaic facts. In the days of our engraving the chronicler of the weather could write of "miraculous Apparitions in the Ayre," "Wonders," and "Signs of Heaven's displeasure." In the pamphlet from which the engraving was copied the writer says:

"So Benummed wee are in our Sences, that albeit God himselfe Holla in our Eares, wee by our wills are loath to heare him. His dreadful Pursuivants of *Thunder* and *Lightening* terrifie us so long as they have us in their fingers, but beeing off, wee dance and sing in the midst of our Follies."

He then goes on to tell of the opening of heaven's windows, the thunder of God's artillery, and the fall of blazing stars in the midst of the elemental war.

"It is not for man to dispute with God, why he has done this so often, ... but with feare and trembling, casting his eyes up to Heaven, let us now behold him, bending his Fist onely, as lately he did, to the terrour and affrightment of all the Inhabitants dwelling within a Towne in the County of Barkshire."

That was before science meddled with the "elemental war." Now the Signal Service man telegraphs across the country: "Look for a fine meteoric display on the evening of the 12th; weather probably clear;" and all the young people sit out on the roofs to see the show. Thus the poetry of life vanishes!

DIGGING FOR A FALLEN METEOR IN 1628.

THE STRAW-NECKED IBIS.

This bird derives its name from the tuft of stiff naked feather shafts which hang from the front of the neck and breast, and greatly resemble small yellow straws. These curious feathers, with their light polished, golden surface, afford a pretty contrast to the glossy green black of the chest and wings, and the pure white of the neck and abdomen. The following description of the bird and its habits is written by Mr. Gould, in the "Birds of Australia":

THE STRAW-NECKED IBIS.

"This beautiful ibis has never yet been discovered out of Australia, over the whole of which immense country it is probably distributed, as it is more abundant in certain localities at one season than at another; its presence, in fact, appears to depend upon whether the season be or be not favorable to the increase of the lower animals upon which the vast hordes of this bird feed. After the severe drought of 1839, it was in such abundance on the Liverpool plains, that to compute the number in a single flock was impossible. It was also very numerous on the seaside of the great Liverpool range, inhabiting the open downs and flats, particularly such as were studded with shallow lagoons, through which it would wade knee high in search of shelled mollusks, frogs, newts, and insects; independently of the food I have mentioned, it feeds on grasshoppers and insects generally. The natives informed me that sometimes many seasons elapsed without the bird being seen. Where then does it go? To what country does it pass? Does there not exist a vast oasis in the center of Australia, to which the bird migrates when it is not found in the located parts of the country? We may reasonably suppose such to be the case."

The coloring of the straw-necked ibis is very conspicuous, and the lines of demarkation between the different tints are sharply drawn. The head and part of the neck are deep sooty black, which suddenly changes into a beautiful white downy plumage, clothing the remainder of the neck. From the fore part of the neck and throat hang a number of delicate fringe-like feathers. The whole of the upper surface is colored of a deep and glistening green black, "shot" with purple, and changing its tints at every variation of light. Irregular bars of the same color as the head are drawn across the back, and the entire under surface is pure white. During the life of this bird the thighs are slightly colored with crimson, but this tinting soon vanishes after death.

New and Constant Bichromate Battery.

Dr. Erck exhibited lately before the London Physical Society, a constant bichromate of potash battery. The ordinary bichromate battery soon loses power when in use, and in order to secure a powerful constant battery to drive a small astronomical clock, Dr. Erck devised the modified form shown. It consists of a narrow lead trough, 12 ins. long by 3 ins. wide and 1 in. deep, lined along both sides with the carbon plates. The zinc plate, 10 ins. long, is immersed in the solution to the depth of an inch midway between the two carbons. A continual circulation of the bichromate solution is kept up by allowing fresh solution to drop into the cell at one end, and the exhausted solution to drop away by a tap at the other end. As the space between the two carbons is only about half an inch wide, there is merely a thin layer of solution between the positive and negative poles. The internal resistance of the cell is therefore very low when short circuited, only about ¼ ohm. To obtain the maximum current, about 8 ozs. of solution per hour should be supplied. Dr. Erck also showed a battery formed of zinc and carbon circular plates mounted on an axle, which is rotated by wheelwork, thus mechanically stirring the bichromate solution.

Drawings Rendered Ineffaceable.

To render pencil drawings ineffaceable the *Papier Zeitung* recommends that the paper be prepared in the following manner:

Slightly warm a sheet of ordinary drawing paper, then place it carefully on the surface of a solution of white resin in alcohol, leaving it there long enough to become thoroughly moistened. Afterwards dry it in a current of warm air. Paper prepared in this way has a very smooth surface. In order to fix the drawing, the paper is to be simply warmed for a few moments. This process may prove useful for the preservation of plans or designs, when the want of time will not allow of the draughtsman reproducing them in ink. A simpler method than the above, however, is to brush over the back of the paper containing the charcoal or pencil sketch with a weak solution of white shellac in alcohol.

Life on Ocean Cables.

Mr. J. Munro, who spent some time with a repairing expedition along the line of the Para-Cayenne section of the Western and Brazilian Companies' cables, describes in *Chambers' Journal* the submarine life that was fished up by the cable. He says:

"We were chiefly at work off the island of Marajo in the estuary of the Amazon. The cable had only been submerged about a month; yet it came on board the ship at places covered with barnacles; at others overgrown with submarine vegetation, crabs, and curious shells, often of singular delicacy and beauty. The seaweeds were in great variety clinging to the cable, sometimes in thick groves of red and yellow algæ; slender, transparent, feathery grasses; red slimy frecoids, and tufts of amethyst moss. We found branching coralline plants upward of a foot in height growing to the cable, the soft skeleton being covered with a fleshy skin, generally of a deep orange color. Some times a sponge was found attached to the roots of the corals, and delicate structures of varied tints incrusted the stems of all these plants and served to ornament as well as to strengthen them. Parasite life seems to be as rife under these soft tepid waters as it is on the neighboring tropical shores. Many star fishes, zoöphytes, and curious crabs and crustaceans were likewise fished up on the cable. The crabs were often themselves completely overgrown with the indigenous vegetation of the bottom, and so were scarcely distinguishable from it. Others, although not so covered, were found to have the same tints as the vegetation they inhabited, and even in structure somewhat resembled the latter. Others were perfectly or partially transparent, and one most beautiful hyaline crab, new to science, united in its person several of the prevailing colors of the bottom. Its slender limbs, like jointed filaments of glass, were stained here and there of a deep topaz brown. Its snout, pointed like a needle, was of a deep scarlet, its triangular body was orange yellow, its eyes were green, and its tiny hands of an amethyst blue."

Furs Used for Ladies' Cloaks.

Frank Buckland, in *Land and Water*, gives the following information as to whence the skins used for lining ladies' cloaks are derived. Fur lined cloaks are now quite abundant and fashionable. The skins used as linings are of various kinds. The commonest of all is white rabbits'; these are not English, but imported from Lissa, in Poland, where they are dressed by the furriers, and manufactured into linings for cloaks. It is not certain whether these skins are from wild or tame rabbits. As many thousand skins are annually used, it is very probable that they are domestic rabbits bred for the purpose. Besides rabbit skins, many cloaks are lined with what are called "squirrel bellies." These are literally bellies of squirrels. These animals are skinned in a peculiar manner so as to make the most of the fur. The squirrels used for this purpose are of various kinds and prices. The most expensive squirrel is the Siberian squirrel. The general color of this is blue, some light blue, some dark blue; the dark blue are the most valuable, particularly if it is void of the red stripe down the back. These squirrels are killed by thousands in Siberia; they are mostly shot with a small bullet. Those from Sweden and Norway are caught in traps, probably pitfalls baited with food; they are also intercepted when in the act of migrating. The Swedish squirrels are very large. Some of the squirrel skins are of a red color; these are the same squirrel in the summer dress. Squirrels are also imported in large numbers, especially from Kasan, in Russia, but they are rather inferior to other sorts. There are various modes of dressing squirrel skins. The Russian skins are pickled in salt, and in consequence are apt to feel damp in wet weather. They do very well in Russia, as the weather there is always dry. In this country the skins are dressed with butter or lard, and it is a remarkable thing that the Russian furriers cannot use butter dressed skins, because in Russia the skins thus prepared become quite hard in very cold weather. For years past the trade of dressing squirrel skins has had its headquarters in Saxony, principally at the town of Weissenfels. Leipsic is celebrated for its fur market, especially at Easter, when the great fair takes place. From Leipsic furs are sent to China, Russia, Turkey, Greece, etc.—in fact, all over the world. Large numbers of common wild rabbit skins and silver grays are exported from England for use in Russia. Cats are largely cultivated in Holland, especially for their skins. The fur of the Dutch cat is very long and soft as compared to the English cat, the fur of which is hard and wiry. There is some secrecy as to how the cats in Holland are fed; it is possible that they are fed on fish. The best Dutch cats are black. A good skin of jet black color is worth half a guinea. The Dutch cat killers have a most peculiar and clever way of killing their cats. It is a fallacy to suppose that cats are skinned alive. In the first place, to skin a cat when alive would be utterly impossible; and secondly, it does not make any difference in the quality of the skin. The origin of the fallacy is probably that a cat is easier skinned immediately after death than if allowed to become rigid. It is very remarkable how fashions set by English ladies influence wild and tame animals even in the most distant parts of the world. It is fortunate that ladies have made cats fashionable, as at last some use is found for these animals, which, being untaxed, are so abundant that any night and in any weather cats—many of them half starved—swarm in the London streets, and the poorer the neighborhood the more abundant are the cats.

A New Material for Paper.

The consumption of esparto grass by paper makers in France and England is now very large, and it is yearly increasing. Sir Joseph Hooker and Mr. Ball, in their recently published journal of a "Tour in Morocco," tell us they saw immense bales of this grass being shipped from the port of Mogador, and "that it is there said that the greater part of what reaches England from Morocco is used in the paper mills that supply the *Times* newspaper." The great value of this grass as a paper making material lies in the tenacity of its fiber, and the comparatively minute quantity of silica in its composition. In these respects it would appear that we have in all wet, healthy places, moors, and damp woods throughout Great Britain and Ireland, and extending over all Europe and into Russian Asia, wherever suitable places for its growth are to be found, a similar material in the grass long known as the purple molinia (*Molinia cærulea*). It is a rather coarse, stiff, perennial grass, often growing to a height of 3 feet; the leaves chiefly form tufts and start from the base of the plant; the flowering stalk is of a greenish or purple hue. It is found over all the moorlands of Scotland and in all the boggy pastures of Ireland, and has been considered of little, if any, agricultural value; it is gradually, by cultivation, being destroyed. From an analysis of hay made from this grass by Dr. Cameron, it would appear to contain an unprecedentedly small amount of ash—only 0·85 part out of 100 parts of hay (dry weight)—and a scarcely appreciable amount of silica. In 100 parts of the ash only 0·55 of silica was found. Dr. Cameron does not suggest this grass as being of value as a paper making material, but he calls the attention of farmers to the fact that it is well worth saving as a food product, as its composition indicates a high degree of nutritive value; indeed, it appears to be quite as rich as meadow hay in all its common ingredients except digestible non-nitrogenous matters. Its analysis, however, indicates its qualities as a paper making material, as which it would have a higher commercial value than as an article of food; and, in a communication to *Nature*, Mr. Christie, of Edinburgh, states that he sent a small quantity of the grass to be operated on by Mr. T. Routledge, of Sunderland, who, after experiment, came to the conclusion that if dried properly, and put up carefully in bundles, free from weeds and dirt, its value would be probably equal to esparto grass—£5 per ton dry. It is to be hoped that some effort may be used to have an extended trial for paper making of this plant. It flowers in the late summer or early autumn, when in this country some hands could be readily spared from other work to collect it. It should cost little over the mere expense of gathering, as the ground in which it flourishes, as a rule, will pay but a minimum of rent.—*London Times.*

Pearls and Pearl Culture.

As far back as we have a history for any gems we have record of pearls; and, not even excepting the diamond, is there a jewel so often spoken of in history, sacred and profane, as this one. What are they, and where are they produced? Are they capable of being multiplied by art? In view of the great commercial value of these jewels, such queries are of considerable importance. There is scarcely a country on the face of the globe where pearls have not at some period been found, though at the present day the principal fisheries are near the coast of Ceylon, Japan, Java, Sumatra, Bahrein in the Persian Gulf, and the islands in the vicinity of Panama. Of all these, however, none equal those obtained in the Persian Gulf, in color, size, purity, and that translucency which gives this gem its great value. The pearl fisheries in the last named locality are said to yield upward of $1,500,000 annually; those of Panama reach about the same figure. Pearls have also been found in various streams of the United States, and in 1858 considerable excitement was occasioned by the discovery of some large sized ones near Salem, in New Jersey. A New Jersey pearl, over an inch in diameter, found near Paterson, was sent to Paris, where it was purchased by the Empress Eugenie for 12,500 francs ($2,500).

This gem was held in great estimation by the Romans, who paid enormous prices for fine specimens. Julius Cæsar is said to have possessed one, the value of which would now be $150,000, and Pliny states that the pearls in the eardrops of Cleopatra, and which she swallowed to the health of Mark Antony, were valued at a sum that would amount to $400,000 of our money. Tavernier mentions a pearl found at Catira, on the coast of Arabia, in 1633, which was sold to the King of Persia for $280,000. The "Peregnine," found in 1574, during some of the filibustering expeditions to America and carried to Spain (where it now remains among the crown jewels), is valued at $37,500. Pope Leo X. had a pearl that was valued at $75,000; and the crown jewels of Portugal have among them a pear-shaped one, weighing about 25 carats. A close examination of the subject reduces the great pearls of the world to a very limited number; the large examples running over 20 carats in weight, which are absolutely known to exist at the present day, do not number over a score.

Having spoken of the value of these jewels, we are led to consider the question, What are they, and how are they formed? According to an old and popular fancy, pearls are dewdrops transmogrified. Pliny asserts that the oysters rise to the surface in the night to feed upon the dews of heaven, which the sun's rays upon the water nourish into pearls. According to Boethius de Bovelt: "The mussels, early in the morning, in the gentle cleare and calme aire, lift up their upper shells and mouthes above the water, and these receive the fine and pleasant breath or dew of heaven; and afterwards, according to the measure and quantitie of this vitall force received, they first conceive, then swell, and finallie produce the pearle." At this very day, in the East, the belief exists that these gems are the drops of rain, which, as they fall into the sea, become pearls, and in that state are swallowed by the oyster. A stay was given to such a belief by Cardonus, who demonstrated that these shell fish have their homes upon the sea bottom, where they are firmly attached to rocks and other substances, and have therefore no power to rise. Still this fancy survived till the researches of Mr. Gray and Sir Everard Home proved that pearls are merely the internal nacreous coat of the shell, which, from some cause or other, has assumed a spherical form. Home's idea, however, that the pearl is an abortive egg of the oyster enveloped in its own nacre, is scarcely worthy the trouble of refutation.

A theory was started at one time that the pearl proceeded from a wound on the shell of the animal. This view was held by Linnæus, who suggested to the Swedish Government a plan for making pearls by boring holes through the shells of the mollusk. He received $2,250 for his plan, which, on trial, was unsuccessful. It was at one time thought, too, that the pearl muscle covered small particles of sand, which accident had introduced between its shells, with pearly matter for protection. That this is not the case is proved by the fact that, though numberless pearls have been split and sawed through the center, it is very seldom that an imperfection is found even of the minutest size.

The theory of Réaumur is now generally held to be the correct one; and that is, that the pearl is a concretion of the juices consequent upon a disease or rupture in the mollusk, without the introduction of any foreign matter. The pearl is simply carbonate of lime—rather harder than calcspar, of which it has precisely the same chemical composition, but with the addition of films of animal membrane between the many layers of mineral matters which go to form it. It is this animal matter which, when dry, gives the pearl its hardness. Several genera and species of bivalve mollusks secrete pearls, especially the *Avicula margaritifera*, or true pearl oyster; and among fresh water species, the *Unio margaritifera*. It is found that only the old animals produce the gems; the fishers do not look for them nor expect them from the young and smooth shelled; the more aged and distorted the shell, the greater the probability of a find of pearls.

Can pearls be produced at the will of man, or multiplied by his aid? This is an important query; for, if it be possible to do so, a way is opened for the cultivation of a valuable industry. Certain it is that the pearl muscle (or "oyster," as it is improperly styled) has the power of covering with concentric layers of nacre such portions of its shell as need strengthening, as well as objects introduced by accident or design. The Chinese and Japanese, taking advantage of this, have long practiced the art of stimulating the secretion of nacre by introducing beads made of spar, or powdered glass and varnish, or sometimes turned from mother-of-pearl; and thus they do actually succeed in forcing the animal to produce pearls at their will, although of inferior quality. The results of the few experiments that have thus far been tried in other quarters seem to be negative. One of the curious circumstances connected with the New Jersey "pearl fever," of 1858, was the discovery of a few shells showing that, many years before, some one had experimented on the pearl bearing muscle by dropping small mother-of-pearl buttons inside the shell, hoping that the animal would cover them with its secretion. The experiments proved a failure, however, the result being that the buttons became fastened to the shells by the action of the secretion, but did not develop into pearls.

Before taking leave of this subject we must refer to a remarkable discussion which has been going on for some time in the pages of our English contemporary, *Land and Water*, under the caption of "Do Pearls Breed?" It seems that some time ago a number of small pearls, of the kind known in commerce as "seed pearls," were sent to Mr. Frank Buckland from Borneo, under the name of "breeding pearls." These pearls were inclosed in a glass tube, we are told, along with some grains of rice to feed upon. The sender gravely asserted that it had long been known in Borneo that pearls when put by for some time in a box along with rice would reproduce their kind. We learn that three or four months have now elapsed since the pearls were dispatched on their journey, and that the grains of rice inclosed with them have all the appearance of being partially eaten. This astounding absurdity is being gravely discussed, and, strange to say, many of the correspondents of the journal actually maintain the plausibility of it. To find a fitting parallel for such a belief in the annals of natural history it will perhaps be necessary to travel back to the olden time when it was firmly held as a truth that the crustaceans known as barnacles gave birth to the fowl called the barnacle goose.

A Gigantic Vegetable.

At a recent meeting of the Linnæan Society, Dr. Masters read an extract from a letter received that morning, describing what is believed to be the largest plant in existence. A botanical traveler in Sumatra has found, growing near the Rafflesia, a plant belonging to the family of the Arums. The bulb or corm growing on the surface measured 5 feet in circumference. Two men endeavored to raise it; it is said they nearly broke their backs in doing it, and the root itself broke while they were lifting it. From this corm sprang a single leaf stalk, 20 feet high. At the top it divided into three branches, each as thick as a man's thigh. The leaf is divided into an immense number of segments, and measures 15 meters in circumference, or 45 feet, covering, therefore, an area of 150 square feet. The plant had done flowering when it was discovered, so that the dimensions of the spathe are as yet unknown. But seeds were obtained, which are now growing at Florence.

A New Telegraphic Conductor.

An electrical conductor of decidedly novel character has just been patented by Mr. Alberger, of Philadelphia. It consists of a conducting wire—preferably of decarbonized steel—surrounded by a vitreous substance and incased in a metallic tube. The manner of making the conductor is as novel as the article itself. The inventor produces a glass bulb at the end of a glass blower's tube, and passes a wire from a neighboring reel through the tube until its end reaches the outer end of the bulb, when the end of the bulb and the wire together are seized and drawn outward, while the tube remains stationary. The wire having the vitreous casing is now introduced into a wrought iron tube, and the whole is heated to a welding heat and reduced in size by rolling. Sections of the conductor are united at the ends by an ordinary screw coupling, the ends being first rounded off by an emery wheel to render a contact of the conducting wires certain. The conductor made in this way is protected from oxidation, and is completely insulated.

THE Berlin Academy renew an offer of a prize of about £46 for an investigation of the following questions (not yet replied to): "In what combination does lime occur in the blood of mammals and of birds, and how does the chemical precipitation of its salts in the tissues, and especially in the bones, take place?" It is desired that these questions be answered by experimental researches on grown animals, in which especially the chemical state of the blood and the bones, after long feeding with substances containing phosphorus and (separately) plant-acid salts, is more exactly determined. Papers must be sent in before March 1, 1881.

CATARRH AND ITS CURE.

Rev. T. P. Childs publishes to-day a wonderfully accurate description of the causes of Catarrh, and the results from inattention to the first symptoms of this terrible disease. From the details given of his method of cure, it seems to be easily applied and very simple in its action. Inhalation is evidently the most rational and sensible way of reaching any disease of the air passages; Mr. Childs' application of this principle in medicine, together with the knowledge of the inhalants to be used, have given him his wonderful success in the treatment of Catarrh and Bronchitis. To judge from the published statements of some of his patients, the medicine Mr. Childs contrives to place, by the use of his inhalers, just where it is needed, must be most powerful and searching in its character to produce such surprising results. None need feel any hesitancy in placing their case in Mr. Childs' hands for treatment. The number and character of the certificates, as well as the favorable notices from well known publishers, who have carefully examined the subject, must dispel every doubt in regard to his reliability. We would call especial attention to the advertisement, and request a careful perusal of the facts as set forth.—Adv.

Business and Personal.

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

National Steam Pump; best and cheapest. National Iron Works, New Brunswick, N. J.

Assays of Ores, Analyses of Minerals, Waters, Commercial Articles, etc. Technical formulæ and processes. Fuller & Stillman, 40 & 42 Broadway, N. Y.

Kimball's Catarrh Cigarettes, an instantaneous relief and a pleasant smoke. They contain no tobacco.

80 H. P. Corliss Engine for sale low, by J. F. Bishop, New Haven, Conn.

The greatest improvement upon Turbine Water Wheels has recently been made by S. M. Smith, York, Pa.

C. M. Flint, Fitchburg, Mass., Mfr. of Saw Mills and Dogs, Shingle and Clapboard Machines. Circulars.

Wood-working Machinery, Waymouth Lathes. Specialty, Wardwell Patent Screw Bench; it has no equal. Improved Patent Planers; Elevators; Dowel Machines. Rollstone Machine Company, Fitchburg, Mass.

Valves and Hydrants, warranted to give perfect satisfaction. Chapman Valve Manuf. Co., Boston, Mass.

Artificial Stone.—Wanted to buy receipt for making. Address Wm. A. Morrison, Alton, Ill.

New Gear Cutting Attachment for Lathes. Lace Leather Cutter. Something new. Send for lists. Jackson & Tyler, Baltimore, Md.

Outfits for Nickel and Silver Plating, $5 to $200. Union Silver Plating Company, Princeton, Ill.

Send for Circulars of Indestructible Boot and Shoe Soles to H. C. Goodrich, 40 Hoyne Ave., Chicago, Ill.

For Sale cheap.—3 H. P. Yacht or Stationary Engine and Boiler, good as new. Aug. Franke, Wapakoneta, O.

Cornice Machines; Parkin's Circular. Calvin Carr, 44 Center St., N. Y.

Save Fuel by using Steam Boiler Damper Regulator. National Iron Works, New Brunswick, N. J.

Emery.—Best Turkey Emery in bbls., kegs, and cases in quantities to suit. Greene, Tweed & Co., 18 Park Place, N. Y.

The unprecedented demand for Kinney Bros.' New Cigarette, Sweet Caporal, is a good recommendation as to their merit.

Kinney Bros.' New Cigarette, Sweet Caporal, fine, mild, and sweet, are becoming extremely popular everywhere.

Wanted.—Information of any improved method or machinery for making Vinegar. Address 909 N. 23d St., St. Louis, Mo.

Want—3 Singer Sewing Machines; 1 Watchman's Time Detecter. Address Millstone, Indianapolis, Ind.

Nearly five acres of woodwork in the two immense dry goods stores of Messrs. A. T. Stewart & Co., of this city, are protected with H. W. Johns' Asbestos Fireproof Paint. H. W. Johns Mfg. Co., 87 Maiden Lane, are sole manufacturers of genuine Asbestos Paints, Roofing, Boiler Coverings, etc.

Brown & Sharpe, Prov., R. I. Best Gear Teeth Cutters and Index Plates at low prices. Send for catalogue.

For Sale.—Brown & Sharp Universal Milling Machine; Bement Profiling Machine; first-class 2d hand Machine Tools. E. P. Bullard, 14 Dey St., New York.

Latest Improved Nut and Washer Machines under J. Noyes Smith's Patents; the only machine that makes hot pressed nuts without burring. York & Smith, Cleveland, Ohio.

For Sale.—7 foot bed Putnam Planer, $350. A. A. Pool & Co., Newark, N. J.

Blake's Belt Studs; strongest, cheapest, and best fastening for Leather or Rubber Belts. Greene, Tweed & Co., New York.

Post Hand, Foot, or Power Band Saws, as good as the best, cut 7½ in. thick; price $55. G. W. Baker, Will., Del.

Wanted—By a first-class practical mechanic, draughtsman, and designer, a situation as foreman or superintendent of a machine shop. First-class references given. Address Lock Box 268, Woonsocket, R. I.

Our Imp. Steam Governor is far in advance of all others; prices reduced. Huntoon Gov. Co., Lawrence, Mass.

Bevins & Co.'s Hydraulic Elevator. Great power, simplicity, safety, economy, durability. 94 Liberty St. N. Y.

Circulars for Inventors and Manufacturers. Pamphlets on machinery, price lists, etc., written, illustrated, and printed; estimates furnished. Park Benjamin, Ph. D., Editor Appletons' "Cyclopædia of Applied Mechanics," 37 Park Row, New York.

A Cupola works best with forced blast from a Baker Blower. Wilbraham Bros., 2,318 Frankford Ave., Phila.

Shaw's Noise Quieting Nozzles and Mercury Pressure Gauges. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

For Steam Pumps send to Dean Bros., Indianapolis, Ind.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Vertical Burr Mill. C. K. Bullock, Phila., Pa.

H. Prentiss & Company, 14 Dey St., N. Y., Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

A Great Bargain.—One new No. 1 14-inch 6 Roll Schenck Planing and Matching Machine. Belcher & Bagnall, 25 Murray Street.

Needle Pointed Iron, Brass, and Steel Wire for all purposes. W. Crabb, Newark, N. J.

Case Hardening Preparation. Box 73, Willimantic, Ct.

Hydraulic Elevators for private houses, hotels, and public buildings. Burdon Iron Works, Brooklyn, N. Y.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

Galland & Co.'s Improved Hydraulic Elevators. Office 206 Broadway, N.Y., (Evening Post Building, room 22.)

The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are to be sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Telescopes of all sizes manufactured; also, telescopes carefully corrected and repaired at short notice. I have testimonials from Lewis M. Rutherfurd, 175 2d Ave., N. Y., certifying to the perfection of my telescopes. John Byrne, 314 E. 21st St., New York.

Warranted best and cheapest Planers, Jointers, Universal Woodworkers, Band and Scroll Saws, etc., manufactured by Bentel, Margedant & Co., Hamilton, Ohio.

Machine Diamonds. J. Dickinson, 64 Nassau St., N.Y.

Eagle Anvils, 9 cents per pound. Fully warranted.

The best Friction Clutch Pulley and Friction Hoisting Machinery in the world, to be seen with power applied, 95 and 97 Liberty St., New York. D. Frisbie & Co., New Haven, Conn.

Fine Taps and Dies for Jewelers, Dentists, and Machinists, in cases. Pratt & Whitney Co., Hartford, Conn.

For Sale.—4 H. P. Vertical Engine and Boiler (New York Safety Steam Power Co.'s make), as good, and in some respects better, than new. Address H. M. Quackenbush, Herkimer, N. Y.

The new "Otto" Silent Gas Engine is simple in construction, easy of management, and the cheapest motor known for intermittent work. Schleicher, Schumm & Co., Philadelphia, Pa.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

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Vick's Illustrated Monthly Magazine is one of the most beautiful magazines in the world. Each number contains a chromo of some group of flowers, and many fine engravings. Published monthly at $1.25 per year. Address James Vick, Rochester, N. Y.

Pulverizing Mills for all hard substances and grinding purposes. Walker Bros. & Co., 23d & Wood St., Phila., Pa.

Inventors' Models. John Ruthven, Cincinnati, O.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

The Scientific American Export Edition is published monthly, about the 15th of each month. Every number comprises most of the plates of the four preceding weekly numbers of the Scientific American, with other appropriate contents, business announcements, etc. It forms a large and splendid periodical of nearly one hundred quarto pages, each number illustrated with about one hundred engravings. It is a complete record of American progress in the arts.

NEW BOOKS AND PUBLICATIONS.

Guide to Rose Culture.—The Dinger & Conard Company of West Grove, Penn., have just issued their 1879 Annual, and like their previous ones it is copiously illustrated. It not only contains engravings of the choicest varieties of roses, but also of other flowering and ornamental plants. Messrs. Dinger & Conard have been growers of fine varieties of roses and ornamental plants for a number of years, and are reliable dealers. The guide is sent free to persons inclosing, with their address, a 3 cent stamp.

Notes & Queries

(1) C. Z. S. asks for the best method of putting water grates in a locomotive fire box. How is the pipe connected with the front and back end of the fire box? A. You can either expand the pipes at the ends, or screw them in, as is most convenient.

(2) A. S. asks how many sizes of pinions will run in an internal gear of 10 inches diameter. I want to run 24, the smallest three quarters of an inch, the largest 3 inches diameter. A. Fix upon some number of teeth in the internal gear that is a common multiple of the number of teeth in all the pinions. You will see then that the number of pinions is only limited by the practical difficulties of construction.

(3) R. B. R. writes: Several journals have stated that the locomotive lately built for the Atchison, Santa Fe, and Topeka Railroad was the heaviest ever built. The weight given is 118,000 lbs. Please inform your readers if this is correct. A. The "Janus," built at the Mason Machine Works, and in use on one of the Pennsylvania coal roads, weighs 84 tons. Possibly there may be an engine heavier still, and if so, we hope some of our readers will inform us.

(4) D. P. asks: What thickness must a cast steel cylinder 8 inches internal diameter have, so as to resist a steam pressure of 250 lbs. per square inch with complete safety? A. Half an inch will answer, unless the length is great.

(5) R. S. H. asks: If I build a boiler 36 inches in diameter, and the flues 30 inches in diameter, the iron in both being the same strength, and apply the steam between the boiler and the flue, which will bear the greatest amount of pressure? A. The 36 inch shall.

(6) C. R. G. asks (1) if there is any difference in the friction of 2 equal lengths of hose, one to be laid straight and the other crooked. A. Yes, other things being equal, the difference will be considerable. 2. If water is forced into a 6 inch pipe from a 3 inch inlet, and after being forced from 500 to 600 feet and discharged from a 3 inch hose, will the water move faster in the center of the 6 inch pipe, or on the sides of the same, or will the water that is forced in act as a piston and make it all move the same? A. The action will be as described in the latter part of your question.

(7) R. E. W. asks for an explanation of the action of the wheels of a car when going round a turn or curve. One of the wheels (I think the outside) must make more revolutions in the same time than the other. How does the slower one make up with the other? A. In such a case, one of the wheels must slip, unless they are so coned that one is running on a longer circumference than the other, sufficient to allow it to pass over a greater distance with the same number of revolutions.

(8) C. H. M. H. asks: What constitutes an artesian well? My friend argues that it is necessary that the water should rise above the surface of the ground. I contend that if it reaches the surface it comes under the head of an artesian. A. It is the manner of sinking, not the nature of the flow, that makes a well artesian. The water may or may not reach the surface.

(9) J. E. F. asks: Which is the best for the Wabash, Mississippi, and Yellowstone rivers, a screw wheel, stern wheel, or side wheels? I am building a boat thirty-five feet long to carry eight persons and baggage, and I want to run good speed, for a pleasure trip up the Yellowstone river. What size should the engines be, and what should the boiler be, and would thirty-five feet be long enough, and how wide should it be? A. A screw will be preferable, if there is sufficient water. For dimensions of machinery, see Scientific American Supplement, No. 158.

(10) W. C. asks: 1. Will it take the temper out of a steel casting or weaken it, under necessary heat to "shrink it on"? A. Yes. 2. In case it does, can a casting be "shrunk on" and tempered at the same time, or under one heating? A. Yes, but at the risk of breaking it.

(11) J. A. M. asks how to soften cast iron that is too hard for filing or drilling, so that it may be filed or drilled. A. Heat it to a cherry red, plunge it into powdered quick lime, and allow it to remain until cool.

(12) W. G. C. asks: 1. How can I drill a hole in a glass plate without danger of cracking the glass? A. Use as a drill a copper tube of the size of the required hole, and as it rotates keep it charged with emery and water. 2. Is American glass good enough for the plate of a "Holtz" electric machine? A. Yes. State your other questions more fully.

Minerals, etc.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. S. W.—The ore does not contain silver, but much manganese and iron oxide. Properly powdered and washed it may have some market value on account of the manganese oxide which it contains.—J. E. R.—It is a fragment of quartz, or pebble that has been rounded by attrition.—E. G. O.—Please send larger sample of your ore.

Any numbers of the Scientific American Supplement referred to in these columns may be had at this office. Price 10 cents each.

COMMUNICATIONS RECEIVED.

On Pyrometers. By C. F. R.
Simple Electric Pen. By G. L. S.
Tide in Lake Superior. By H. J. W.
Culture of the Pear. By E. P. P.
New Patent Bill. Inventor.
On Ice Yachts. By H. B.
The Senate Patent Bill No. 300.
Patent Legislation. By W. F. S.
On the Progress of Chemistry in 1878. By E. G. H.
On Protection of Inventors' Rights. By V. B.
On Improvements in Cane Mills. By H. M. W.

[OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 4, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Accordion, O. Stark 212,065
Alloy for metric gold coin, W. W. Hubbell 211,909
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THIRTY-FOURTH ANNUAL REPORT
OF THE
NEW YORK
LIFE INSURANCE COMPANY
OFFICE:
Nos. 346 & 348 Broadway.

JANUARY 1, 1879.

Amount of Net Cash Assets, Jan. 1, 1878, $34,452,905 29

REVENUE ACCOUNT.

Premiums received and deferred.....	$6,121,856 04	
Less deferred premiums Jan. 1, 1878..	396,289 26	$5,725,566 78
Interest received and accrued.....	2,364,560 48	
Less interest accrued Jan. 1, 1878..	315,895 35	$1,948,665 13—$7,674,231 91
		$42,127,137 20

DISBURSEMENT ACCOUNT.

Losses by death, including Reversionary additions to same		$1,687,675 61
Endowments matured and discounted, including Reversionary additions to same.....		673,051 44
Life annuities and reinsurances.		231,005 29
Dividends and returned premiums on canceled policies ...		2,288,674 25
Commissions, brokerages, agency expenses and physicians' fees..		518,809 94
Taxes, office and law expenses, salaries, advertising, printing, etc.....		417,258 78
Reduction of values on United States and other stocks.....		88,635 00
Profit and loss account		8,568 98—$5,913,679 59
		$36,213,457 61

ASSETS.

Cash in bank, on hand, and in transit (since received).....		$932,839 43
Invested in United States, New York City, and other stocks (market value $15,415,105 34)...		14,791,367 72
Real estate.....		4,582,270 42
Bonds and mortgages, first lien on real estate (buildings thereon insured for $12,860,000 and the policies assigned to the company as additional collateral, security).....		14,364,158 43
*Loans on existing policies (the reserve held by the company on these policies amounts to $3,225,000).....		621,984 93
*Quarterly and semi-annual premiums on existing policies, due subsequent to January 1, 1879..		379,839 09
*Premiums on existing policies in course of transmission and collection (estimated reserve on these policies, $560,000, included in liabilities).....		146,834 75
Agents' balances.....		88,036 91
Accrued interest on investments to January 1, 1879.....		306,225 93—$36,213,457 61
*A detailed schedule of these items will accompany the usual annual report filed with the Insurance Department of the State of New York.		
Excess of market value of securities over cost.....		623,837 62
CASH ASSETS, Jan. 1, 1879.		**$36,837,295 23**
Appropriated as follows:		
Adjusted losses, due subsequent to Jan. 1, 1879.....	$399,486 68	
Reported losses, awaiting proof, etc	180,993 39	
Matured endowments, due and unpaid.....	19,601 07	
Reserved for reinsurance on existing policies; participating insurance at 4 per cent. Carlisle net premium; non-participating at 5 per cent. Carlisle net premium.....	32,369,333 40	
Reserved for contingent liabilities to Tontine Dividend Fund, over and above a 4 per cent. reserve on existing policies of that class.....	1,041,456 87	
Reserved for premiums paid in advance.....	14,987 18—$34,025,858 59	
Divisible surplus at 4 per cent.....		2,811,436 64
		$36,837,295 23

Surplus, estimated by the New York State Standard at 4½ per cent. over $6,500,000 00

From the undivided surplus of $2,811,436 64 the Board of Trustees has declared a Reversionary dividend to participating policies in proportion to their contribution to surplus, available on settlement of next annual premium.

During the year 5,082 policies have been issued, insuring $15,949,986.

Number of Policies in force Jan. 1, 1876, 44,661. Amount at risk, $126,132,119.
Number of Policies in force Jan. 1, 1877, 45,421. Amount at risk, $127,748,473.
Number of Policies in force Jan. 1, 1878, 45,605. Amount at risk, $127,901,887.
Number of Policies in force Jan. 1, 1879, 45,005. Amount at risk, $125,282,144.

Death-Claims paid 1875, $1,524,815.
Death-Claims paid 1876, 1,547,648.
Death-Claims paid 1877, 1,638,128.
Death-Claims paid 1878, 1,687,676.

Income from Interest, 1875, $1,870,658.
Income from Interest, 1876, 1,906,960.
Income from Interest, 1877, 1,867,457.
Income from Interest, 1878, 1,948,665.

Divisible surplus at 4 per cent., Jan. 1, 1876, $2,499,656.
Divisible surplus at 4 per cent., Jan. 1, 1877, 2,626,816.
Divisible surplus at 4 per cent., Jan. 1, 1878, 2,664,144.
Divisible surplus at 4 per cent., Jan. 1, 1879, 2,811,436.

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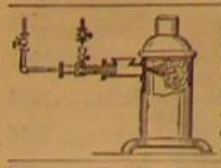

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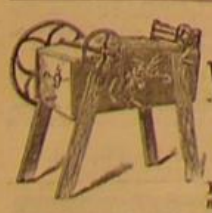

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CATARRH

Thousands suffer without knowing the nature of this almost universal complaint. It is an ulceration of the head. Its indications are, hawking, spitting, *weak inflamed eyes*, frequent soreness of the throat, dryness and heat of the nose, *matter* running from the head down the throat, often ringing or deafness in the ears, loss of smell, memory impaired, *dullness* and *dizziness* of the head, often in the first stages, but more commonly in its advanced stages, attended with pains in chest or left side, and under the shoulder blades. Indigestion usually attends Catarrh; a hacking cough and colds are very common; some have all these symptoms; others only a part. Very little pain attends Catarrh, until the liver and the lungs are attacked in consequence of the stream of pollution running from the head into the stomach.

All persons thus affected take cold easily, and have frequently a running at the nostrils; the breath sometimes reveals to all around the corruption within, while the patient has frequently lost all sense of smell. The disease advances covertly, until pain in the chest, lungs or bowels, startles him; he hacks and coughs, has dyspepsia, liver complaint, and is urged by his doctor to take this or that; perhaps cod liver oil is prescribed. Perfectly ridiculous! The foul ulcers in the head can not be reached by pouring such stuff into the poor, jaded stomach. The patient becomes nervous; the voice is harsh and unnatural; he feels disheartened; memory loses her power, judgment her zeal, gloomy forebodings hang overhead; hundreds, yes thousands, in such circumstances, feel that to die would be a relief, and many even do cut the thread of life to end their sorrows.

THOUSANDS ARE DYING

In early life with consumption, who can look back a few years—perhaps only months—when it was *only catarrh*. Neglected, when a cure is possible, very soon it will transform the features of health and youth into the dark, pallid appearance; while the hacking cough, the excess of blood gushing from the lungs, or night sweats, all significantly proclaim it is *too late; and thus a neglected catarrh ends in the consumptive's grave.*

NASAL CATARRH.

Sometimes the disease only affects the membranes lining the nasal passages, and they may be easily reached and cured by simple means. But when it is located in the *frontal sinus*, or in the *posterior nares*, or if it has entered the *Eustachian tubes*, and is injuring the ears, then nothing but finely medicated vapor can effectually reach it and destroy it. And certainly, after it has affected the throat and bronchial tubes, as all well-read physicians will readily attest, nothing can be relied on to effect a permanent cure but the inhalation of properly medicated vapor. In the same manner that we breathe common air, we can inhale and breathe a medicated air, and it is perfectly simple, any one can see, thus to treat diseases of the *throat, bronchial pipes, and lungs*. How much better this method, by which remedies are conveyed directly to the seat of the disease, than to resort to the uncertain and too frequently *mischievous action* of medicines taken into the stomach.

AMONG WOMEN catarrh is very common. The decrees of fashion compel women to go from the dry atmosphere of furnace heated houses, into the open air, with the head but poorly protected. Many suffer keenly from bronchitis and difficulties of the throat and lungs.

TEACHERS IN OUR SCHOOLS are greatly subject to this fearful malady. Confinement in close, ill ventilated school-rooms; the over heated atmosphere, charged with the steaming poison exuding from the bodies of the not always over clean children, breed this disease with fearful rapidity.

PUBLIC SPEAKERS after leaving the platform, overheated with the strain of their mental and physical effort, neglect sufficient precaution, and a cold is the result. This neglected opens the way to catarrh, and to a possible loss of voice. I have suffered so keenly myself that I can not urge upon public speakers too strongly the necessity of removing this disease when a cure is possible.

MY EXPERIENCE.

Eighteen years of terrible headache, digusting nasal discharges, dryness of the throat, acute bronchitis, coughing, soreness of the lungs, raising bloody mucus, and even night sweats, incapacitating me for my professional duties, and bringing me to the verge of the grave—ALL were caused by, and the results of *Nasal Catarrh*. After spending hundreds of dollars, and obtaining no relief, I compounded my CATARRH SPECIFIC AND COLD AIR INHALING BALM, and wrought upon myself a *wonderful cure*. Now I can speak for hours with no difficulty, and can breathe freely in any atmosphere. At the calls of numerous friends, I have given my cure to the public, and have now thousands of patients in all parts of the country, and thousands of happy fellow-beings whose sufferings I have relieved. My cure is *certain, thorough and perfect*, and is indorsed by EVERY PHYSICIAN who has examined it. If I can relieve my fellow beings as I have been relieved of this loathsome disease, which makes the possessor at once disgusting to himself and others, I shall be satisfied, and feel that I have done my little toward removing the ills of mankind.

T. P. CHILDS.

FROM THE CHANCELLOR OF THE UNIVERSITY OF NEBRASKA.

T. P. CHILDS.—*Dear Sir:*—I think you have the true theory and practice for the cure of Nasal Catarrh, and also, for the treatment of the respiratory organs. My throat is now so well restored, that I lecture daily without difficulty, and I find no difficulty whatever in preaching. You are at full liberty to use my name for the benefit of others.

Your very truly, E. B. FAIRFIELD, D.D., LL.D., Lincoln, Neb.

JUDGE J. COLLETT, of Lima, O., writes: "You well remember how terribly Catarrh had taken hold upon me, making me offensive to myself and to all around, and withal suffering day and night. I am cured; head free, air passages all open, and breathing natural. 'A thousand thanks to you for so sure a remedy, and so very cheap.'" (Write to him.)

MR. T. GILLESPIE, of Woodworth, Kenosha Co., Wis., writes: "I must say that I never had a medicine take hold of my Catarrh by the root, and *root* it out, as this has."

MR. THOMAS J. DAILY, of Homer, Champaign Co., Ill., one of the worst cases I ever had under treatment, who was six months bed fast, and nearly blind, one eye utterly destroyed by Catarrh, nose and face much defigured, and throat and lungs in a critical state, writes, June 21, 1878:

"DEAR MR. CHILDS: I have used your Catarrh treatment, that my brother, B. O. Daily, of your place, kindly sent me, now over three months, and almost all this time in hopelessness, as it seemed I must die. By-and-by it began to take effect, and I began to have hope. I improved rapidly, soon could sit up, passages of the head began to open, throat and bronchial tubes grew better, cough ceased, and now I can see to write. I now expect to get well and go about my business again. I owe you a great debt of gratitude. Indeed, I owe my life to your treatment,

"Very truly your friend, THOMAS J. DAILY."

Mr. D. is now (Sept. 10) in Troy, looking quite well; almost every vestige of Catarrh has disappeared.

The following names have been selected from thousands in my possession. If desired, any of them can be consulted by letter or otherwise:

W. L. Wilson, Troy, Pike Co., Ala.
Rev. W. L. Tillinghurst, Bloomer, Wis.
T. G. Gaunt, Greenville, Ala.
A. J. Cowles, Beloit, Rock Co., Wis.
Wm. H. Gaylor, Ft. Plain, Mont. Co., N. Y.
Mrs. O. W. Lake, McZena, Ashland Co., O.
Amanda Fisher, Freeport, Stephenson Co., Ill.
J. M. Lytle, Brady, Indiana Co., O.
Rev. J. L. Pettigrew, Raymond, Hinds Co., Miss.
Samuel T. G. Bigelow, 10 LaGrange St., Worcester, Mass.
Rev. P. W. Free, Waterford, Erie Co., Pa.
Rev. T. Gillespie, Woodworth, Wis.
Alonzo Bennett, Jackson Co., Mich.
Miss Flora Webber, Urbana, Champaign Co., Ill.
Rev. J. Lentz, Kanawha C. H., W. Va.
Rev. W. R. Lathrop, Hartsville, Ind.
Mrs. J. A. Humphrey, Franklin, Pa.
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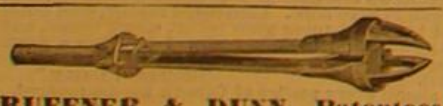

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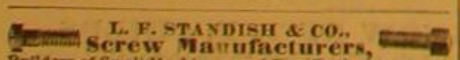

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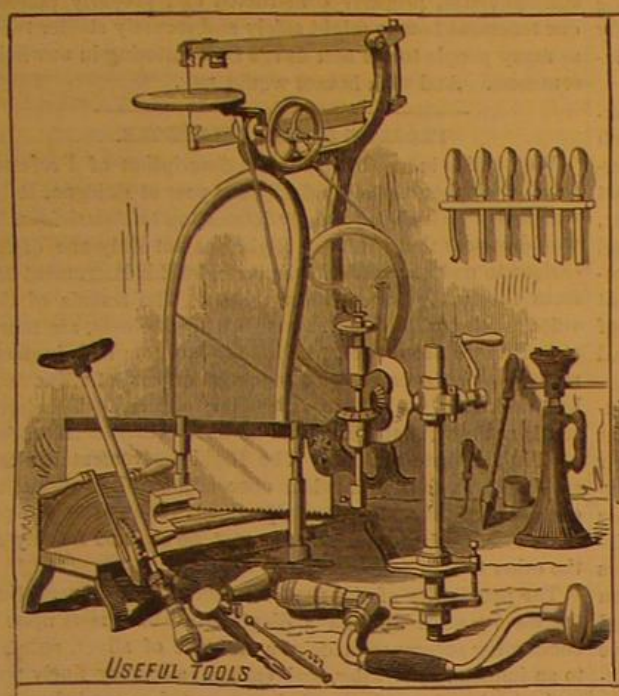

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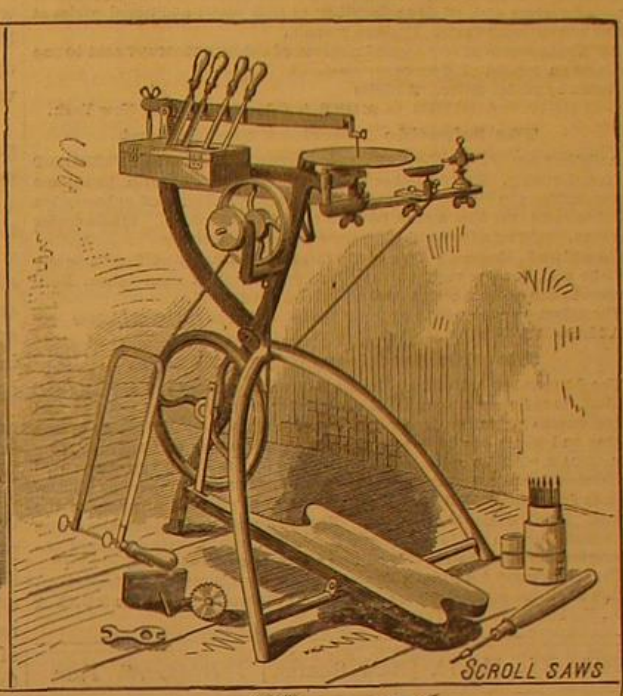

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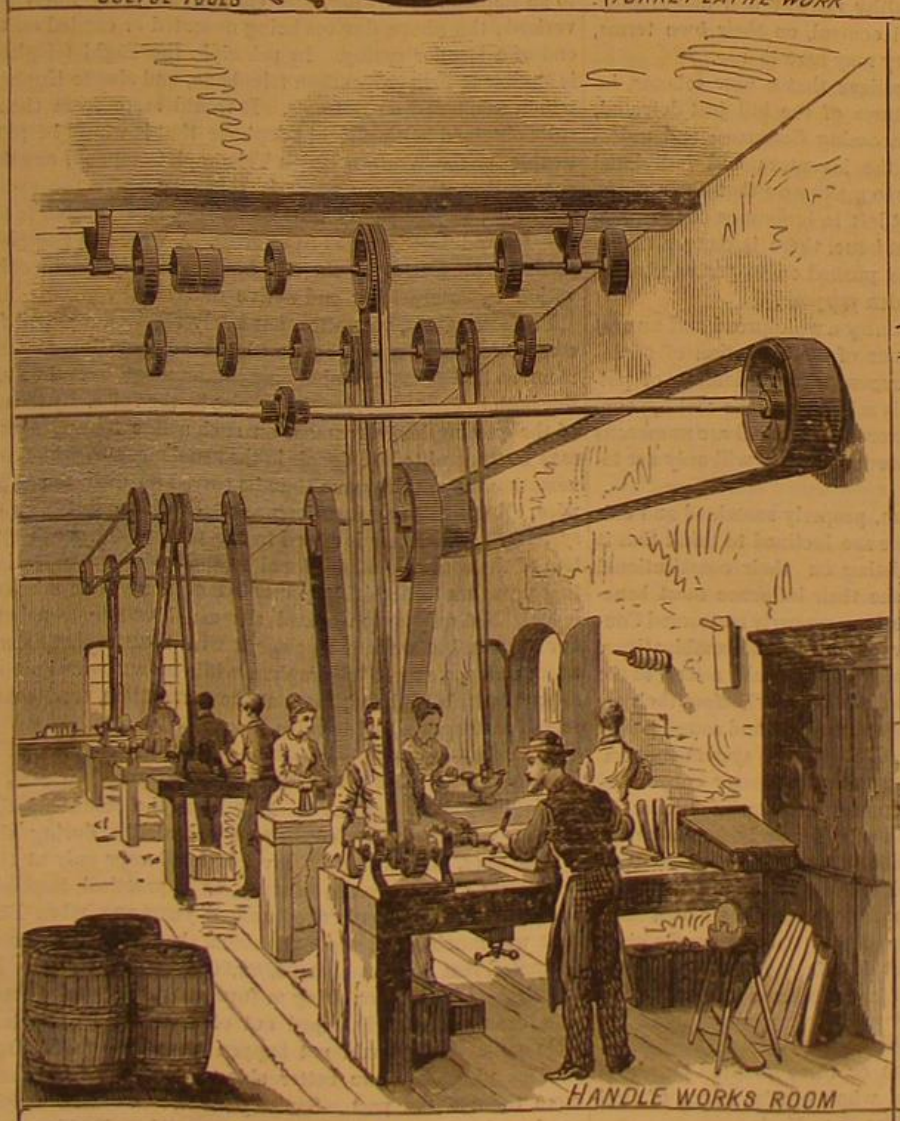

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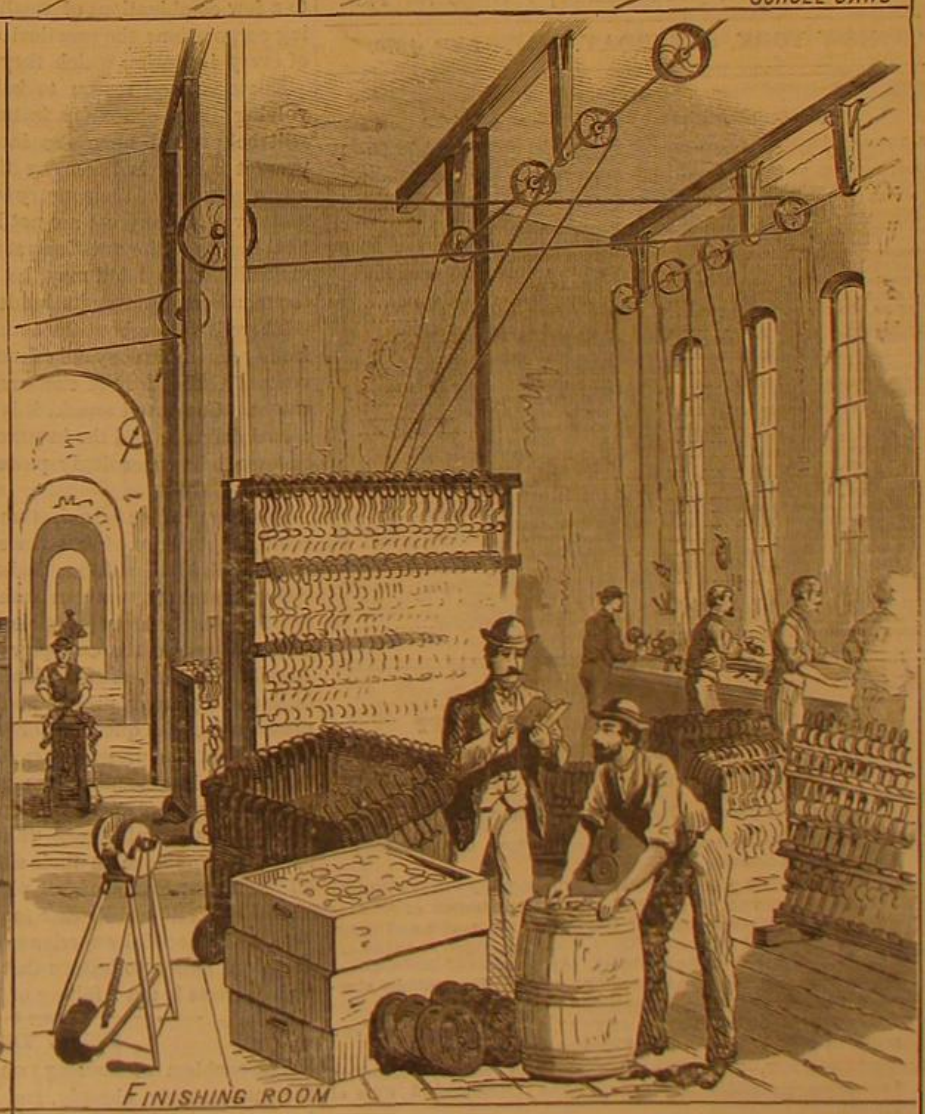

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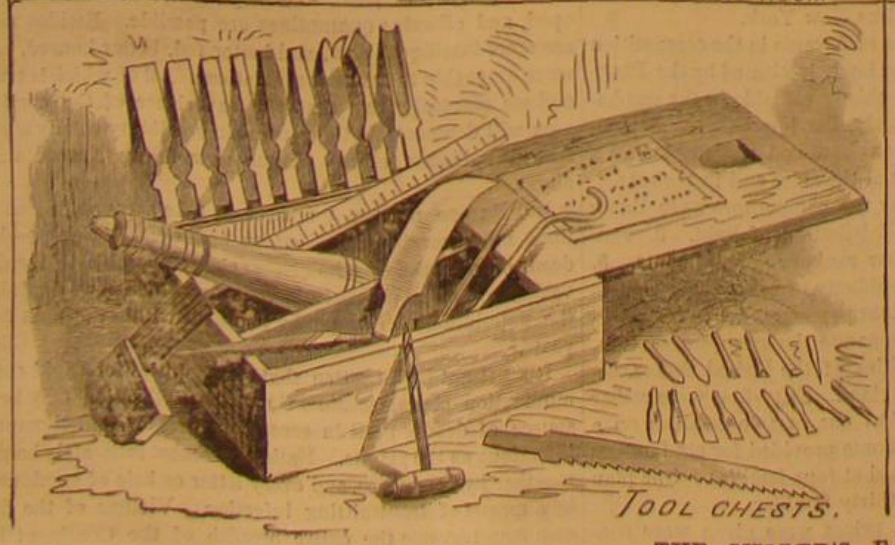

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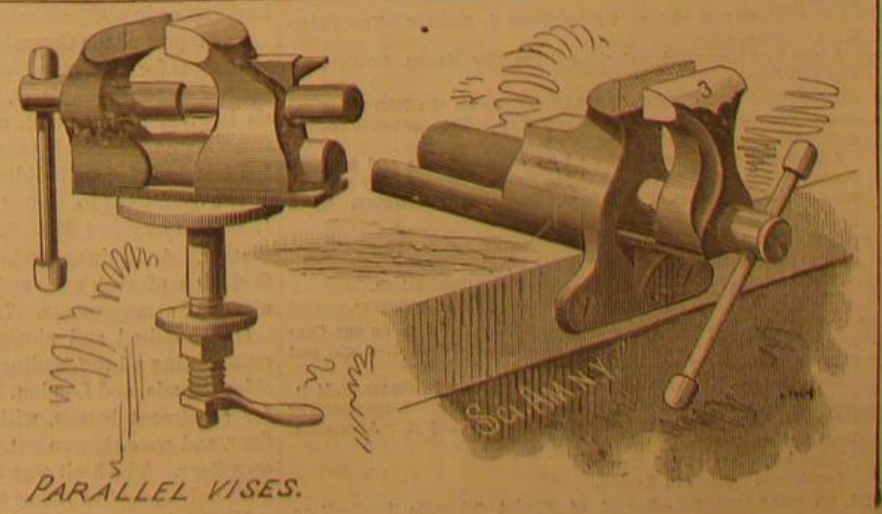

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 168,

For the Week ending March 22, 1879.

Price 10 cents. For sale by all newsdealers.

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III. ARCHITECTURE AND ORNAMENTAL ART.—Design for a Town Hall. By ROBERT W. GIBSON. Elevation and two plans.

IV. TECHNOLOGY.—The Henze-Ellenberger High Pressure Saccharifier, 1 engraving.—Cartridge Manufacture.—The Unconsidered Uses of Timber.

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A New Fast Green and Malachite Green. By Messrs. BINDSCHEDLER and BUSCH.

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THE PATENT BILL DEFEATED.

The bill which threatened so much injury to the patent system (Senate Bill 300) was brought before the House, March 1, and failed to pass.

The industrial interests of the country have happily escaped an imminent peril; for a measure which involved so serious an invasion of the rights of a valuable species of property, to the discouragement of the class of men upon whose efforts our varied industries are chiefly founded, must have reacted disastrously upon the prosperity of all classes.

Accordingly the thanks, not only of inventors and manufacturers, but of the entire community, are due to the members of Congress who voted against the obnoxious measure, and still more to the thoughtful citizens throughout the land, whose multitudinous protests against the passage of the bill convinced Congress that the people were emphatically opposed to the threatened invasion of the rights of inventors.

The advocates of the measure attribute its failure in Congress very largely to the storm of communications which poured in upon the members during the last days of the session; an admission which inventors, and all who hold that the law should favor the patentee rather than the infringer, will do well to bear in mind. The same honorable and effective weapon of defense against the sophistries of powerful corporations—who are determined to mould the patent system in their own interest and against the just rights of inventors and small manufacturers—will assuredly be needed again.

The victory is but a temporary one. Those who are conspiring against the integrity of the patent system are as persistent as they are powerful and unscrupulous. Their agents in Washington and elsewhere are very adroit in covering their aims. While volubly asserting that their sole purpose is the removal of certain evils attending the administration of the patent law, whereby a few innocent farmers and others are made to suffer the consequences of their own indiscretion, the real object is to secure the virtual reversal of the fundamental spirit of the patent system, so as to give to a few combinations of wealthy railway and manufacturing corporations the practical control, on their own terms, of every invention which they may care to use.

There is good reason to believe that a new scheme, involving all the obnoxious features of the bill just defeated, will be pressed upon the incoming Congress; and unless prompt action is taken by the inventors and individual manufacturers of the country to make sure that their representatives in Congress are not left in ignorance of the practical merits of the questions at issue, there is danger that a skillfully worded bill may be pushed on to passage before the members discover its hidden purpose.

There is throughout the country a widespread and earnest feeling among inventors in favor of the formation of an Inventors' Guild, for the encouragement and defense of patentees. Concerted attack, it is said, should be met by concerted defense; and the inventors of the land are numerous enough to be exceedingly powerful, if they will only act together.

Possibly such an organization, properly sustained and officered, might be useful; but we are inclined to think that it is as individual citizens, insisting on their constitutional rights, that inventors can make their influence most beneficially felt. It is not possible for a properly instructed Congress to become the cat's-paw of anti-patent combinations. And if the inventors of the land will personally attend to the business of placing plainly and persistently before their representatives the questions of fact, justice, and sound policy involved in the preservation of the patent system substantially as it is, amending it only to give greater encouragement to inventors and fewer opportunities to infringers, the selfish aims of infringers' unions will surely be thwarted. The inventors have on their side justice and the support of all intelligent lovers of fair play. They are sure to win if they do not allow their case to fail through their own inaction. The hopeful experience of the past few weeks gives abundant reason to believe that indifference to their rights and interests is not a failing of inventors as a class.

MODEL TENEMENTS.

The problem of housing two or three hundred people to the acre securely, cheaply, and wholesomely, is one of vital importance in a city situated like New York.

The report of the Committee of Awards in the competition of designs for tenement houses, lately instituted by the *Plumber and Sanitary Engineer*, is chiefly valuable in the emphasis it gives to one point, namely, the impossibility of constructing an acceptable tenement house on one city lot, 25 x 100 feet, inclosed by buildings at the sides and in the rear.

The conditions to be met by the competitors were these: 1. Security against fire. 2. Distribution of light. 3. Ventilation. 4. Drainage and other sanitary appointments. 5. Seclusion of each suite and publicity of access. 6. Convenience of arrangements. 7. Inexpensiveness.

One hundred and ninety separate designs were sent in, representing all the leading cities of the United States, besides Canada, and London, England. Fifty-four were rather for apartment houses, with but one or two families on a floor, and were thrown out. Some provided for six families on a floor. The limit was fixed at four families. One plan gave only sixty-five rooms to thirty families.

While the plans to which prizes were given were considered by the committee to be improvements on the existing tenement, not one of them was without serious objections; the decision of the committee being that it is impossible to secure the requirements of physical and moral health within the narrow limits of one city lot.

The matter should not be allowed to rest here. Not only should the building of tenement houses on a single lot be prohibited, but a new test should be made as to the possibility of erecting light, safe, and wholesome tenement houses on two or more lots. Obviously it is not the circumstance that two or three hundred people are trying to live on each acre of land that makes our crowded city wards so unwholesome, but the fact that they are living badly under unfavorable conditions. The Windsor Hotel will house luxuriously five hundred people on two thirds of an acre, and then have an average of but one person to a room. Built in blocks of sufficient size, properly constructed and properly policed, our tenement houses might safely and securely shelter twice as many people to the acre as are now festering in unwholesomeness. And such houses would pay.

PROGRESS OF THE TELEPHONE.

We publish in another column a description of Professor Righi's telephone, made and tried last year at Bologna, Italy, which will be found especially interesting to electricians. It would appear that Professor Righi was not only one of the earliest to make a practical telephone, but his instrument has from the first given superior results. The sounds of the voice are transmitted with marvelous distinctness, are heard at a distance from the receiving instrument; and, in fact, many persons, even large audiences, at one end of a line may hear addresses, etc., made at the opposite end. This in itself is not new, as the Edison and Bell instruments have been used in the same manner. The Righi instrument has the special advantage that when once adjusted it continues to operate perfectly without readjustment for an indefinite period; this, we believe, cannot as yet be claimed for any of the other telephones.

The peculiarity of the new instrument is in transmitting the wave sounds through a diaphragm which rests upon a conducting substance made of a mixture of silver, reduced to an impalpable powder, and carbon, also very finely pulverized; the above devices being mounted or carried on the end of a slender spring. In principle the Righi telephone is similar to Edison's carbon telephone, and also to Hughes', which was based on Edison's. It would seem from the results obtained by the Righi telephone that it would be practicable for the Western Union Telegraph Company, or other corporation, to open a room is this city where the visitor might go, and by payment of a small fee sit and listen to the debates and proceedings of Congress. A wide and unbroken field for other uses of the telephone evidently awaits cultivation by enterprising and active individuals.

Professor Gray, we notice, has lately received a patent for a combination of a telephone with the ordinary Morse instrument, so that the telegrapher may communicate over the same line both by the Morse signals and also by the voice. By the use of the quadruplex instrument on such a line four messages may be transmitted by signals in the usual manner, while conversation may at the same time be carred on over the same wire, all without any interference of the different signals or systems. Thus there is added to the present telegraph system of the country an additional method of communication that promises to be highly promotive of the public convenience. Not only may we send the usual written signals to our friends, but we may also speak with them over the same wire; and the expert telegrapher, while he writes one set of messages with his hand, may, at the same time, send other sets of messages with his voice.

THE MENACE TO EUROPE.

We have been taught to look upon the return of the plague which devastated Europe repeatedly during the middle ages, and ceased its ravages in Europe only at the beginning of the present century, as a practical impossibility. In one epidemic five hundred years ago, when Europe was much less densely populated than now, it has been estimated that not less than 25,000,000 people perished. It was, indeed, a common thing in former ages for entire communities to be utterly wiped out of existence by this terrible pest. That could not happen now, it is said. Our modern physicians are better able to combat disease than were those of the past. Sanitary science has been developed, and effective quarantines are possible. Besides men are more intelligent now, and better fed, better housed, and more amenable to sanitary regulations. All of which is true; and we sincerely trust that the experience of the coming year will demonstrate the present impossibility of any widespread epidemic of the plague now filling Europe with alarm.

But Europe must not neglect to take account of conditions now prevailing in Western and Central Europe—indeed, all over the Continent—specially favorable to the development of an irresistible scourge, which may diminish the population of Europe by one-half within the next five years.

It must not be forgotten that the facilities for rapid communication characteristic of modern civilization may be a source of deadly peril in case of a disease so malignantly infectious as the plague. Nations are most intimately bound together by commerce, and every letter or bale of goods may be a means of transmitting infection. Victims of the disease may traverse the entire breadth of the Continent between the time of exposure and the full development of the

disease. With every extension of the area of the plague the possibility of staying its advance by quarantine regulations becomes less, and after it passes a certain limit, pestilence, like fire, is uncontrollable. The supply of physicians and medicines at any time is adequate only for ordinary conditions; let the usual bounds of disease be much overpassed and resistance is hopeless. Such a state of things is by no means impossible in Europe to-day.

Consider the situation of affairs in Eastern Europe. Turkey is a chaos, and the military power which keeps a semblance of order there would soon break down with the plague in its camps. The local governments have neither the power nor the intelligence required to successfully combat an epidemic. The spread of the plague is little hindered by climatic conditions. Russia seems to be unable to stay its progress. The Russian people are already upon the brink of desperation and revolt through poverty and military oppression. Let the controlling arm of the government, the army, be paralyzed, as it is liable to be by the plague, and Russia will present scenes of disorder and death appalling to think of. On such food the plague fattens. The government would be blamed for every disaster, and mobs crazed by fear and revenge and hunger and blood would do their fatal work in every city. All who could command means of flight would fly, and carry the infection into adjoining lands in spite of the strictest sanitary regulations. Germany is almost ripe for revolution. Add to existing hard times and financial disorders the business derangements which precautions against contagion must entail, and a general lack of food and remunerative labor would necessarily ensue. Under such conditions, socialistic outbreaks would be inevitable. The experience of Russia would be repeated, and the steady advance of the plague over Western Europe would certainly follow. Once under way, the wave of death would sweep over Europe as surely and as destructively as it did in the fourteenth century.

Do we, therefore, predict a repetition of those terrible times? By no means. We have only shown that they are possible; that Europe presents conditions which, with plague upon its border, must be considered, to say the least, as decidedly menacing to the entire Continent, if not to the entire civilized world. If reports are true, and the plague is steadily approaching the heart of Russia, the promptest, most rigorous, and most thoroughgoing measures to stay its advance are imperatively needed. Indifference and inaction now will entail the most fearful consequences.

HOW THE PATENT BILL DIED.

The final action of the House of Representatives, in relation to the proposed amendment of the Patent Law, is reported in the *Congressional Record* for March 2, as follows:

"*Mr. Vance*—I am directed by the Committee on Patents to move to suspend the rules and pass the bill (S. No. 300) to amend the statutes in relation to patents and for other purposes, as amended by the House Committee on Patents."

[The bill as proposed to be amended was then read; the only notable change in the bill as printed January 24, appearing in section 12, the supplementary fees having been reduced by the House Committee from $50, at the end of four years, and $100, at the expiration of nine years, to $20 and $50, respectively.]

"*Mr. Garfield*—Is it proposed to pass the whole of this bill without the House having any opportunity to debate and consider it?

"*The Speaker*—The motion is to suspend the rules and pass the bill.

"*Mr. White, of Pennsylvania*—Does the bill not change our whole patent system?

"*The Speaker*—That is not a parliamentary question.

"*Mr. Rice, of Ohio*—I desire to ask whether this is the report of the Committee on Patents, and whether the bill as it has been read has the sanction of the committee.

"*Mr. Vance*—It has.

"*The Speaker*—The Chair is only recognizing gentlemen who have the authority of their committees to move to suspend the rules.

"*Mr. Keifer*—Will the gentleman from North Carolina not allow me to offer a single amendment to provide that the bill shall not be applicable to pending causes of action?

"*Mr. Vance*—I have not that authority.

"The question being taken on the motion to suspend the rules and pass the bill, there were—ayes, 67; noes, 79.

"*Mr. Vance*—I call for the yeas and nays.

"The question being taken on ordering the yeas and nays, there were ayes 26; not a sufficient number.

"*Mr. Townshend, of Illinois*—I call for tellers on the yeas and nays.

"Tellers were not ordered, only twenty-six members voting therefor.

"So the yeas and nays were not ordered, and two-thirds not voting in favor thereof, the rules were not suspended."

MR. ROBERT G. HATFIELD.

The architectural profession has lost one of its best known and most esteemed members in the death of Mr. R. G. Hatfield, of this city.

For many years Mr. Hatfield had been a prominent officer of the American Institute of Architecture, of which he was one of the founders, and also member of the American Society of Civil Engineers. His professional writings were numerous, "The American House Carpenter," published some thirty years ago, being among the earliest. A later and more important work on "The Theory of Transverse Strains, and its Application in the Construction of Buildings," enjoys the highest professional favor. His contributions to the SCIENTIFIC AMERICAN and other periodicals were many and valuable, his last, a very ingenious discussion of the origin and nature of the ancient structure known as the Old Mill at Newport, R. I., appearing in *Scribner's Monthly* on the day of his death.

As a constructor Mr. Hatfield was noted for superior knowledge and ability, and was much consulted by his professional brethren in difficult undertakings. The splendid arched iron roof of the Grand Central Railway Depot in this city is regarded not only as a model structure, but as a fine illustration of Mr. Hatfield's boldness and skill as a designer. Personally, Mr. Hatfield was greatly and justly esteemed by a wide circle of friends and acquaintances. His last public service was as Chairman of the Committee of Award in the competition of designs for model houses for workingmen, noticed in another column.

Gary's Alleged Neutral Line.

To the Editor of the Scientific American:

In an article upon "Gary's Motor," page 144, issue of March 8, the "behavior of the nail" is explained by its tendency to fly to the magnet upon approaching the same, but that in leaving the piece of sheet iron, the force of gravitation acts more strongly than the force of magnetic attraction, and the nail consequently falls to the ground. Having, by invitation, witnessed the nail experiment at Mr. Gary's room, I do not think the above theory is correct; inasmuch as the nail, when suspended from the sheet iron armature and at the distance of a few inches from the magnet, shows but little movement during the approach of the armature to the magnet; certainly not sufficient to cause its dislodgement by the force of gravitation. My own explanation, given to the exhibitor at the time of witnessing the experiment, is that the sheet iron armature, being polarized by the magnet, in turn polarizes the nail which is suspended from it, and that this polarity (of the nail) is necessarily reversed when brought within the direct control of the magnet, or sufficiently near thereto to be more powerfully affected by it than by the sheet iron (the power of which to increase its ability to control the nail, as they both approach the magnet, depends upon its thickness and area.)

Now, as the nail cannot have its polarity reversed and remain suspended from the sheet iron (by which it was originally polarized) throughout the process, by attraction, then, at the point of neutralization, the nail drops, without, of course, any change in polarity of the sheet iron armature, or the existence of any so-called "neutral line."

Boston, Mass., March 3, 1879. G. F. MILLIKEN.

AMERICAN INDUSTRIES.—No. 9.

SMALL TOOLS.

The industry under consideration is peculiarly American. It is representative of a class of establishments that have given our manufacturers a world-wide reputation for goods that are both cheap and reliable. This success is mainly due to the system of manufacture inaugurated here some years since, and which seems to thrive better in this country than anywhere else. But for the special machines, the system of inspection, and assembling we should still have the old-fashioned tools, with the defects consequent upon fitting one piece to another, and the prices would be far higher than the more perfect machine-made article now demands.

The Miller's Falls Company, of Miller's Falls, Mass., manufacture a great variety of useful tools, most of them being of the smaller sort, such as are of the most general utility. A few of these, shown in the title page engraving, will be recognized by most of our readers as familiar objects. Among these are breast drills, bench drills, Barber's bit brace, the ratchet brace, parallel vises, the miter box, the screw jack, all of which are so well known as to need no special description. The saw in the background of the left hand view is known as the Rogers scroll saw. It is a marvel of cheapness; the frame, of elegant design, is entirely of iron; the shaft, treadle motion, and drive wheel are well fitted, and the whole affair, while it is substantial and really good, is sold for $3. We mention the price as this machine exemplifies in a remarkable manner what has already been stated. In the upper right hand corner of the engraving is shown a Lester scroll saw, which combines a saw and a lathe; a hand scroll saw and a small drill are shown on the floor.

The two views in the lower part of the engraving represent two forms of parallel vise made by this company, also the well known tool chests which are used by both young and old.

The works of the Miller's Falls Company contain the most modern machinery for doing work rapidly and accurately. The middle view at the top of the engraving shows a turret lathe, one of the most useful tools for this kind of work.

The special use of the one shown is to make small universal chucks, such as are used with small lathes, hand drills, bit braces, etc. In five minutes from the time a bar of iron is put through the hollow mandrel of this lathe it is turned, drilled, tapped, chamfered, turned to the required form, and cut off.

Of the larger views, the right hand one represents the machinery for making various styles of tool handles; the left hand view represents the department in which the different kinds of tools are finished.

The main building of the works is divided into six compartments, separated from each other by heavy brick walls and iron doors, as a protection against the spread of fire. The works are complete in themselves, consisting of iron and brass foundries, blacksmith shops, a tempering shop, pattern, wood turning, machine, grinding, and polishing shops; inspection and stock rooms.

The machinery is driven by turbines having a total of 300 horse power. As an evidence of the success of this establishment it may be mentioned that great numbers of their tools are shipped to England, many of which go to Sheffield, which was once the very tool center of Europe.

The New York warerooms of the Miller's Falls Company are located at 74 Chambers street.

A GLASS MOUNTAIN AND ROAD.

Mr. P. W. Norris, the Superintendent of the Yellowstone National Park, on a recent visit to the capital gave a lecture on some of the natural curiosities of the region over which he presides and is engaged in exploring. Among these may be mentioned as the most novel a mountain of obsidian or volcanic glass, and a road made from this material.

Near the foot of Beaver Lake the explorers discovered this mountain of glass, which there rises in basalt-like columns and countless huge masses many hundreds of feet high from a hissing hot spring forming the margin of the lake, thus forming a barrier where it was very desirable that a wagon road should be, as the glass barricade sloped for some 300 feet high at an angle of 45° to the lake, and its glistening surface was therefore impassable, there being neither Indian nor game track over it. To make the road, huge fires were made against the glass to thoroughly heat and expand it, and then by dashing cold water from the lake against the heated glass suddenly cool the latter, causing large fragments to break from the mass, which were afterward broken up by sledges and picks, but not without severe lacerations of the hands and faces of the party, into smaller fragments, with which a wagon road one quarter of a mile long was constructed, about midway along the slope, thus making, it is believed, the only road of native glass upon the continent.

On reaching the Grand Cañon of the Gibbon river the explorers found the eastern palisade, for about two miles in length, to consist of vertical pillars, hundreds of feet high, of glistening black, yellow, mottled, or banded obsidian or volcanic glass.

This obsidian has been and is still used by the Indians for making arrow heads and other weapons and tools, and the mountain has formed a vast quarry for the making of such instruments or weapons of a quality and quantity unequaled elsewhere.

The lecturer gave a graphic description of "Old Faithful," and other geysers of Firehole Basin, and of the Liberty Cap and other geyser cones, resembling in their grotesque forms the monuments of an extinct race. He also exhibited a number of specimens of minerals found in the park, including chalcedony, amethysts, opals, petrified wood, lava, etc.

A SURPRISE TO MILLERS.

A decided sensation was caused in the United States Circuit Court at St. Louis, Mo., February 25th, during the trial of the great Middlings Purifier case. The American Consolidated Middlings Purifier Company had sued several St. Louis millers for infringement of patent and for damages, which, at the rate of three cents a barrel of flour, will amount to several millions of dollars. On the day named Mr. Rodney Mason, of Washington, leading counsel for the complainants, dismissed the suit against ex-Governor T. O. Stanard, Vice-President of the Millers' National Association, and T. B. M. Kehlor, of the Missouri State Association. The announcement carried dismay into the camp of the defendants, who had looked upon both men as among the staunchest of those engaged in the defense of the case. Ex-Governor Stanard was sued for $150,000, and he compromised by paying $900; Mr. Kehlor made an equally favorable arrangement.

The compromise was effected, it is said, against a written pledge of the two men with the other large millers of St. Louis to resist the complainants' claims. They have been thus associated for four years, and the combined defendants have spent over $100,000 in legal expenses.

SAFETY AT SEA.

At a special meeting of the American Geographical Society, February 27, Lieutenant J. B. M. Mason, of the United States Navy, gave an uncommonly instructive address on the means which inventors have devised, but which ship owners never furnish, for preventing loss of life in case of accident at sea. The address was abundantly illustrated with stereopticon views and life-saving apparatus. Very few, probably, of the large audience, were before aware of the existence of so many approved devices for preventing accident at sea, or for rescuing the victims of shipwreck; and very many of those who had been at sea must have felt the force of the Lieutenant's sarcastic description of the average traveler's anxiety for comfort and indifference with regard to the provisions made or neglected for securing safety. It is because of this happy-go-lucky spirit of travelers that it is possible to say, as Lieutenant Mason did, that there is not a single vessel sailing or steaming from this port or any other that is properly provided with life-saving apparatus.

Lieutenant Mason paid a handsome tribute to our Life Saving Stations as a useful and humane provision for saving life from wrecks on our coast.

NEW VERTICAL FRENCH BURR MILLS.

We give herewith perspective and sectional views of a new vertical French burr mill, which is manufactured by Mr. C. K. Bullock, of 1357, 1359, and 1361 Bridge avenue, Philadelphia, Pa. This mill is adapted to all kinds of grinding, from ordinary feed to the heavy work of reducing gold quartz. It is particularly adapted to regrinding middlings and bran; and the manufacturers state that there is no work done by burrstones that this mill will not do satisfactorily.

In the engraving Fig. 1 is a vertical section of the mill; Fig. 2 is a transverse vertical section; Fig. 3 is a face view of one of the millstones; Fig. 4 is an exterior side view of one of the stones, and Fig. 5 is an enlarged view of part of the mill spindle.

The cylindrical casing, A, is made in two parts, the interior being separated by a partition, *e e'*, into the feed compartment, B, communicating with the hopper, B', and the grinding compartment, D, devoted to the millstones, and having an outlet, D'. The horizontal mill spindle, E, has bearings, *d d'*, at opposite ends of the casing; one end of the spindle is furnished with a pulley, *f*, and an adjusting screw, *h*, bears against the opposite end. The screw is provided with a jam nut, which prevents it from becoming loosened accidentally. G and G' are the two millstones. The millstone, G', is secured to a flanged disk, H', the central hub, *i*, of which is fast on the spindle, E. As the millstone is vertical and revolves at a high rate of speed, it must be properly balanced in order to prevent the violent shaking of the mill. For this purpose there are in the flange, J, of the disk, H', a number of holes at equal distances apart throughout its circumference, each hole being threaded for the reception of the stem of a set screw, *k*. Should the stone be out of balance in the first instance, one or more of these set screws may be entirely removed at the proper points in the circumference of the disk, or lighter or heavier screws may be attached to the flange, until the stone is balanced.

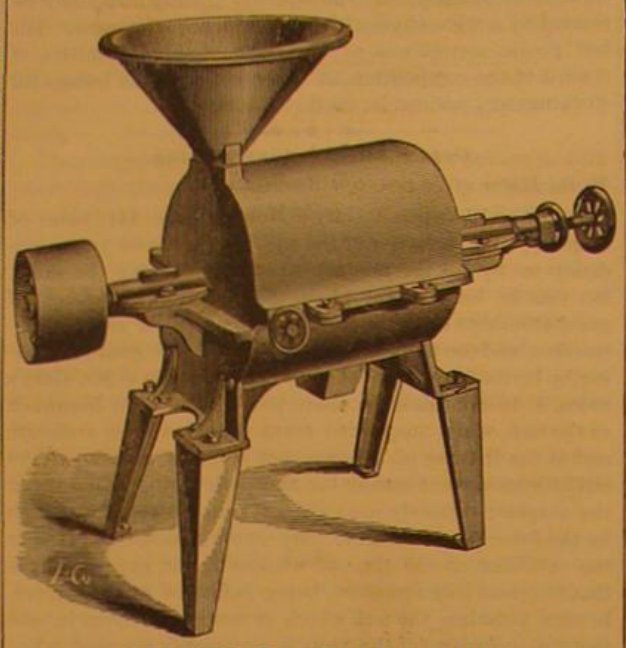
The fixed millstone, G, is secured to a flanged disk, H, having a central opening forming a continuation of the eye of the stone. The disk, H, is secured to the end of the casing at three points—at one point to the enlarged portion, a^2, by a bolt, *n*, and at the other points by similar bolts, n^1 and n^2, to the upper ends of bars, K K, which are bolted at their lower ends to the inner face of the casing. Rubber cushions, *p*, are placed between the disk, H, and the casing, so that the stone, G, can be readily adjusted so that its grinding face will coincide with that of the stone, G'. Between the flanged disk, H, and the partition, *e*, there is a rubber ring, S, adapted to a recess in the outer face of the disk.

This ring prevents the grain from passing into the compartment, D. The only communication between the feeding compartment and the grinding compartment of the mill is through a circular opening in the partition exactly opposite the eye of the stone. A portion of the spindle (shown on an enlarged scale in Fig. 5) has a number of projections, N N, of triangular form, one edge of each projection being in a plane at right angles to the shaft, and the other two edges being inclined. This portion of the shaft, with its triangular projections, is contained partly within the feed compartment, B, partly within the opening in the partition, *e*, and partly in the eye of the stone. The feeding is effected by the triangular projections when the spindle is turned in either direction. This seems to be an important feature of this mill, as it enables the user to drive it in whichever direction may be most convenient.

The amount of grain fed to the eye of the stone will depend upon the position of the two adjustable gates, P P'. These gates are made to fit to the spindle between the triangular projections. When closed the gates will entirely cover the opening in the partition, *e*. One or both gates can be partially or wholly opened, as required. In the present instance the gates are adjusted by screws. In mills having stones the grinding faces of which are vertical, the flour is apt to pass from the stones having the ordinary dress in an unfinished condition. To avoid this the inventor has adopted the dress shown in Fig. 3, the depressed portions of the face of the stone being shaded and the land portion unshaded. The radial portion, W, concentrate at the center of the stone, and do not extend out through the edge. Hence they form pockets, from which the partially ground grain cannot escape without crossing the land before reaching the triangular depressions.

Steamboat Inspection.

At a recent meeting in Washington, the Board of Supervising Inspectors of steam vessels amended rules 4, 14, 29, 40, 76, and 78 of General Rules and Regulations of 1877. It was also ordered that at their annual inspections of steam boilers the local inspectors shall remove from the surface of such boilers as are covered so much of the covering as may be necessary to enable them to examine parts of the boilers which cannot be properly examined from the inside. There is added to Rule 4, a method of testing boiler iron, which boiler makers will find important. Samples of iron may be tested on any reliable testing machine. Rule 14 provides that "All life rafts and floats composed of hollow cylinders, and approved by the Board of Supervising Inspectors, must be rated in their carrying capacity according to the cubical dimensions of such cylinders, in the ratio of one person to every three (3) cubic feet for ocean steamers, and two (2) cubic feet for lake, bay, sound, and river steamers. Such life rafts and floats must be suitably equipped with life lines and oars."



VERTICAL FRENCH BURR MILL.

The transportation of petroleum, especially on passenger vessels, is permitted only under stringent regulation. The use of steamers for excursions is also made subject to careful regulation, particularly with regard to ample provision of life saving apparatus.

RECENT AMERICAN PATENTS.

A simple and ingenious permutation padlock, which consists of a body, or case, a sliding hook having pins which are engaged by slotted disks, and a series of index disks connected with the slotted disks, is the invention of Mr. Mortimer B. Mills, of De Witt, Iowa.

An improved apparatus for casting metals in vacuo has been patented by Mr. H. W. Barnum, of Omaha, Neb. The mould is contained in a vacuum chamber, and the metal, in its passage to the mould in the chamber, is spread out upon a fan-shaped spout, allowing the injurious gases to escape from the metal before it reaches the mould.

Mr. Albert H. Hogins, of Morrisania, N. Y., has invented an improved ironing table, whose top has a movable wedge shaped section, which may be used as an ironing board for special purposes.

A simple and effective support for weak ankles has been patented by Mr. J. G. Pugsley, of Brooklyn, E. D., N. Y. It is intended to be worn with a shoe or boot, and is made of leather, felt, or cloth, the material being chosen to suit individual cases.

A shoe brush having a hollow back and tubular handle for containing liquid shoe blacking, and provided with a valve for letting out the blacking as the spreading brush is applied to the foot, is the invention of Mr. J. A. Stahle, of Crestline, O.

An improved beer faucet, which is constructed so that the operation of a single handle or lever will cause the escape of beer and the admission of air simultaneously, has been patented by R. W. Tavener, of West Bay City, Michigan. The faucet may also be used independently as a beer drawing or air forcing pump or as an air vent.

An improved telescope drinking cup having a stand which gives it the appearance of a goblet when in use, is the invention of Mr. G. H. Hazelton, of Birmingham, Conn. The stand, when not in use, is contained by the cup.

An improved pump having a heavy plunger fitted to a barrel, having at the top a large funnel for receiving water and at the bottom a single valve, has been patented by Mr. Rocco Misso, of Macon, Miss.

A wedge provided with a spring pawl, to be used in connection with one or more wedges having ratchet teeth, has been patented by Mr. L. F. Johnston, of Pocahontas, Ark. It is designed for splitting logs; the ratchet arrangement obviates bouncing or the slipping out of the wedge.

An improved ventilating flue cap, invented by Mr. John D. McLinden, of New York city has a rotary shield or cap which moves with great freedom and is not liable to become choked by the accumulation of soot around the spindle, the latter being incased by a tube.

Mr. M. J. Hughes, of Jersey City, N. J., has invented an improved apparatus for casting stereotypes, which simplifies and facilitates the operation of casting and preparing for the press. The invention consists in an arrangement of adjustable bars and slotted section pieces which cannot be clearly explained without an engraving.

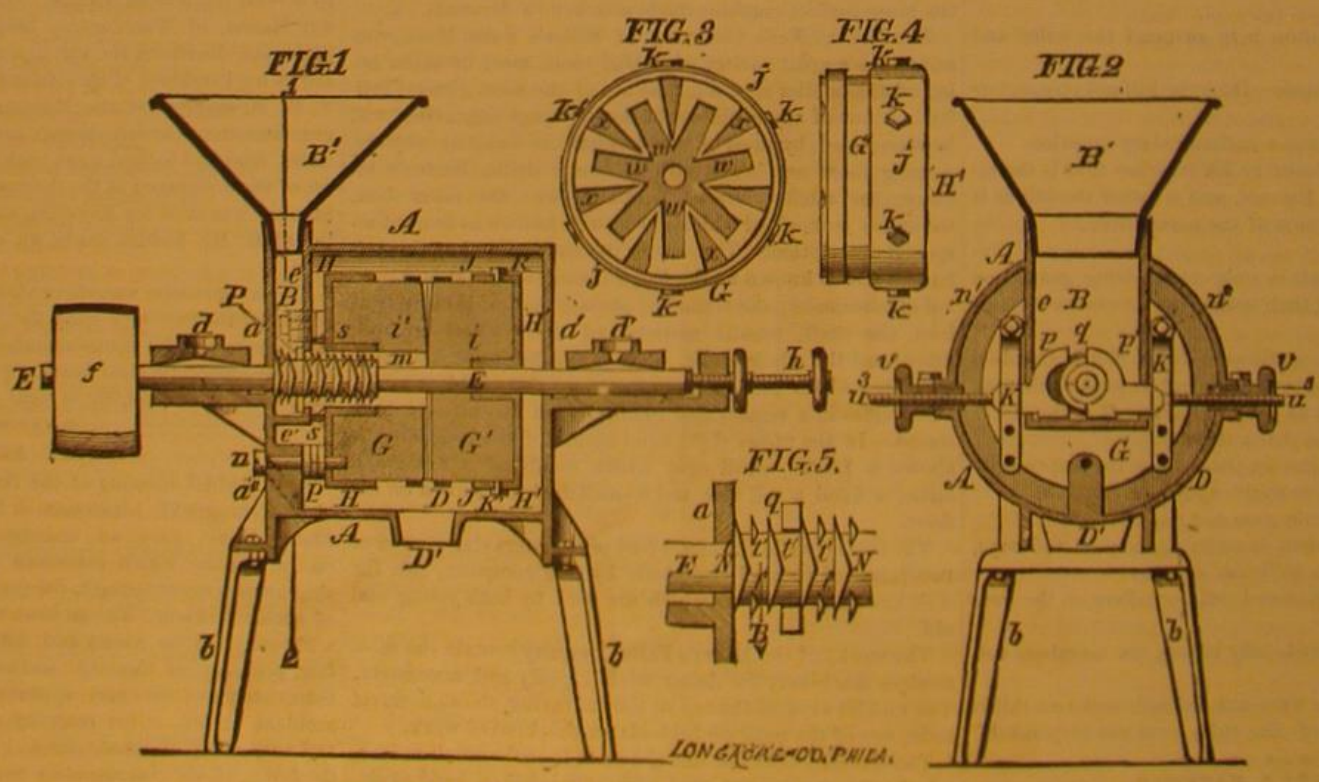
Red and White Wine.

Physicians and others, in discussing the qualities of wine, and the effect of different kinds and vintages on the human system, have arrived at the conclusion that red wine is less injurious to the health then white wine. The subject has been revived latterly in the *Spectator*, and the following reason has been given for the difference in effect. Red wines are rich in tannin; white wines are not: the natural inference being that the astringent principle present forms a counteraction to the stimulating influence of the alcohol contained.

The Steam Engine versus the Horse.

A man may now obtain a mechanical motor, exerting the power of a horse for the price of a horse. If he be able to employ 100 horses, he can obtain 100 horse power in steam engines at a much lower price than he would pay for 100 horses. And the animals will only last a few years, eight or ten at the outside. They must be regularly fed, work or no work; they must rest for at least sixteen hours out of the twenty-four.

Take what pains we will, we cannot obtain a horse power from a horse at much less than 4*d.* an hour, taking into account the cost for twenty-four hours, and the work done in eight hours, or fewer. For the mechanical horse power, on the contrary, which becomes cheaper the larger the quantity in which it is employed, a cost of a penny per working hour is the outside for a small engine. For a large one a halfpenny or less per hour per horse power will cover all expense. And then the steam horse never tires. Instead of one rider being able to tire out three horses or more in a day, one steam horse will work steadily on so as to employ the successive care of three drivers in the twenty-four hours, if each work for only eight hours. And the steam horse eats only in exact proportion to the work he does. He costs, as matter of interest of money and depreciation, less than half the cost of the animal, per annum or per week. And as to provender, he consumes only the exact quantity which he converts into work. For all exertion of power in a continuous groove, then, the productive energy which is added to the resources of a nation by the discovery and application of the mechanical theory of heat is practically illimitable.—*The Builder.*



SECTIONAL VIEWS OF VERTICAL BURR MILLS.

NEW TESTING MACHINE.

The testing machine shown in the accompanying illustration was built for the Pennsylvania Railroad Company. It is said to be one of the most complete and accurate machines yet produced at the Philadelphia Scale and Testing Machine Works, Riehlé Brothers proprietors. Although not of so great a capacity as a 300,000 lb. chain tester recently built at the same works, it contains a greater number of new and peculiar features, it being arranged for tensile crushing and transverse strain or pressure. The range of the machine is great; the crushing and tensile powers can accommodate specimens from four feet in length down to an inch or two, while the transverse power can be applied to bars from one to five feet in length. On the table, which is five feet in length, there are movable supports, that can be adjusted to any position to suit the specimen. A girder or beam of any length may be tested by bringing to bear against it a beam or girder of superior strength, the pressure on the center being indicated on the weigh beam. The machine is compact, powerful and well designed. The hydraulic cylinder in the center of the bottom frame, is encompassed by the leverage which supports the iron table or platform. The heavy base, which consists of a single casting, contains the steel bearings which support the levers, and in it is formed the reservoir which supplies the hydraulic pumps. The machine is thus self-contained, requiring no special foundation. The pump has three plungers, and consequently throws a steady stream. The stroke of these plungers or pistons can be lengthened or shortened, without stopping the motion, by turning the hand wheel seen at the rear end of the machine. This arrangement readily reduces or increases the flow of oil. When a long and ductile piece of iron is being tested the fast feed may be employed, and when about finishing the test, the stroke may be shortened. The manufacturers state that delicate tests of brittle substances can be made, as the minutest quantity of oil can be thrown into the hydraulic cylinder, and the supply of oil may be cut off or turned on instantaneously, while pumping still continues.

The upright hand lever, seen to the right, governs the rise and fall of the plunger, acting like the reversing lever of a locomotive. In case the operator should, through carelessness or neglect, allow the machine to act continuously, no injury can occur to the machine, as a safety valve opens automatically, and allows the oil to flow back into the reservoir. As it is sometimes desirable for the strain to remain upon the specimen for hours or days the manufacturers have provided a device which clamps the plunger, maintaining the strain at the required point. This is not a necessary portion of the machine, but it is a useful adjunct. The whole capacity of the machine, 50 tons, is marked upon the beam. The gripping tools are made for headed specimens, the well known clam shell pattern being used. Wedge grips are also provided for flat, round, or square specimens, the change from one to the other being readily made. The Pennsylvania Railroad Company, in their binding specifications, required extreme accuracy. It was required that in every case the registries of the loads on the scale beam must be within one two-thousandths of the actual load transmitted to the machine. This variation was allowed in consideration of the tremendous shocks to which the machine was subjected during the contract test from the breaking of the steel specimens, which was calculated to displace the parts; but it remained intact, and registered the pressure correctly.

These tests, together with others, were made at the works of Riehlé Brothers, and occupied the greater part of three days, at the end of which time the machine was approved. This apparatus was designed by T. Olsen, M. E., superintendent of Messrs. Riehlé Brothers' works, and patented February 11, 1879.

The dimensions of this machine are as follows: Height, 10 feet; width, 3 feet; length, 7 feet; weight, 6,800 lbs.

Gloomy Thoughts and Gloomy Weather.

Dull, depressing, dingy days produce dispiriting reflections and gloomy thoughts, and small wonder when we remember that the mind is not only a motive, but a receptive, organ and that all the impressions it receives from without reach it through the media of senses which are directly dependent on the conditions of light and atmosphere for their action, and therefore immediately influenced by the surrounding conditions. It is a common sense inference that if the impressions from without reach the mind through imperfectly acting organs of sense, and those impressions are in themselves set in a minor æsthetic key of color, sound, and general qualities, the mind must be what is called "moody." It is not the habit of even sensible people to make sufficient allowance for this *rationale* of dullness and subjective weakness Some persons are more dependent on external circumstances and conditions for their energy—or the stimulus that converts potential into kinetic force—than others; but all feel the influence of the world without, and to this influence the sick and the weak are especially responsive. Hence the varying temperaments of minds changing with the weather, the outlook, and the wind.—*Lancet.*

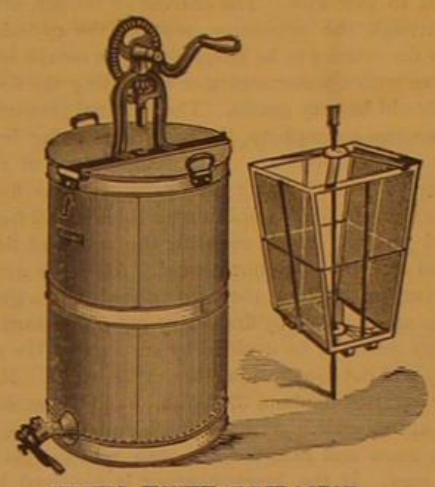
A NEW HONEY EXTRACTOR.

The advantages afforded by the judicious use of the honey extractor are acknowledged by every bee-keeper. The invention of the movable comb frames by Mr. L. L. Langstroth, and that of the honey extractor by Major V. Hruschka, are perhaps the greatest among all improvements pertaining to the apiary, having done more to systematize bee culture and multiply the product than all other inventions combined.

UNCAPPING KNIFE.

The accompanying engravings represent a new honey extractor recently patented by Mr. Charles F. Muth, of 976 and 978 Central avenue, Cincinnati, Ohio.

The construction of this machine will be readily understood by referring to the engravings. The comb basket, which consists of wire cloth fastened to a frame having slanting sides, is supported by a vertical shaft which is journaled in a substantial tin can. On the cover of the can are mounted a bevel wheel and pinion, by which a rapid rotary motion is imparted to the comb basket. The separation of the honey from its comb is effected by centrifugal action. As the honey tends to separate from the comb by its own gravity the advantage of inclining the sides of the comb basket will be apparent.



MUTH'S HONEY EXTRACTOR.

The can is intended to hold 60 lbs. or more of honey below the comb basket, and the baskets can be made to suit the size of the comb frames in any particular case. The top of the can is tightly fitted to exclude dust and insects.

It is stated that this machine will extract the honey from the comb very rapidly and effectually. In the smaller figure is shown a thin-bladed knife for uncapping the honeycomb previous to placing it in the basket of the extractor.

Further information in regard to this useful invention may be obtained from the inventor, whose address is given above.

Treatment of Delirium Tremens.

Dr. G. W. Balfour, in a clinical lecture on the treatment of delirium tremens, printed in the *Lancet*, calls attention to an opinion very widespread, not only among the public but even among the profession, that delirium tremens does not arise from drinking, but from ceasing to drink. This idea he pronounces fallacious in the extreme. We are often told that so long as the patient is kept drinking, so long will he keep from an attack of delirium, while the very reverse is the case. So long as he keeps drinking he usually keeps from a bad attack, because a serious attack, as a rule, is associated with a loathing of drink; but he always keeps coming nearer to it, and the sooner his drinking bout can be arrested the less risk he runs of having an attack at all. So long as the patient is permitted to obtain drink, just so long will his case prove intractable to treatment; while when the treatment is continued, minus the drink, the cure is rapidly obtained. Dr. Balfour concludes that the administration of alcohol in any form during the course of delirium tremens is necessary only in very rare cases, where exhaustion is great, and even in these cases it delays the cure. Under the treatment recommended by him (which, for the benefit of professional readers, we may state is chloral), so rapid in its action, he believes it possible that alcohol may never be required in such cases, and that ordinary tonics may supply its place.

Recent Sunless Weather near London.

The past two months have been remarkably sunless, and although the records of registered sunshine at the Royal Observatory, Greenwich, only extend as far back as February, 1877, it will not be without interest to note a few facts from the records of sunshine since that date. Both in 1877 and 1878 June was the sunniest month, the number of hours of recorded sunshine being respectively 267·1 and 183·4. After June the monthly amount of sunshine declined steadily in each year to 27·0 and 16·3 hours respectively, in December, 1877 and 1878. In January, 1878, the hours of registered sunshine were 35·0, and in February, 32·9; whereas in the January of this year only 14·8 hours of sunshine were measured, the smallest monthly amount on record. During January last on only eight of the thirty-one days was any sunshine recorded; indeed during the fourteen days ending 5th February no sunshine was registered. With reference to the recent departure of frost it may be noted that the change of wind from northeast to southwest on Feb. 5th was accompanied by a marked increase in the amount of ozone in the air. The daily amount of ozone measured in the ten days ending 4th February was but 0·7, whereas in the four days of southwest wind ending on Saturday last the degrees of ozone averaged 9·9.—*Lancet.*

RECENT AMERICAN INVENTIONS.

A novel tool for the use of glaziers and manufacturers of picture frames, has been patented by Mr. Wm. H. G. Savage, of Kingston, Ontario, Canada. It consists of a receptacle having a spring acted follower, and containing the points or brads used in fastening the glass. A metallic plate is connected with the handle of the instrument, and contrived so as to carry a single brad or point out of the receptacle and drive it into the sash or frame as the handle is moved forward.

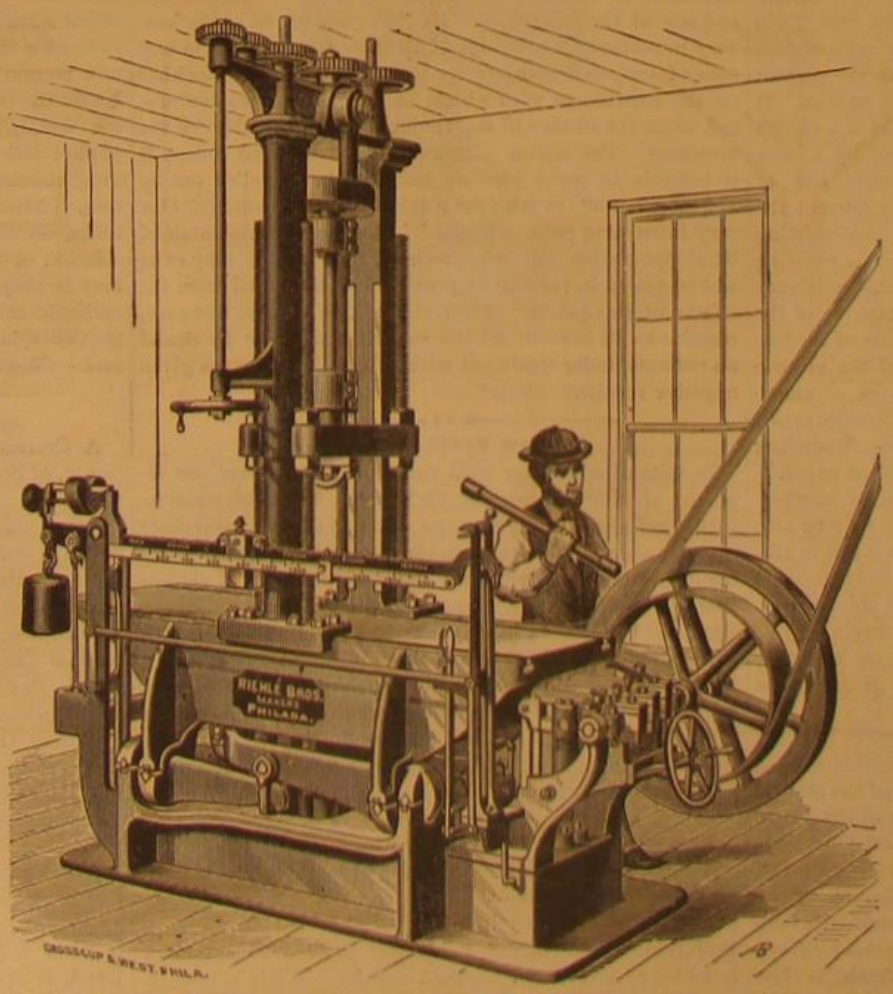
An improved coffee roaster, invented by Rachel Davis, of Omaha, Neb., is constructed so that the body of the cylinder in which the coffee is placed, as well as the handle for moving it, are kept from actual contact with the stove during roasting, thus avoiding the burning of the coffee.

Mr. A. L. High, of Mount Holly, N. J., has invented a picture exhibitor, consisting of several picture carrying wheels journaled on a common axis in a suitable picture frame, and arranged so that they may be turned by a key inserted in the face of the frame, to bring the pictures successively into view.

An improved bill file, in which the papers can be arranged in chronological order without being folded, has been patented by Mr. E. H. Owen, of Los Angeles, Cal. It is designed to facilitate the inspection of the papers and to avoid folding.

Messrs. John Searl and E. G. Bly, of Haverhill, Mass., have invented a shoe, whose vamp, quarters, and flap are made in one piece from a blank of peculiar form. The button hole piece is made separately and sewed on.

An improved animal trap has been patented by Mr. S. J. Bennett, of Harrison Township, Daviess County, Mo. This is an improvement in tilting platform traps for catching rats, mice, mink, and other animals. It combines several novel features, which cannot be described without an engraving.



TESTING MACHINE. DESIGNED BY T. OLSEN.

SOME ANATOMICAL PECULIARITIES IN THE MALE CHIMPANZEE.

The body of the male chimpanzee, which recently died at the Philadelphia Zoölogical Gardens, was immediately removed to the Medical Department of the University of Pennsylvania, where Dr. Joseph Leidy, Professor of Anatomy, has been gradually dissecting it. Dr. Leidy has already dissected the bowels, lungs, and brain of the animal, which has enabled him to develop certain facts in the anatomy of the chimpanzee not hitherto known. There were in some respects several marked differences between the brain of the female champanzee, which was dissected in Philadelphia some weeks since by Dr. H. C. Chapman, and that of the male now dissecting by Dr. Leidy.

Dr. Chapman reported, in his paper on the subject read at a late meeting of the Philadelphia Academy of the Natural Sciences, that the brain of the animal under his examination closely resembled that of a human being, with the exception of the fact that the cerebrum did not cover the cerebellum. This statement coincides with that of a distinguished anatomist whose dissection of the body of a champanzee, many years ago, is one of the few cases on record. Dr. Leidy, on the other hand, found that, in the case of the male champanzee, the cerebellum is covered by the cerebrum, so rendering the resemblance anatomically exact between its brain and that of man, and at the same time showing that the intellect of the male champanzee is greater than that of the female. From this fact the inference may readily be drawn that the present is the only case on record in which an anatomical examination of a male chimpanzee has been made.

Another striking difference in the anatomy of the male and female chimpanzee is a most remarkable peculiarity in the formation of the vocal organs. This peculiarity consists in the possession on the part of the male chimpanzee of a natural bagpipe, which communicates with the larynx and extends into the chest and armpit. This bag is covered by powerful muscles. To produce a loud sound by means of this bag but a slight motion of the arms is necessary. When Dr. Leidy discovered this bagpipe he at once wrote to the superintendent of the Zoölogical Gardens to inquire if the male chimpanzee had any distinctive call or cry. In reply he received answer that the "voice of the male, for so young an animal, was simply enormous; and that its cry, when enraged, was loud, piercing, and shrill." It is a well known fact that this physical arrangement is found in the male gorilla, in the orang-outang, and in the howling monkeys of Southern Africa, whose cry can be heard for miles.

The body of the animal will be preserved and placed in the Medical Museum of the University. Dr. Leidy will shortly incorporate the result of his examinations in a paper to be presented to the Philadelphia Academy of Natural Sciences.

Professor Tyndall on the Electric Light.

At a recent meeting of the Royal Institution, Professor Tyndall delivered a discourse on "The Electric Light." He commenced by expressing his thanks to all who had afforded him information about the various arrangements for electric lighting now before the public, and those which have for a while held their ground, but have been superseded. The electric light has been known for 70 years, as in 1808, and again in an improved form in 1810, it was shown to audiences at the Royal Institution. Sir H. Davy's carbon points "threw sunshine into the shade," and in 1808, 2,000 pairs of plates, obtained for the Institution by subscription among the members, produced such heat from the current they gave that quartz and calcium were melted as wax. It was early known that to produce heat and light in a circuit there must be resistance. This was illustrated by a wire composed alternately of platinum, which resists, and of non-resisting silver, when on the passage of a current the platinum became dazzlingly white hot. A non-resisting copper wire will carry enough electricity to split a resisting oak tree. In the case of two carbon points, this resistance causes the one point to waste with double the rapidity of the other. This, which was formerly regarded as one of the two great obstacles to the general introduction of the electric light, had been overcome by various appliances of clockwork, which kept the two points at the proper distance apart. The second great obstacle was a more serious one, depending on the inexorable law of nature which demands an expenditure of force of one kind for the production of another. Zinc may be burnt in air, that is, oxidized; it may be also "burnt" or oxidized in acidulated water, but it has to displace the oxygen from the hydrogen for this to occur, and four fifths of the heat produced are used up in this process. So that when zinc is thus "burnt" only the remaining one fifth is available. The rate of "burning" makes no difference; one ounce of zinc, for example, always gives out the same amount of heat.

This "burning" of zinc which had been used in the production of electricity was an expensive fuel, and this seemed to be a very great drawback to the general use of the electric light. In the year 1831 a discovery was made at the Royal Institution by Faraday—that of magneto-electricity. He showed that when the earth's lines of magnetic force are cut, an electric current is produced. Prof. Tyndall quoted Faraday's saying, that he would rather occupy himself with finding fresh effects than spend his time in exalting those effects. But it was the exaltation of those effects which he first studied in a simple way which has led to the present possibilities of our electric lighting. In 1854, Werner Siemens, of Berlin, invented what is now known as a Siemens armature, with 16 permanent magnets, in the working of which there is only the ordinary mechanical friction to be overcome. Working the machine by hand, the expenditure of muscular force becomes apparent as heat through the machine. But this and the Wilde and Gramme machines in the same way show that the external work falls short of the originating work.

Now, whatever electricity is, it is a swift carrier of heat. We have motive power converted into current, and then we can have current converted into motive power. For example, Sir William Armstrong has his electric light worked by a water wheel. The great advance on Faraday's spark of 1831 as to practical use is the use of a cheap fuel—coal—for obtaining through the steam engine the motive force required. All the various modifications of the light as now used depend on this.

Prof. Tyndall gave a historical sketch of the various arrangements, beginning with that of Mr. Holmes, in 1862. He did not believe any fresh scientific discovery was needed to make the electric light of general application to large places. The scientific man knew what different natures of machines were required to do the different kinds of work to be done. It remained now for mechanical skill to carry out the work.

Preservation of Iron.

Capt. Bourdon has devised simple forms of apparatus for coating iron with Barff's magnetic lacquer. In the course of his experiments he found that the coat of oxide could be formed by the air in the following manner: The serpentine part of a sheet iron reservoir communicates with air which is heated to 248° Fah. The current of hot air, after circulating through the serpentine, reaches the cylinder which contains the articles to be lacquered. The escape spout communicates with a water aspirator regulating the flow of air, which should be very gentle. The internal pressure is little more than one atmosphere, the apparatus being in communication with the open air. The temperature of the air in the cylinders is 536° Fah.; the operation lasts five hours, giving a coat 0·05 of a millimeter thick (0·002 inch), of a beautiful greenish black, resisting the action of fine emery paper and of dilute sulphuric acid. After the articles are taken from the cylinder, they are rubbed with a greasy rag, and spots are removed by fine emery paper or scouring grass. Spots may generally be avoided by suspending the pieces, so that they will not touch each other or the walls. If the temperature is raised to about 572° Fah., a thick coat is secured, but it is apt to scale. Articles thus lacquered have been exposed to snow and rain for a month without getting any spots of rust. If the black coating is removed by emery paper, there is a grayish layer on which rust does not take much hold; the spots can easily be removed by a bit of hard wood. Barff has observed the same peculiarity in articles which have been steam lacquered.—*Ann. des P. et Chauss.*

The Study of Hair in its Medico-Legal Aspect.

In a recent monograph on human hair by M. Jeannot, the author proceeds first to point out the difference which exists between hair in a healthy or diseased state of the body, and on the corpse; and then gives certain peculiarities by which we may be enabled to distinguish between human and animal hair; and, finally, shows what varieties are found in hair itself, in reference to its place of growth, and the age and sex of the individual. He then goes on to prove how very important a knowledge of all these facts may be in any case of supposed murder; for in this way hair found either on the instrument with which the crime has been committed, or on the clothes of the victim, may help to identify the murderer. The author afterward shows by what means it is possible to prove whether hair has been pulled out by violence, cut off, or whether it fell out spontaneously. One very interesting point advanced is the assertion maintained by Hoppe-Seyler and Sonnerschein, that arsenic may exist and be traced in the hair of persons who have died from the effects of this poison. The truth of this theory, however, remains to be proved; all the experiments made by Stadel on patients under treatment with arsenic have always given negative results.

Yellow Fever in Winter.

In spite of midwinter cold cases of yellow fever are reported at New Orleans and Vicksburg. In some cases returned refugees entering houses that have been closed since summer are said to have taken the disease; in other instances the disease is attributed to the active disinterment of victims hastily buried when the plague was at its height. In Mississippi and Tennessee physicians insist that if this dangerous work is not stopped a return of the epidemic may be expected in the spring; and in some cases the health commissioners have been compelled to forbid the removal of last summer's victims. Wealthy families, no doubt, find it painful to leave their dead in potters' fields, but personal feeling should not be suffered to endanger the entire community.

BLACK LACQUER FOR METAL AND WOOD.—Nine parts of shellac are dissolved in fifty parts of methylic alcohol and set aside for a few days. Then ten parts of pulverized asphaltum are dissolved in fifty parts of coal tar benzine. Both liquids being mixed, a sufficient quantity of lampblack is added to give it the required density. When necessary, it may be diluted with a mixture of alcohol and benzine.—*Chemiker Zeitung.*

Self-Illuminating Watch Faces and Clock Dials.

M. Olivier Mathey, a Neufchâtel chemist, and the manufacturer of the well-known "diamantine," communicates the following information in regard to the composition of these dials, to one of our foreign exchanges:

Phosphorescent dials are usually made of paper, or thin card-board, enameled like visiting cards. They are covered with the adhesive varnish, or with white wax, mixed with a little turpentine, upon which is dusted, with a fine sieve, powdered sulphide of barium—a salt which retains its phosphorescence for some little time. The sulphides of strontium and calcium possess the same property, but lose it more quickly than the former. After the dial has remained in darkness some days it loses its phosphorescence; but this may be readily restored by exposure for an hour to sunlight; or, better still, by burning near the dial of a few inches of magnesium wire, which gives forth numerous chemical rays.

M. Recordon, of Paris, states that two years ago he took out a patent for, and has since been manufacturing, illuminated dials on an entirely different principle from those produced by the use of chemicals. His device is this: A Geissler tube, containing a gas which gives a brilliant light, is placed on the dial; a battery about the size of a thimble is attached as an ornament to the watch chain, and a miniature induction coil is also hidden in the latter. When it becomes desirable to consult the watch in the dark, a spring is pressed, the current passes into the coil, then into the Geissler tube, and illuminates the dial. The portable battery used for this purpose is that of Trouvé, which, in a small compass, has considerable strength. Reduced to the size of a thimble, it is still sufficiently strong in its action to last a year. Mons. Recordon also applies the same principle to the illumination of clock faces.—*The Watchmaker.*

The Fermentative Power of the Papaw.

The question of the fermentative action of the juice of the papaw (*Carica papaya*) upon animal tissues has received some confirmation from the experiments of Herr Wittmack, which he recently embodied in a paper communicated to the Natural History Society of Berlin. The juice, as obtained from the fruit, is of a white milky character, and is present in the fruit apparently only in small quantities, for Dr. Wittmack obtained, after repeated incisions made in a half-ripe fruit, only 1·195 grain of the milky juice of the thickness of cream. When dried it has a strong odor and flavor of petroleum or vulcanized India rubber. In the experiments some juice was dissolved in three times its weight of water, and some fresh lean beef boiled in it for five minutes. Below the boiling point the meat fell into pieces, and at the close of the experiment it had separated into coarse shreds. Fifty grains of beef in one piece, enveloped in a leaf of the papaw and left in this position for a period of twenty-four hours, at a temperature of 15° C., became perfectly tender after a slight boiling, while on the other hand a piece of meat of similar size and weight, simply wrapped in paper and heated in the same manner, remained quite hard. The experiments prove that in the milk juice of the papaw a ferment resides which has a powerfully energetic action upon nitrogenous substances, and it is to this action that the peculiar and well known property of the papaw is attributable.

New Mode of Manufacturing White Lead.

The molten lead is poured through an iron sieve into a tank filled with water. Hereby it is converted into threads of one sixth of an inch in thickness, which are now placed in vats, each of which holds about 1,000 threads. Vinegar is now poured over the lead, and immediately drawn off again. Under the influence of the air and the vinegar adhering to the metal, the latter is oxidized. The vinegar is now poured into the vat and again drawn off, when it carries away the acetate formed on the surface of the metal in solution. After this process has been repeated a number of times, the vinegar has been transformed into a concentrated solution of basic acetate of lead, from which the carbonate may be prepared by the introduction of a current of heated carbonic acid gas. The supernatant liquid is, mixed with another quantity of vinegar, used again for the same process.—*Chemiker Zeitung.*

Hop Fiber.

A German agricultural journal reports that Mr. Nordlinger, of Stuttgart, has invented and patented a process by which hop stems can be made the source of fiber almost equal to flax. The stems and other parts of the plant are boiled in water, to which soap or soda has been added, for three quarters of an hour, thoroughly washed, and then again boiled in very dilute acetic acid. The fibers are now washed free and dried, and when properly combed can be worked like other textile materials. They are said to resemble flax fibers very closely, and to be superior to all others in elasticity, softness, and durability. It is much to be hoped that this process of employing the stems may prove a practical success, for at present, if the hop itself fail, the crop so tenderly nurtured is little less than a dead loss to the unfortunate grower.

PYROPHOROUS IRON.—Iron sponge, which ignites on contact with the air, may be obtained by heating tartrate or oxalate of iron in a narrow-necked vial to complete decomposition, and closing the vial immediately. The residue, which is magnetic and of a velvet-black color, ignites and burns with a beautiful red flame when exposed to the air.—*Chem. Notizbl.*

The Shipping of New York.

The collection district of New York includes the waters of New York Bay and Harbor, East River and Long Island Sound bordering on Westchester county, to the Connecticut line, the north and south shores of Long Island, Staten Island, and that part of Hudson and Bergen counties lying on New York Bay and Hudson River, and the navigable waters of the Hudson River. The district possesses a water front of about 700 miles, and the wharf fronts of New York port cover 25 miles. Marine sailing papers are issued at New York city, Albany and Troy, on the Hudson, and Cold Spring, Port Jefferson and Patchogue, on Long Island.

The registered shipping of the port of New York on the first day of January, 1879, was as follows:

Sail vessels under register foreign trade, number 814; tonnage 481,545·28.

Sail vessels under enrollment or license for the coasting trade or fisheries, 1,384; tonnage, 100,922·81.

Steamers under register foreign trade (wood hulls), 43; tonnage, 56,146·43.

Steamers under register foreign trade (iron hulls), 19; tonnage, 43,266·25.

Enrollment or license coasting trade (wood hulls), 546; tonnage, 138,241·49.

Enrollment or license coasting trade (iron hulls), 34; tonnage, 35,812·93.

Total of steam vessels, 642, with 273,467·10 tons.

Barges and rigged vessels enrolled or licensed, 379; tonnage, 94,234·24 tons, to which may be added the total sailing vessels as above, namely, 2,198, of 582,468·09 tonnage, and 642 steam vessels, of 273,467·10, making the grand total number of vessels of the port of New York 3,219, with a capacity of 950,169·93 tons.

The shipping of the other ports of the district (mostly sail vessels and barges) was, on the same day:

Albany, 304 vessels, 46,306·39 tons; Troy, 465 vessels, 45,656·06 tons; Patchogue, 193 vessels, 2,811·77 tons; Port Jefferson, 119 vessels, 10,723·23 tons. Making a total, for the entire district, of 4,398 vessels, with a capacity of 1,052,-731·42 tons.

The steam fleet of the district numbers 811 vessels, embracing a tonnage of 302,820·42. It is estimated that if all the above vessels were placed in a *line* they would reach from Albany to New York, a distance of 144 miles.

Anatomy of Walking.

Dr. J. W. Ranney gave a lecture the other evening at Chickering Hall on anatomy and physiology, with special reference to athletic exercises. After giving a description of the human skeleton, of the skin and its various glands and vessels, the doctor addressed himself to the muscular system, which was illustrated, first with histological micrographs, and finally with a general plan of the muscular arrangement projected upon a screen. The most novel part of the lecture was the exhibition upon the screen of tabular statements of the amount of force required to carry on the various physical operations. Premising that a foot ton is merely a symbol for the power required to raise one ton a foot high, the relative amounts of power expended in vital action, concerned in vital movements, and required for the production of animal heat for one day are, respectively, 260, 300, and 2,840 foot tons. To row one mile at racing speed requires an expense of 18·56 foot tons of muscular energy; to walk one mile, 17·75 foot tons; to walk one mile, carrying a knapsack weighing 60 pounds, 24·48 foot tons. The force expended in a day's work is calculated at from 250 to 350 foot tons.

Dr. Ranney took occasion in the course of his lecture to inveigh very severely against the mania for walking which is now prevalent, in which young women, without training and without proper preparation, attempt such impossible tasks as walking 3,000 quarter miles in 3,000 consecutive quarters of an hour. Such practices, he said, were not athletic exercises in any proper sense of the term, but downright cruelty, and he hoped the time was not far off when spectacles of this class would cease. Dr. Ranney regards rowing, when properly pursued, as a finer and more healthful exercise than walking.

The St. Gothard Railway Tunnels.

In addition to the great tunnel, thirteen miles long, there are on the St. Gothard Railway twelve other tunnels, the shortest of which, Waren, is 1,106 yards long, while the longest, the Olberg, reaches 2,027 yards. The total length of these twelve tunnels is very nearly ten miles—15,578 meters. Then there are five tunnels between 220 and 550, and twenty-five between 110 and 220 yards, making in all fifty-two subsidiary tunnels, of an aggregate length of 16 miles. Between Immensee and Goschenen there will be thirty-three tunnels; between Airolo and Giubiasco, seventeen. The highest part of the line above sea level is the big tunnel, 3,307 feet; the lowest a point between Cadenazzo and Magadino, 675 feet. The line will be carried over sixty-four bridges and viaducts, the longest of which, that of Cadenazzo, in Tessin, will consist of five arches, each having a span of 55 yards. The total length of the Gothard line will be 151 miles, 17 per cent of it being tunnels and 1 per cent bridges and viaducts. In the first instance the line for the greater part of its length will be single, but the tunnels and permanent way are to be so arranged that additional rails can be laid down so soon as the financial success of the enterprise seems to be assured. If all goes well, the entire length of road will be in running order in from four to five years.

THE PRAXINOSCOPE.

We are all familiar with the zoetrope, which consists of a short cylinder, on the walls of which are represented different positions taken successively by a body in motion. These representations are viewed through longitudinal slits in the cylinder while it revolves at great speed. The pictures viewed in this way appear as if possessed of life. This is certainly one of the most curious of optical phenomena. The accompanying engravings represent an apparatus based on an entirely different principle.

In the praxinoscope, as the apparatus is called by the inventor, Mr. Reynaud, the different pictures representing the consecutive positions of a moving body substitute each other incessantly, the light remains constant in brightness, and it is stated that it constantly presents to the eye an image of a moving body, without exhibiting the slightest irregularity or interruption.

A mirror, A B (Fig. 1), being placed at a certain distance from a picture, C D, the image of the latter will be reflected and visible at C′ D′. When we now turn the mirror as well as the picture, C D, around a common center, O, in the same direction, so that they will occupy positions at B E and D F respectively, the image of the picture will be seen at C″ D″. As will be seen, its axis has remained unchanged.

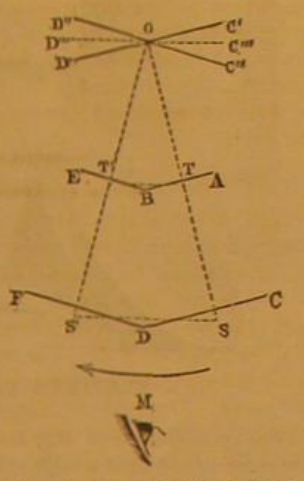


Fig. 1.—THE PRAXINOSCOPE.

If another mirror is placed at A B and another picture at C D, the eye being placed at O, one half of the first picture will be reflected from O D″, and one half of the second picture from O C′. When both pictures and mirrors are turned, the second mirror at T T′ and the second image will be fully visible at C‴ D‴. Afterward the second mirror and the picture will be found in B E and D F respectively. By replacing them by another mirror and design at A B and C D, the same succession of changes of position will be produced.

In the apparatus of Mr. Reynaud the pictures are placed within a polygonal box. Turning around a common center there is a concentric polygonal prism formed of mirror plates, and having a diameter equal to the radius of the exterior

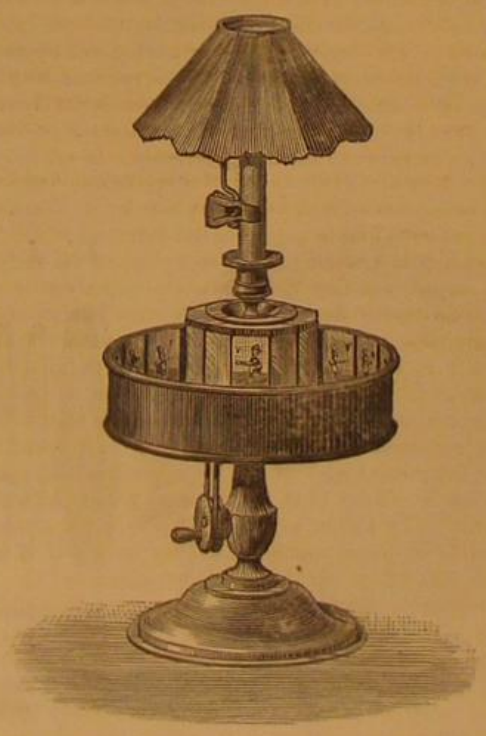


Fig. 2.—THE PRAXINOSCOPE.

polygon, as shown in Fig. 2. The box carrying the pictures and the reflecting prism is revolved at a moderate speed by means of a crank, pulley, and cord.

In the evening the apparatus may be lighted by a lamp or gas flame, the light being reflected downward by a shade.—*G. Fussandier, in La Nature.*

The Piezometer.

This is an apparatus invented by Dr. W. E. Woodbridge, M.D., in 1853. It signifies a pressure measurer, or, more accurately, a measurer of a great or hard pressure. Among all the philosophical instruments that have been invented this deserves to take a place as one of the most ingenious. It consisted essentially of a small steel cylinder, in which was placed a piston fitting it accurately. The cylinder was filled with oil, on which the piston rested, and was screwed into the bore of the gun, inside the powder chamber. All liquids are compressible in a very small degree. When the powder in the gun was fired, the piston was forced down on the oil in the piezometer and compressed it. The distance to which the piston was driven in was recorded on what may be termed the piston rod by a small steel point in the side of the cylinder, which scored a line in the side of the rod. The length of this line was subsequently measured by a micrometric scale, divided into ten-thousandths of an inch, with the aid of a microscope. In order to establish a standard of comparison, the compression of the oil under various pressures was first ascertained by means of a hydraulic press and gauges of special construction. Precautions were taken to prevent changes in temperature from affecting the accuracy of the indications of the instrument.

The experiments were made at Washington Arsenal in 1855, under the direction of Major Alfred Mordecai. Two six pounder guns, one of iron, the other of bronze, were used. The diameter of the bore of each at the shot was 3·69 inches, very nearly. The iron gun was used in the first three experiments, the piezometer being attached to the bottom of the bore. It was afterward pierced through the side to receive the instrument, inclosed in a hollow steel plug, the place in the hole being 1·5 inch in advance of the bottom of the bore. It was thus employed in many experiments. The bronze gun was, however, more used. It was drilled with nine holes at different distances from the bottom, beginning with 1 inch and ending at 47·8 inches. They were arranged alternately to the right and left of a central vertical plane in the upper half of the gun, and inclined 45° to that plane. Not the least interesting feature in the trials consisted of tests made with a musket barrel. The results obtained are very instructive, and support most of the theories held in the present day concerning the action of fired gunpowder. For example, the larger the charge the greater the pressure, irrespective of the space in which the powder was fired. Thus, while pressures of as much as 22,000 pounds, or over 9·8 tons to the inch, were registered in the six pounders, the highest that would be got in the musket barrel was 18,500 pounds to the square inch.

Bennet Woodcroft, F.R.S.

The death is announced of Mr. Bennet Woodcroft, for many years the executive officer of the British Patent Office. Mr. Woodcroft was widely known as a successful inventor, manufacturer, and author of several works relating to invention and the industrial sciences, as well as an efficient public officer. Born in December, 1803, Mr Woodcroft early learned the art of weaving. He studied chemistry under Dalton. On reaching his majority he joined his father in business as dyer and velvet finisher, at Manchester. In 1826, in one of his patents, he described himself as a silk manufacturer. About this time he became acquainted with Whitworth, Nasmyth, Fairbairn, and other eminent Manchester mechanicians. In 1843 he started in Manchester as consulting engineer, removing to London in 1846. From 1847 to 1851 he occupied the Professorship of machinery at University College, and in 1852 was appointed Superintendent of Specifications in the British Patent Office, becoming, in 1864, the sole controller of the department, with the title of Clerk of the Commissioners. From this office, which he had filled with signal ability for twelve years, he retired in March, 1876. His death occurred at his residence in South Kensington, February 7.

Mr. Woodcroft took out his first patent when only twenty-four years of age. It was for processes and apparatus for printing yarns before being woven. It was a valuable invention, and notably useful in the manufacture of ginghams. His next inventions were in naval engineering, the principal being the well known increasing-pitch screw propeller. About the same time he patented certain improvements in calico printing. The patent with which his name is most widely associated was granted in 1838, for an improved tappet for looms. In his official capacity Mr. Woodcroft is accredited with the foundation of the South Kensington Patent Office Museum, the Patent Office Library, and many improvements in the management of the Patent Office.

A New Insect Pest.

At the annual meeting of the New York State Agricultural Society, held in January last, at Albany, Mr. J. A. Lintner, the entomologist of the State Museum, read a paper in which, among other injurious insects recently observed, he gave an account of the larvæ of an insect which had been discovered two years ago in several localities in eastern and northern New York, hidden within the seed pods of the red clover, and destroying the seeds. The perfect insect had not yet been seen, but the examination of the larva showed it to belong to the cecidomyidæ, and in all probability very nearly allied to the wheat midge. A description of the larva was given under the name of *Cecidomyia trifolii*, Lintn. (n. sp.).

The range of the insect's depredations, or the extent of its ravages, was as yet unknown. In some localities in the western counties of New York the clover was so infested with it last year that it was worthless for seed. It is believed that the not infrequent failure heretofore reported of the clover seed crop throughout the country, which has been ascribed to imperfect fertilization of the blossoms and various other causes, has been the result of the secret operations of this destructive little insect.

It is said that a gentleman of wealth and liberality, in the city of Rochester, whose name is not given for the present, proposes to furnish a site and build an observatory for Professor Lewis Swift, at an expense for both of $20,000, provided a glass of sixteen inches in aperture is purchased. Such a telescope complete, with globe and charts, will cost several thousand dollars. The heirs of the late Lewis Brooks have already given $3,000 toward a telescope, and an effort is to be made to raise the necessary sum remaining by subscription.

SOME RECENT INVENTIONS.

The accompanying engraving shows several inventions for which patents were recently issued from the United States Patent Office.

Figs. 1 and 2 represent a bolt holder, invented by Mr. Martin Ketchum, of Avon, N. Y. Its design, as the engraving indicates, is to prevent a bolt from turning while the nut is turned. It consists in a frame containing a sliding bar, having formed on one of its sides a rack which is engaged by a sector lever. The sliding bar is shown in detail in Fig. 2.

A brush for cleaning boiler flues, invented by Mr. C. C. Miller, of Hamilton, Ohio, is shown in perspective in Fig. 3. A spiral wire, shown in detail in Fig. 4, is placed between two disks for receiving the wire, whalebone, cane, or other material used in filling the brush. When the brush requires refilling it may readily be done by loosening the bolts that bind the two disks together, pulling out the old filling, inserting the new, and tightening the bolts. The device seen suspended from the brush handle is designed to guide the brush centrally through the flue; it also permits of thrusting the brush entirely through the flue and drawing it back again without catching.

Figures 5 and 6 represent an improved horseshoer's rasp, patented by Mr. C. H. Perkins, of Providence, R. I. This rasp enables the blacksmith to make the hoof even and level on both sides at a single operation.

Fig. 7 shows a novel form of combined candlestick and match safe, patented by Mr. G. E. Heinig, of Louisville, Ky. Its construction will be readily understood from the engraving.

A self-lighting lamp, recently patented by Mr. H. W. Covert, of New York city, is represented in Fig. 8. In this invention a lamp having a small continuously burning wick is employed. A spring-acted mechanism, which is released by the clock at a given time, is employed to turn up the larger wick, which is lit by the smaller one.

In Fig. 9 is represented a liquid tank, having a measure attached under the bottom, and a two-way cock for letting the liquid from the tank into the measure and for letting it out of the measure. A small pipe extends from the measure to the top of the can to allow air to enter and escape. This measure is the invention of Mr. J. J. Roberts, of Geddes, N. Y.

A novel medicine spoon, patented by Mr. E. K. Walker, of Exeter, N. H., is shown in Fig. 10. The handle has a longitudinal groove on its upper side, and is notched and numbered. A small rubber ring is placed around the handle in the notches corresponding to the number of drops to be given. The spoon has a peculiar lip which facilitates dropping.

In Fig. 11 is represented a combined fan and caster, the invention of Mr. Joseph S. Letord, of Nevada, Mo. The fans are drawn down by the foot, a cord extending from each arm to a single cord running downward through the table and attached to a pedal for this purpose. The fans are raised by elastic cords connected with a spindle at the top of the caster.

A NEW PACKING BOX.

In these days of competition, manufacturers and dealers vie with each other in details of trade which were unthought of a few years ago. This is nowhere more noticeable than in the packages or cases used for containing goods. For many purposes some novelty in the form of the package seems to be the great desideratum, while in other cases the form is of little account compared with other considerations.

In the accompanying engraving is shown a box recently patented by Mr. G. W. Bradley, of Sunderland, Vt., which seems admirably adapted to certain purposes, while it seems to fulfill the requirements for general uses.

BRADLEY'S PACKING BOX.

The construction of this box will be readily understood by reference to the accompanying engraving. It consists of a hoop of tough wood fastened together by stitching. The heads, which are both loose, are held in place by the fasteners, which are simply wires having a spiral spring formed at the middle and hooks at each end. These wires are hooked over the heads, forming a simple, cheap, and secure fastening. In some cases the inventor uses a thin veneer lining inside of each head.

Although these boxes are made in various sizes, the one pound box seems to be best adapted to general use. If it is required to place more than a single pound in a package, it may be done by fastening several of the boxes together with long fastenings. The inventor has a novel method of packing a number of the boxes in a single case, which insures safe transportation and prevents the spoiling of the contents of the boxes. After arranging the boxes in the case, the interspaces are filled as far as possible with square blocks of wood and the remaining space is filled with fine salt. The inventor states that this method has proved more satisfactory than the use of refrigerants. In addition to the improved method of packing, Mr. Bradley has devised improved machinery for manufacturing the boxes rapidly and cheaply; he has also invented a machine for filling the boxes by foot power.

ENGINEERING INVENTIONS.

An improved packing for stuffing boxes, consisting of a metallic box divided longitudinally into two sections and having flaring ends, into which are fitted beveled packing rings having diagonal laps or joints, has been patented by Mr. G. C. Phillips, of Gold Hill, Nevada.

A car coupling, recently patented by Mr. R. B. Potter, of Kansas City, Mo., has a gravity arm that swings in the draw head and carries the coupling pin, which it drops into the link when the latter, in entering the draw head, strikes the lower end of the swinging arm.

Another car coupling, patented by Mr. John Worrall, of Viola, Iowa, is to be used in connection with the ordinary coupling link and pin, and is designed to be operated from the top of the car.

Mr. George R. Hamilton, of Waynesville, Ohio, has invented a simple and easily operated car coupling, which acts automatically, and will uncouple itself in case of accident.

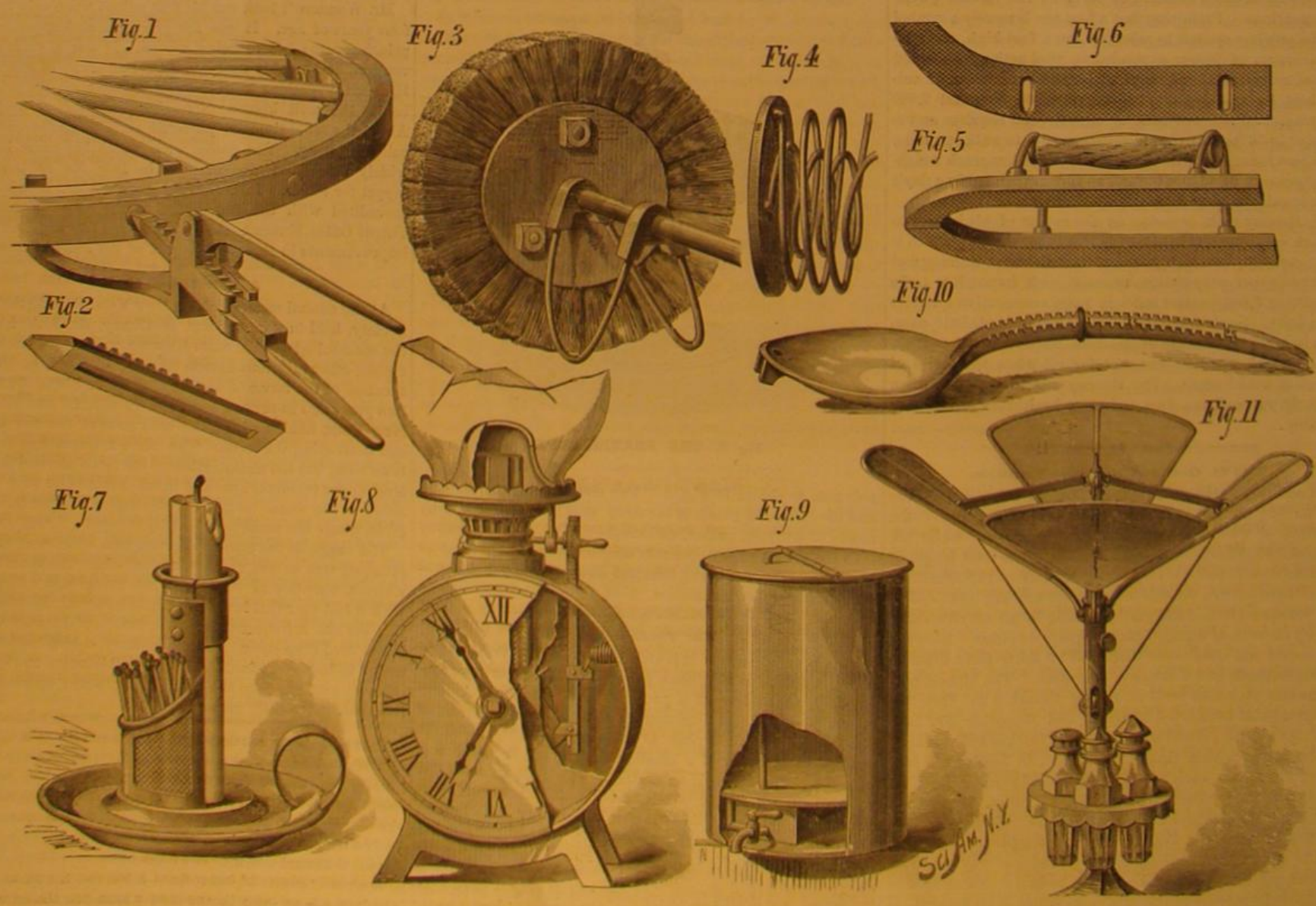
A novel fire escape ladder, which is so contrived that it may be easily and quickly extended to any desired height and secured, and may be contracted into very compact form for transportation or storage, has been patented by Messrs. La Fayette Twitchell and John A. Clark, of Elizabethtown, Illinois.

An improved machine for steaming and drying feathers, for the purpose of purifying and renovating them, has been patented by Mr. T. E. Livesey, of Ashley, Ill. This improvement, although very simple, is said to be effective.

Court Plaster.

Soak isinglass in a little warm water for seventy-four hours, then evaporate nearly all the water by gentle heat, dissolve the residue in a little proof spirits of wine, and strain the whole through a piece of open linen. The strained mass should be a stiff jelly when cool. Now stretch a piece of silk or sarsanet on a wooden frame, and fix it tight with tacks or packthread. Melt the jelly, and apply it to the silk thinly and evenly, with a badger hair brush. A second coating must be applied when the first has dried. When both are dry, apply over the whole surface two or three coatings of balsam of Peru. Plaster thus made is said to be very pliable and never breaks.

CEMENT FOR CAST IRON.—Five parts of sulphur, two parts of graphite, and two parts of fine iron filings, are melted together, taking care that the sulphur does not catch fire. The parts, previously warmed, are covered with the cement, reduced to a pasty consistence on a fire, and firmly pressed together. This cement, it is said, is very well adapted to fill out leaks in cast iron vessels.



A FEW PATENTED NOVELTIES.

THE PARASOL ANTS OF TEXAS.

At a recent meeting of the Philadelphia Academy of the Natural Sciences the Rev. H. C. McCook presented the results of his studies of the habits of the parasol ants of Texas. Two forms of nests were found by him—one that of a mound twenty-one feet long and four feet high, built around the trunk of a double live oak tree, and the second form consisting of twenty or thirty circular, semicircular, and S-shaped elevations, consisting of fresh earth pellets scattered over a flat space denuded of grass. The mound nest resembled a spittoon in shape, having a round entrance on top. This mound, when first seen, seemed to be deserted; but as evening approached hosts of ants of various sizes were seen hurrying out of the open gate into the neighboring thicket, and two long double columns were stretched from the bottom to the very top of the live oak. The ants in the descending column all carried above their heads portions of green leaves, which waved to and fro and glanced in the lantern light, imparting a weird look to the long line of march. They resembled a procession of Lilliputians bearing their banners aloft.

The opening and closing of the great gate to the nest occurs before and after every exit and entrance of ants. Towards evening the gates are gradually thrown open and remain so until morning, when they are again carefully closed. The work is performed by ants of various sizes, who transport particles of wood and fragments of leaves, etc., of proportionate bulks, for the ants themselves vary from one fourteenth to one sixteenth of an inch in length, at least ten distinct castes or sizes having been counted. When the gates are to be opened, the minions, or smaller forms, carry away from the heap particles of sand. Larger ants take bits of refuse, which they deposit a couple of inches from the gate. This process is slow and it takes a long time to accomplish very little. When the whole mass is thus loosened comes the final burst, with soldiers, majors, and minors in the lead, who bear away the rubbish in front of them, which, in a few minutes, is thus cleared away from the gallery and spread around the margin of the gates.

In cutting, the parasol ant grasps the leaf with feet outspread and makes an incision at the edge by a scissors-like motion of its great sickle-shaped, toothed mandibles. It then gradually revolves, cutting as it goes. Carriers on the ground take up the fragments as they fall and carry them to the nest, each piece being loaded up on its edge within a deep furrow which runs along the entire middle line of the ant's head, and is kept in position by prominent spines on the edge of this furrow and on the fore part of the ant's body.

The cutting and carrying was done, as far as was noted, by the smaller ants. The soldiers rarely engaged in this work, but were seen to precede the excursion columns as they moved out of the nest and up the tree, and afterward to return as though only engaged as scouts or pioneers. The principal leaves gathered were those of the live oak, although others were cut and carried off by the ants. These ants are fond of sugar, grain, and tobacco. The use made of the cut leaves is to construct cells, slightly resembling those of the hornet's nest, but more irregular in shape. These cells were contained in the underground caverns, or pockets. Within these caverns great numbers of the smaller castes of ants were found.

With regard to the opinion of the late Mr. Belt, that these leaf-paper masses were used as a sort of "mushroom garden," a minute fungus being purposely cultivated upon them, which the ants were supposed to use for food, the belief was expressed that this was not correct, but that the ants fed upon the juice of the leaves, the fungi being merely what would naturally grow under the circumstances.

The ability of these ants to excavate vast halls and subterranean avenues was alluded to. Some of the holes examined were nearly as large as the cellar of a small house, and Linceeum's assertion that a tunnel had been excavated under the bed of a stream was pronounced to be not at all incredible.

The digging operations were participated in by the smaller castes only. The large castes would therefore appear to assist in opening the gates, making the excursions, and doing the cutting; the small forms dig and carry out the excavated earth, while the smallest castes assist in opening and closing doors and take care of the larvæ.

These smallest castes, or minions, however, are quite ferocious in the attack and gallantly support the large headed soldiers.

The extreme variation of size found in one nest is one of the most serious special difficulties which the evolution hypothesis has encountered. The variations of domestic cattle by inter-breeding and other results of cultivation, although they throw some light upon the matter, yet require an efficient superintending intelligence which cannot be supposed to operate in the differentiation of ant forms, unless, indeed, we may believe that the evolution hypothesis implies and requires the interposition of a personal intelligence infinitely superior to that of both ant and man.

THE GIANT SNAPPING TURTLE.

Dr. Ruschenberger remarked that these parasol ants in Panama did not confine their operations to the night time, but were seen in long columns transporting leaves during the day also.

Dr. John Le Conte gave an account of the work of these ants in Honduras, where he had known them to excavate a gallery under a roadway into a house. The tiled wall of the house being too hard for them to penetrate, they had tunneled the adobe wall for a foot or more above the floor, and had thus obtained access to the room. Efforts to expel the visitors by the explosion of a mixture of sulphur, saltpeter, and charcoal met with but partial success, and it was only by forcing powdered wood ashes into their gallery and thus neutralizing the formic acid by the help of which they probably carry on their excavations, that their inroads could be in the least prevented.

Dr. Joseph Leidy spoke of the advisability of examining the contents of the stomach of these insects microscopically for the purpose of determining the nature of the food used by them. He was of the opinion that the fungi found in the formicaries were only such as would naturally be found on such vegetable deposits, with the accompanying conditions of heat and moisture. SAMUEL M. MILLER.

THE GIANT SNAPPING TURTLE.

In the accompanying engraving is represented the North American giant snapping turtle (*Tryonyx ferus*). It attains a weight of about 60 to 80 lbs., and specimens nearly six feet in length have been frequently caught. The back is of dark slate blue color and covered with numerous yellow and reddish dots. The belly is white and the head covered with dark spots. A light band connects the eyes and descends on both sides along the neck to the shoulders. The chin, feet, and tail are marbled white; the iris of the eye is of a bright yellow color.

This turtle inhabits principally, according to Holbrook, the Savannah and Alabama rivers, also the northern lakes, and even the Hudson River; but it is missing in all rivers entering the Atlantic between the mouth of the Hudson and that of the Savannah. Into the great lakes of the North the turtle was probably brought from the great Southern rivers, in which it is indigenous, by the great inundations, by which the Illinois River is brought in connection with Lake Michigan, the Peters River, and Red River. Into the State of New York it probably emigrated through the Erie Canal, as before the completion of the latter it was unknown in New York waters.

In most of these rivers, especially those of the South, this turtle is very common. In clear, quiet weather they appear in large numbers at the surface or on the rocks in the water, sunning themselves. When watching for prey, they hide under roots or stones, and lie motionless, till some small fish, lizard, or even a small water bird, approaches its hiding place. Then the somewhat elongated neck darts out suddenly; it never misses its aim. In an instant the prisoner is swallowed, and the turtle resumes its old position to repeat the same operation, when opportunity offers. They are also great enemies of the young alligators when these are just hatched. Thousands of them are devoured by the voracious turtles, which again fall a prey to such of the grown up alligators as were happy enough to escape.

In May the females select sandy spots along the shore, mounting hills of considerable size if necessity requires it. Here the eggs are deposited. Their calcareous shells are very fragile, more so than those of the eggs of other sweet water turtles. Very little is known of the early life of the young, which are hatched in June.

Among all North American turtles this species is, for culinary purposes, the most valuable, and it is therefore extensively hunted. They are either shot or caught in nets and with the hook. Grown specimens must be handled with great care, as they defend themselves desperately, and can inflict dangerous wounds.

The Latest Snake Story.

Under the above heading, a reporter communicates to one of our daily papers as follows: Mr. Jacob Smith, an undertaker, in Freeport, L. I., owns a horse which recently became blind in the right eye—a bluish film completely covering the eyeball. Under this film, playing about in a lively manner, could be distinctly seen something resembling a snake, apparently about three inches long and as thick as a large sized darning needle. It was in constant and rapid motion, having the action of a snake or an eel in the water. A great many people in the neighborhood inspected the phenomenon, which to all was unaccountable. A few days after the snake disappeared as suddenly as it came, leaving the eye totally blind.

Whether the above story is correct or not, similar cases of a worm—*Filaria papillosa Rudolphi*—in the eyes of horses are well authenticated.

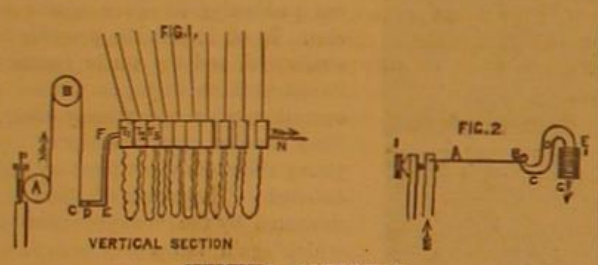
The SCIENTIFIC AMERICAN SUPPLEMENT, No. 168, contains an illustrated article on the subject, with engraving of the worm, actual size. A similar parasite has been known to exist also in the human eye.

By observation and experiment alone can the mind of man arrive at a knowledge of the laws which rule the universe.—*Bacon.*

SIEMENS' ELECTRIC CURRENT GOVERNOR.

The idea of employing the stretching of a wire by the heating of the current passing through it was suggested by the early contrivers of electric lamps as a simple means of regulating the distance between the carbons, and it has the advantage that, as the heat produced per second is proportional to the square of the current flowing through it, a very slight change in the current will produce a considerable variation in the quantity of heat produced per second, and, therefore, in the temperature, if the mass of the substance to be heated is very small. On the other hand, when the current diminishes in strength it is necessary that the temperature of the heated substance should immediately fall; this requires considerable radiating surface. These conditions Dr. Siemens has fulfilled in the following instrument, the principle of which is shown in the accompanying engraving, which we extract from the *Electrician:*

A B C is a vertical band of metal not more than a twentieth of a millimeter, or two-thousandths of an inch, thick, passing over the roller, B, one end of the band being fixed to the roller, A, and the other, C, to the short end of a lever, C D E F, turning on a pivot, D. If now, by turning the pinion, P, the thin metallic band is tightened, the upper end, F, of the lever, C D E F, is pressed against the movable metallic terminals, T_1, T_2, T_3, etc., of the resistance coils; the result is, these are pushed out of the vertical and pressed together, and all the coils are short circuited. If now a current, entering at A, and leaving at N, passes through the vertical metallic strip, A B C, the lever, C D E F, and the terminals, T_1, T_2, T_3, etc., it heats the strip, which consequently expands and diminishes the pressure of F on T_1; some of the terminals, therefore, separate from one another, and some of the resistance coils are introduced into circuit (in the engraving six are shown short circuited and three in circuit). Resistance will be automatically introduced until an equilibrated state is arrived at, when the heat lost from the metallic strip, A B C, by radiation, convection, and conduction is exactly equal to that generated by the current, and any further decrease or subsequent increase of the current (provided the change is within certain limits) will be at once checked. To provide against accidental charges in the radiating power of the strip, produced by currents of air, etc., the portion, A B C, is under a glass cover.



SIEMENS' GOVERNOR.

In some trials made with this instrument before the Royal Society it was shown that the interposition of a certain resistance into the circuit only altered the deflection of a tangent galvanometer from 40° to 39·5°, when the regulator was employed, whereas, without it, the insertion of the same extraneous resistance diminished the deflection from 60° to 40°.

Fig. 2 shows another form of governor proposed by Dr. Siemens. The wire, A B, is stretched until the lever, C D E, turning on the pivot, D, produces sufficient pressure on a pile of Edison carbon disks in the glass tube, G. This pressure becomes less, and the resistance of the carbons becomes greater the more the wire stretches by heating with the current passing through it and through the carbon disks; the stronger, therefore, is the current the greater is the resistance opposed to it.

Either of these instruments may be used as a recorder of the electric current by attaching a pencil to the lever and allowing it to make a continuous mark on a strip of paper moved by clockwork at right angles to the direction of motion of the lever.

A Reptile which Lived Twelve Million Years Ago.

The American Museum of Natural History, of this city, has just been enriched by a contribution of three slabs of sandstone taken from the Connecticut Valley. The donor of the slabs desires that his name shall not be mentioned in print, but the specimens are said to have come from Turner's Falls, Mass. On two of the slabs are impressed large foot prints of some amphibious animal. Professor Hitchcock names the animal the *Brontozoum giganteum*. The beast is, or was in ancient times, a reptile of enormous size, as the prints of his feet on the slabs presented to the museum show. The theory of the geologists is that this monster was formed something like a frog; that he walked mostly on his hind legs, only using his fore legs when it was necessary for him to drop down to rest. It is estimated that he lived about 12,500,000 years before the appearance of man on this earth.

The third slab is covered with the marks of the feet of some insect which is unknown to the present generation. From the foot prints the geologists have determined that the insect was of the *ephemana* genus. Insects of this class can live in the water several days, but on the land they survive for but from one to twenty-four hours. The theory regarding these foot prints is that the insect found himself on dry land, with the tide receding, and in attempting to gain the water he left these marks upon the sand, which are presumed to teach the nineteenth century something of the history of the past.

NEW ELECTRIC LAMP.

To the Editor of the Scientific American:

I notice in a recent paper a cut of Mr. Edison's platinum lamp. This lamp is so like one I made about two years ago, that I send you mine, and hope you will find a place for it

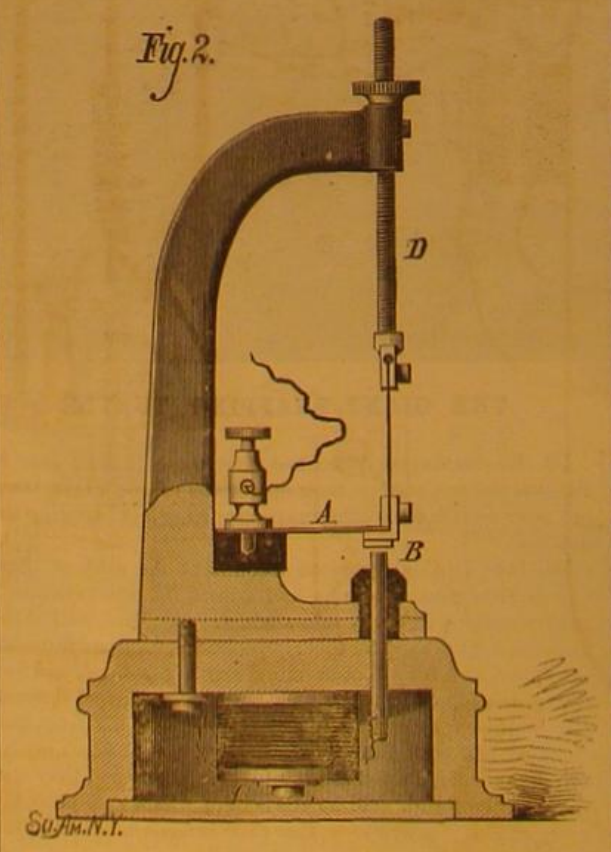
Fig. 1.

in your paper. Upon a careful examination of the two you will see that they both have the following features in common, namely: 1. The light is produced by a band of incandescent metal. 2. The metal is held taut by a spring. 3. The current is shunted by the expansion of the metal producing the light. 4. The shape of the metal is the same. 5. The contact points of the shunt are tipped with platinum. 6. The degree of expansion before the current is shunted is regulated by a screw.

The only thing not common to both is, I had a resistance coil in the shunt. Now, as I never saw Edison and he never saw me, how did it happen that we both made the same thing and almost exactly alike, except in the shape of minor details?

I never applied for a patent on my lamp, from the fact that I found from experiment that it required a very much greater expenditure of power to produce a given light with it than was required with the carbon points, so I put it on the shelf. Its operation is so simple that you need no explanation to understand it. I made the model represented in the engraving during the summer or fall of 1877; I have the original drawing. I first tried it on 35 cups Bunsen, as I

Fig. 2.



had no magneto machine then. About one year ago I took the resistance coil out of the base to use for another purpose. When I tried it again I run the wires outside of the case and used a rheostat. I afterward cut them off and connected them inside, so that for the last 10 or 12 months it has been in principle just exactly like Edison's lamp. I look upon the matter as a remarkable coincidence. HIRAM S. MAXIM.

Bridgeport, Conn., February 26, 1879.

[Fig. 1 shows Mr. Maxim's lamp in perspective; Fig. 2 is a vertical section. The spring, A, which clamps the lower end of the platinum strip, is secured by a binding post to a vulcanite block attached to the base of the iron standard. An insulated platinum tipped rod, B, extends through the base of the standard, and is connected with one terminal of a resistance coil, C, concealed in the base. The other terminal of the coil is in electrical communication with the iron standard. A threaded rod, D, extends downward through the upper end of the standard, and has at its lower end a clamp for holding the upper end of the platinum strip. The rod, D, is adjusted by the nut which bears on the top of the standard, so that when the platinum foil is cool the spring, A, does not touch the rod, B.

One electric wire being secured in the binding post that holds the spring, A, and another being connected with the vertical standard, the current passes through the spring, A, the platinum strip, the rod, D, and the vertical standard, heating the platinum to incandescence. Should the current increase so as to bring the temperature of the platinum nearly to the melting point, the strip expands until the spring, A, touches the end of the rod, B, when a portion of the current passes through the resistance coil, C.

When the temperature decreases the platinum contracts and breaks the contact between A B.]

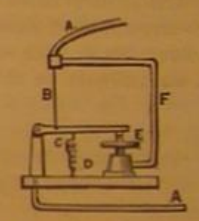
Cement for Glass.

Take 10½ lb. of pulverized stone and glass and mix with it 4¾ lb. of sulphur. Subject the mixture to such a moderate degree of heat that the sulphur melts. Stir until the whole becomes homogeneous, and then run it into moulds. When required for use it is to be heated to 248°, at which temperature it melts, and may be employed in the usual manner. It resists the action of acids, never changes in the air, and is not affected in boiling water. At 230° it is said to be as hard as stone.

EDISON'S ELECTRIC LIGHT.

A correspondent of the *Electrician* gives the following description of Edison's regulator:

His sheet of iridio-platinum is rigidly affixed, at the top, to a crossbar, to which is attached one wire. The crossbar at the bottom, to which the lower edge of the sheet and the other wire are attached, is a lever drawn down by a spring. Underneath this lever is an adjustable screw, tipped with platinum. From the standard of this screw runs a shunt wire to the top of the sheet. As the sheet is heated it expands, and the spring on the lever draws it down. The shunt screw is set to the desired degree of heat (light), and when this is reached the lever is in contact with the screw, and the current is shunted out of the sheet. In practice, this contact is being constantly made and broken. There you have the key to this "wonderful" performance.



A A, conducting wires; B, edge of illuminating sheet; C, lever; D, spring; E, shunt post; F, shunt wire.

Ocean Beach (Cal.) Placer Mines.

At a meeting of the San Francisco Academy of Science, Mr. Christy reports that in the black sand beach placer mines of California, the gold is found in the layers of magnetic iron sand which alternate with layers of common quartz sand; also in the gravelly layers swept by the surf. Hard pan is reached at a depth of two to four feet. It is composed of a sort of clay sandstone, and upon the "hard pan" is usually found a layer of coarser sand or granite, which is usually the best pay dirt found. Some of the higher layers of black sand are quite rich also. Under the microscope the black sand shows itself to be composed of more or less perfectly rounded grains of magnetic oxide of iron, with a few silica grains and occasional fragments of what appears to be garnet. Mixed with the sand is the gold, which, under the microscope, is usually bright, and in only a few cases presents a rusty appearance. The gold is invariably in the form of oblong or elliptical scales, which are doubly concave and usually surrounded by a thickened rim. Another curious fact is the great purity of the gold, which has been reported to have assayed from 950 to 953 fine, and is said to be the purest placer gold ever found in California.

Thrift of the French Working Classes.

The most striking fact with regard to the French working classes is that nearly all are possessed of money. However little they earn they save something. Thrift is their great characteristic; in fact, it is said of the French operatives that they spend less in proportion to their means than any in the world. Many keep their accumulations in an old stocking secreted in their houses; others—a daily increasing number—invest in various securities, the most popular investment being the purchase of land. Every Frenchman, when he can, becomes the owner of the house in which he lives. Of course he is greatly aided in this by the French land laws and laws of inheritance, which cut the whole country up into small holdings. Savings banks with government security, building clubs, sick clubs and friendly societies are also in favor; but no money is tied up in trade unions.

THE EDISON ELECTRIC LIGHT.

The following is an abstract from an article describing Edison's electric light, which appeared in a late issue of the *Engineer:*

We publish herewith accurate copies of the three principal drawings of Edison's electric light apparatus lodged with the French specification, and we have no doubt that they are in all respects identical with those which accompany all the applications which Mr. Edison has made in other countries for a patent. He has used in all no fewer than forty-eight figures to render the nature of his inventions clear; but the great majority of them represent comparatively insignificant modifications of the ideas illustrated by our engravings, and consequently we have not thought it necessary to reproduce them.

The invention is divided into two parts—the first refers to the means of producing electricity, the second to the lamp.

The electro-magnetic machine is thus described in the specification:

"It has long been known that if two electro-magnets, or an electro-magnet and a permanent magnet, be drawn apart or caused to pass by each other, electric currents will be set up in the helix of the electro-magnet. It has also been known that vibrating bodies, such as a tuning-fork or a reed, can be kept in vibration by the exercise of but little power. I avail of these two known forces, and combine them in such a manner as to obtain a powerful electric current by the expenditure of a small mechanical force. In Fig. 1 of the drawing a tuning fork, *a*2, is represented as firmly attached to a stand, *b*2. This fork is preferably of two prongs, but only one might be employed upon the principle of a musical reed. The vibrating bar or fork may be two meters long, more or less, and heavy in proportion. It has its regular rate of vibration like a tuning fork, and the mechanism that keeps it in vibration is to move in harmony. A crank and revolving shaft, or other suitable mechanism, may be employed, but I prefer a small air, gas, or water engine, applied to each end of the fork. The cylinder *a*1 contains a piston and a rod, *b*1, that is connected to the end of the bar, and steam, gas, water, or other fluid under pressure acts within the cylinder, being admitted first to one side of the piston and then the other by a suitable valve; the valve and directing rod, *c*2, are shown for this purpose. The bar of fork, *a*2, may be a permanent magnet or an electro-magnet, or else it is provided with permanent or electro-magnets. I have shown an electro-magnet, *c*1, upon each prong of the fork—there may be two or more on each—and opposed to these are the cores of the electro-magnets *d*. Hence as the fork is vibrated a current is set up in the helix of each electro-magnet, *d*, in one direction as the cores approach each other, and in the opposite direction as they recede. This alternate current is available for electric lights, but if it is desired to convert the current into one of continuity in the same direction a commutator is employed, operated by the vibrations of the fork to change the circuit connections each vibration, and thereby make the pulsations continuous on the line of one polarity. A portion of the current thus generated may pass through the helixes of the electro-magnets, *c*1, to intensify the same to the maximum power, and the remainder of the current is employed for any desired electrical operation wherever available. I, however, use the same, especially with my electric lights, but I remark that electricity for such lights may be developed by any suitable apparatus. I have represented commutator springs or levers, *c*3, *c*4, operated by rods that slide through the levers, *c*3, *c*4, and by friction move them. When the prongs, *a*2, *a*2, are moving from each other the contact of levers, *c*3, *c*4, will be with the screws, 40, 41, and the current will be from line 1, through *c*1 to *c*, thence to *c*3 to 41, 43, and to circuit of electro-magnets, *d d*, and from *d d* by 42 to 40, *c*4, and line as indicated by the arrows. When the prongs, *a*2, *a*2, are vibrating towards each other the circuit will be through *c*1, *c*, *c*3, 42, in the reverse direction through the circuit and magnets, *d d*, back to 43, and by *c*4 to line."

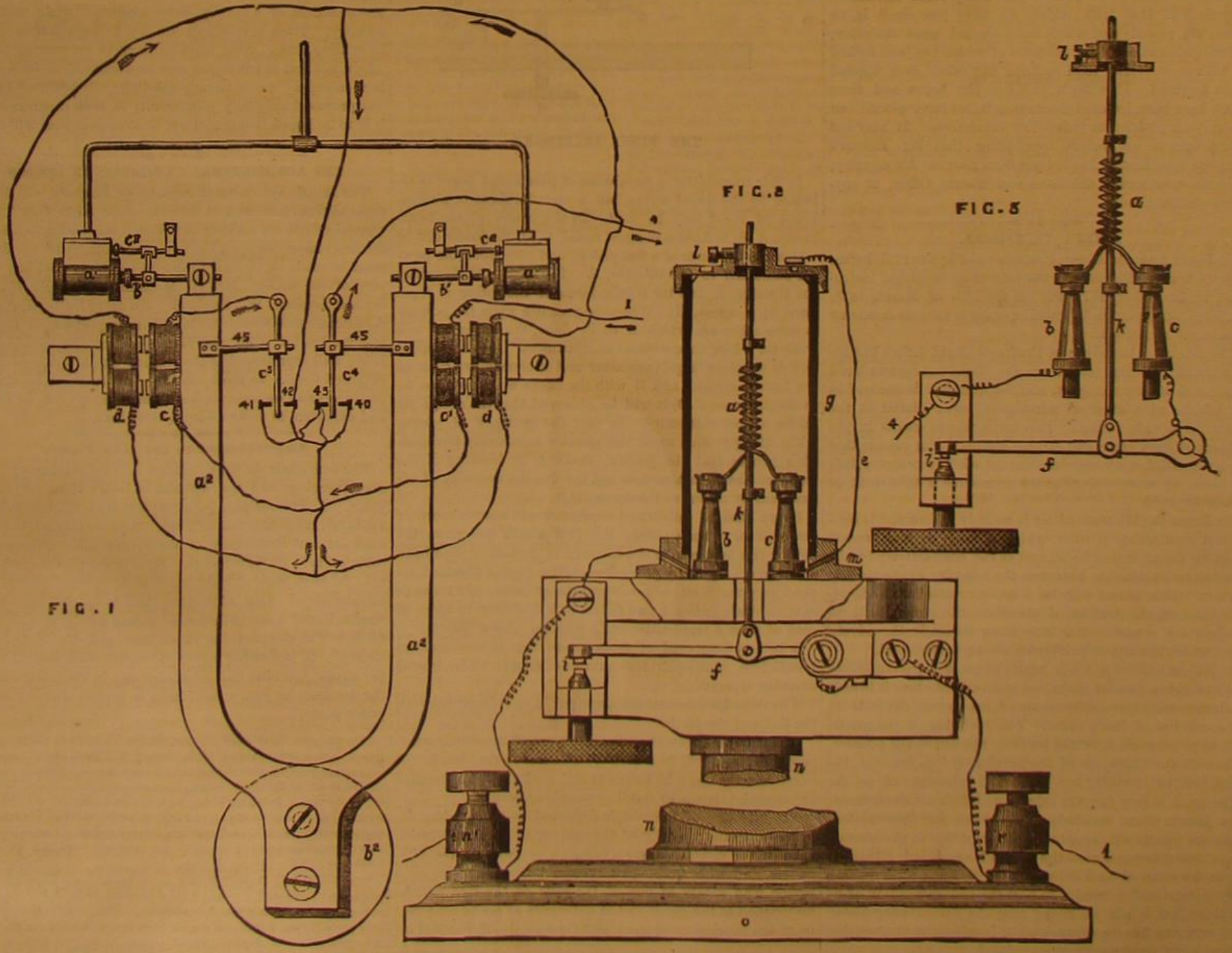
Fig. 2 shows the Edison lamp, which is thus described by the inventor:

"Platinum and other materials that can only be fused at a very high temperature have been employed in electric lights; but there is risk of such light-giving substance melting under the electric energy. This portion of my invention relates to the regulation of the electric current, so as to prevent the same becoming so intense as to injure the incandescent material. The current regulation is primarily effected by the heat itself, and is automatic. In Fig. 2 I have shown the light producing body as a spiral, *a*, connected to the posts, *b c*, and within the glass cylinder, *g*. This cylinder has a cap, *l*, and stands upon a base, *m*, and for convenience a column, *n*, and stand, *o*, of any suitable character, may be employed. Most of the other figures are in the form of diagrams to more clearly represent the electrical connections. I remark that it is preferable to have the light within a case or globe, and that various materials may be employed, such as alum water, between concentric cylinders, to lessen radiation, retain the heat, and lessen the electric energy required; or colored or opalescent glass, or solutions that reduce the refrangibility of the light, such as sulphate of quinine, may be employed to moderate the light, and the light may either be in the atmosphere or in a vacuum. The materials that I have found especially adapted to use as light-giving substances are set forth hereafter. The electric circuit, Fig. 2, passes by line 1 to the post, *r*, and by a wire to the lever, *f*, thence by the wire or rod, *k*, cap *i*, wire, *e*, to the post, *c*, through the double spiral, *a*, to the post, *b*, and by a metallic connection or wire to the post, *n*1, and line 4, and so on through the electric circuit, and the light be developed in *a*. The rod, *k*, will expand in proportion to the heat of the coil, or in proportion to the heat developed by the passage of the current through the fine wire, *k*, and, if the heat becomes dangerously high, injury to the apparatus is prevented by the expansion of rod, *k*, moving the lever, *f*, to close the circuit at *i* and short circuit or shunt a portion of the current from the coil, *a*, and reducing its temperature; this operation is automatic, and forms the principal feature of my invention, because it effectually preserves the apparatus from injury. The current need not pass through the wire or rod, *k*, as the expansion thereof by the radiated heat from the coil, *a*, will operate the lever, *f*, as indicated by Fig. 3, but the movement is not so prompt. It is to be understood that in all cases the action of the short current through the light-giving substance and the circuit-closing devices play up and down at the contact point, maintaining uniformity of brilliancy of light."

Most of the details of this invention, taken separately, are not new. The use of an incandescent substance was first patented in this country, not by King in 1845, as is generally believed, but by De Moleyns in 1841. The materials named by Mr. Edison, such as platinum, iridium, osmium, etc., have all been used or proposed to be used long since. In this direction, therefore, there is nothing about Mr. Edison's invention to encourage hope or excite fear. There remains, however, the device for protecting the incandescent material from overheating, and this is very pretty and ingenious, and will probably work very well in competent hands; but it is a delicate bit of mechanism, which must not only be adjusted to begin with, but kept in adjustment with minute accuracy, or the wire coils will be destroyed or the light will go out. Mr. Edison will no doubt attain much success at Menlo Park, where everything will be under his own control; but for the ordinary purposes of lighting our houses an electric lamp has probably yet to be invented.

With all its defects for domestic purposes, still Mr. Edison's lamp might perhaps be used to much advantage for street lighting, and in factories or theaters; in fact, in any situation where it could be looked after by a skilled attendant.

We reproduce the following portion of Mr. Edison's spe-



EDISON'S NEW ELECTRIC LIGHT APPARATUS.

cation, omitting the figures and the references to them, as we fancy the passage will be intelligible without them: "In lighting by electricity it is often important to use a secondary battery in connection with the main current. Electric light coils may be put in a secondary circuit containing cells, with plates in a conducting liquid; and a lever is vibrated by an electro-magnet or by clock-work. When the lever is in contact the current from line 1 passes through the electro-magnet and cells, but when the contact ceases the line is closed, but a local circuit is made through the coils and secondary battery; the discharge of the secondary battery gives the light, and the movement is so rapid that the light appears continuous. A single secondary battery may be introduced with one or more lights, the expansion of the light-giving material short circuiting the current through the secondary battery. Instead of a rheostat in the shunt circuit I sometimes employ a button of carbon. In this case the spring lever bearing upon the carbon button lessens the resistance by the increase of pressure, as the platina strip expands, and as it contracts and lessens the pressure on the carbon button the resistance of that carbon button increases, and a greater portion of the current is sent through the platina strip. This regulation is very accurate."

Mr. Edison's claims are as follows: "(1) The combination with an electric light of a thermal circuit regulator, to lessen the electric action in the light when the maximum intensity has been attained, substantially as set forth; (2) The combination with the electric light of a circuit closing lever, operated by heat from the electric current or from the light, and a shunt or short circuit to divert the current or a portion thereof from the light, substantially as set forth; (3) The combination with the electric light and a resistance of a circuit closer operated by heat, and serving to place more or less resistance in the circuit of the electric light, substantially as set forth; (4) The combination with an electric light of a diaphragm operated by the expansion of a gas or fluid in proportion to the temperature of the light to regulate the electric current, substantially as set forth; (5) The combination with a vibrating body similar to a tuning fork of mechanism for maintaining the vibration, and magnets, cores, and helixes, whereby a secondary current is set up, so as to convert mechanical motion into electric force, or the reverse, substantially as set forth; (6) The combination with electric lights, substantially such as described, of means for regulating the electric current to the same, in proportion to the heat evolved in the light, so as to prevent injury to the apparatus, substantially as set forth."

In all this it will be seen that we have not one word concerning any new or extraordinary contrivances for dividing the electric light. Mr. Edison has many other patents in progress, but that with which we have just dealt is, no doubt, *the* patent; that which has attracted more attention, and the publication of the contents of which has been looked for with more avidity than perhaps any other ever applied for in England. How far it justified the hopes and fears which have been fostered concerning it, we have placed our readers in a position to judge for themselves. It may not be improper to say before concluding, that Mr. Edison's complete specification has not yet been filed in this country, and cannot be seen at the Great Seal Patent Office, or anywhere else save Paris.

RIGHI'S TELEPHONE.

Professor Augusto Righi, Professor of Physics at Bologna, began his experiments with the following described instrument in December, 1877, and on the 14th of March, 1878, exhibited the apparatus in working order before the Academy of Sciences of Bologna.

The receiving telephone of Professor Righi differs but little from the old Bell telephone; the Righi instrument has a larger and stronger magnet, and the iron disk is secured in the middle of a sheet of parchment paper placed at the mouth of a wide funnel. This arrangement results in the delivery of very clear and strong sounds. But results that are quite satisfactory may be obtained with an ordinary Bell telephone by substituting for the membrane a thin sheet or veneer of wood.

Professor Righi's transmitter is entirely different. It contains a conducting powder, which is more or less pressed upon by the vibrating body, and as the conductivity of the powder varies with the pressure, the intensity of the electric current which passes will be relatively varied with the vibrations, and the receiver, if placed in the circuit, will reproduce the sounds. It is interesting to study the advantages which the use of pulverized conductors present.

If the current from a pile passes through a galvanometer and through a powder contained in a tube of glass, it is easy to demonstrate that the intensity of the current depends on the condition of the powder. The deviation of the needle will be in proportion to the pressure applied to the powder. Whatever the character of the powder, if it is not fine, the variations of intensity are small and irregular; if, on the contrary, it is very fine, the intensity of the current increases with the pressure regularly and without any interruption. Different effects will be produced, according to the character of the powdered material which is employed. Thus, if silver be reduced to an impalpable powder, after having been compressed, it retains in part the new disposition of its particles, for it will be found that the compressing piston no longer touches the powder when it returns to the position it was in before the current was closed.

On the contrary, with very fine graphite, when the pressure is diminished, the current shows anew the same intensities which it had before in the same positions of the pressing piston when it was being moved to give pressure. The effects which other powders produce resemble more or less those of silver and graphite.

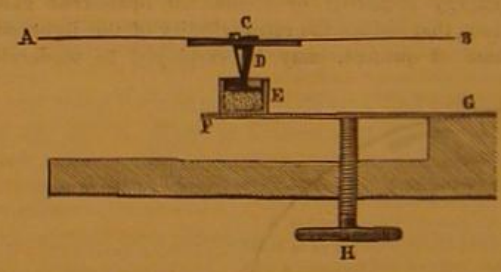
The author does not know in virtue of what force the powder tends to assume its primitive condition when the pressure is diminished. It might be called the elasticity of readjustment.

The possibility of transmitting very acute sounds with certain powders shows that this elasticity is sufficiently active to permit the powder rapidly to acquire the same condition which it had before being compressed. It may be also that this elasticity of readjustment, which is perfect in some powders, is due to the elasticity of the atmosphere of gas which adheres to the particles of the powder.

We know that there are solid bodies which operate in a manner analogous to these powders, and that they have been employed in the construction of transmitting telephones; such are the retort carbons, iron, and graphite. In these bodies the variations of conductivity obtained by pressure are less than with powders, but in all cases they are produced by extremely small movements of the vibrating body. Very strong sounds cause a complete and periodical separation of the metal which compresses the carbon, thereby producing loud rumblings in the receiver, which prevents the understanding of the transmitted words. In order that the circuit may not be opened by the vibrations, it is necessary to increase the pressure upon the carbon or diminish the mobility of the vibrating body which produces the pressure; but in that case we experience considerable loss in the intensity of the sounds; hence the necessity of frequent adjustment by means of the screw. On the other hand, it is found that the strong disagreeable rumblings are produced by the loosening of the particles of the carbon during the vibrations.

With this class of telephones, and also with those of Bell, it is necessary to place the receiver close to the ear in order to understand the transmitted words.

With the pulverized conductor these inconveniences are avoided. It is much more flexible than the carbon, and we are able to use in connection with it a body which easily vibrates, and in which the vibrations will have much amplitude without opening the circuit; and as the variations of the resistance of the powder are very great, the sounds which the receiver reproduces are very intense.



THE RIGHI TELEPHONE.

In this transmitter, a membrane of parchment paper is vibrated by the sound waves, but a metallic sheet or a membrane of wood may be used. In the center of the membrane, A B, is fixed a piece of metal, C D, the lower end of which has the form of a flat piston, and rests upon the powder contained in the thimble, E. The spring, F G, carries the thimble, E, and the elastic force of the spring is regulated by a screw, H. When the pressure upon the powder is once adjusted, which is easily done, the apparatus will work for a long time without readjustment. If in an electric circuit we place a galvanometer and a transmitter such as we have described, and if with the finger we press upon C, in the direction C D, it will be observed that the needle remains almost stationary. In fact the spring, F G, yields, while the pressure upon the powder is scarcely changed. This proves that the jarring, shaking, or bending of the wood of the apparatus does not involve the necessity of adjustment by means of the screw, H.*

Every kind of pulverized conductor will answer more or less well in a transmitter; but that which has given the author the best results is a mixture of carbon or plumbago and silver, very finely pulverized. The results obtained depend very much on the quality of the graphite. In order to communicate between two points it is desirable to place at each of them a transmitter and a receiver, also a battery.

A battery composed of from one to four Bunsen couples is sufficient, or an equivalent number of couples of Leclanche or other system.

The three instruments are arranged in one circuit between the line and the earth.

It is better to throw the transmitter out of the circuit when receiving, as it will be a useless resistance in the circuit. In every case the one who listens is able at all times to interrupt the one who speaks by sending sounds or words.

The intensity of the sounds delivered by the receiver depends upon the intensity of the current and the total resistance of the circuit. Over a distance of two or three kilometers, and with four small Bunsen pairs, the voice of a person who speaks at one of the ends of the line will be understood at the other end at a distance of six to nine feet from the receiver. Singing and the sounds of musical instruments will be heard perfectly at a distance of twenty-five or thirty-five feet, and sometimes even further. If at the hearing station two or more receivers are used, they may be so arranged that a large number of persons may simultaneously hear what is being said.*

In order to transmit speech or other sounds, it is not necessary to produce them close to the transmitter; words spoken at a distance of several feet from the instrument are heard perfectly at the other end of the line. Effects especially notable have been obtained over lines of considerable length;† but the resistances are very easily overcome by employing the induction coil. For this purpose it is necessary to have: 1, a transmitter; 2, a receiver; 3, an induction coil; 4, a battery. The large wire of the coil, the receiver, and the transmitter (when sending), form a closed circuit with the battery. The fine wire of the coil communicates at each station with the line wire at one end and with the ground at the other end. Thus arranged, the variations of intensity which the transmitter produces at one of the stations, gives rise to induced currents in the fine wire of the induction coil, which are propagated along the line to the fine wire of the coil at the next station; at which place, by secondary induction, variations of intensity in the local current will be determined, and the receiver will be correspondently affected. It is in this manner that the latter instrument reproduces the sounds. The voice of a person speaking is heard at a distance of some six feet from the receiver even when the line has interposed resistances amounting to hundreds of kilometers; the louder sounds of the instrument are heard at a still greater distance. But it must not be forgotten that there is a difference in the effects, as between an artificial resistance and that of a regular line, particularly in view of the imperfect insulation of the latter.

The clearness and intensity of the sounds obtained with the telephone we have described, permit the hope of its useful applications both for civil and military purposes.

* Many of these instruments, sent by railway from Paris to Bologna, operated very well on their arrival, without the necessity of touching the regulating screw.

THE MEXICAN INDUSTRIAL EXHIBITION.

It has been announced officially at the City of Mexico that the proposed Industrial Exhibition of the products of Mexico and the United States will open on Jan. 15, next year (1880). The construction of the building has been begun already. The Department of Public Works is acting with energy in the matter. Full information will be promptly furnished to American manufacturers and the press. President Diaz is resolved that nothing shall be left undone to make the exhibition successful and advantageous to the industries of Mexico and the United States.

The Western merchants, who lately started on a commercial mission to Mexico with so much enthusiasm, returned less confident of a speedy development of trade with that country. Trade revolutions are not brought about simply by willing them. New markets have to be won by patient effort, not less in educating new customers than in learning how to supply wants already existing. Exhibitions like the one proposed may help wonderfully in both directions; and it is to be hoped that the efforts of President Diaz will not go unseconded here.

THE AGRICULTURAL EXHIBITION IN LONDON.

The Royal Agricultural Society of England will hold a great agricultural show in London, June 30 to July 7 next. Special efforts are making to insure a successful exhibition. Several classes are open to American competition. Entries must be made on printed forms, to be obtained of the secretary of the society, Mr. H. M. Jenkins, No. 12 Hanover Square, London, W., England. No entry fee is required for American exhibitors. In view of the importance of England as a market for American farm produce, the advantage of being well represented at the coming exhibition need not be enlarged upon. In most cases the entries must be made by producers and owners, so that farmers cannot rely on dealers and exporters to make a display for them.

Improvement in the Iron Trade.

The iron trade shows a decided upward tendency; prices are advancing, and the demand is better than for several years. A Philadelphia paper reports that all the Pennsylvania rail mills are full of work, while structural iron is in such demand that many of the larger mills are engaging other mills to fill their orders. Most of the producers of steel rails in that State already have their production sold for months ahead. One mill lately had to decline an order for nearly 20,000 tons at favorable prices owing to inability to fill it. The demand for sheet iron and bar iron is also strong. It is further reported, on the authority of one of the largest machine tool establishments in Philadelphia, that the demand for heavy machinery is greater than for several years past.

* On the evening of April 27, 1878, with two receivers, which had been placed in one of the saloons of the Society of Arts of Milan, more than 500 persons were enabled to hear the sounds and voices produced at a distant station. In the same manner, on the evening of August 27, 1878, during the lecture of Professor Cornu, in the grand amphitheater of the Conservatory of Arts and Artisans of Paris, all present were able to hear the singing and the sounds produced in a saloon situated at a great distance, which were reproduced by means of two receivers suspended in the amphitheater.

† On the evening of April 7, 1878, an experiment was made on a telegraph line between Bologna and Ferrara, which is 154 miles long. The numerous auditors assembled at each end of the line were enabled to hear perfectly the sounds, the words, the songs, which were emitted from the opposite station. In the experiments made in Bologna, Ferrara, Milan, Pavia, and lastly in Paris before the Physical Society, the Academy of Sciences, at the Exhibition, etc., the resistances of the lines were much less.

TO INVENTORS.

An experience of more than thirty years, and the preparation of not less than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly, the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent complete—including the model—to the Patent Office the same day the papers are signed at our office or received by mail, so there is no delay in filing the case, a complaint we often hear from other sources. Another advantage to the inventor in securing his patent through the Scientific American Patent Agency, it insures a special notice of the invention in the SCIENTIFIC AMERICAN, which publication often opens negotiations for the sale of the patent or manufacture of the article. A synopsis of the patent laws in foreign countries may be found on another page, and persons contemplating the securing of patents abroad are invited to write to this office for prices, which have been reduced in accordance with the times, and our perfected facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN.

Business and Personal.

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

Steam Tug Machinery, Engines, Boilers, Sugar Machinery. Atlantic Steam Engine Works, Brooklyn, N.Y.

Jarvis Patent Boiler Setting, same principle as the Siemens process for making steel; burns screenings and all kinds of waste fuel, without blower. A. F. Upton, Agent, 48 Congress St., Boston, Mass.

Valves and Hydrants, warranted to give perfect satisfaction. Chapman Valve Manuf. Co., Boston, Mass.

Try the new fragrant Vanity Fair Cigarettes, both plain and halves. Most exquisite of all.

Save Fuel by using Steam Boiler Damper Regulator. National Iron Works, New Brunswick, N. J.

Gold, Silver, and Nickel Plater wants situation. Address Plater, Oakville, Conn.

Small Metal Tubing; Gold and Silver Plated Metal; Hard Solders. J. U. Gerow, 44 State St., Brooklyn, N.Y.

Engines, ½ to 5 H. P. G. F. Shedd, Waltham, Mass.

Manufacturers of Bag Fasteners will please address, with circular, P. O. Box 737, Carbondale, Penn.

Vertical and Yacht Engines. F. C. & A. E. Rowland, New Haven, Conn.

Patents Sold on Commission.—Describe patent and inclose stamp. Address W. Taft, Tolland, Conn.

Auction Sale.—The well known Hardie's Machine Works, 62 Church St., Albany, N. Y., will be sold March 26, at noon. Address as above for circulars.

Greatest improvement of the age in Artificial Limbs. Perfect-fitting Elastic Limbs of pure dental rubber, made on fac-simile cast of natural limb. Great strength, elasticity, durability, lightness. Address C. T. Mason, Jr., 1330 Chestnut St., Philadelphia.

Amateur Photo. Apparatus, including instructions; outfits complete. E. Sackmann & Co., 278 Pearl St., N.Y.

Wanted—Brown & Sharp Universal Milling Machine, Lathe 36-inch swing, planer about 6-ft. bed, upright drill; all second hand. Address Box 4055, N. Y. P. O., with full description and lowest price.

80 H. P. Corliss Engine for sale low, by J. F. Bishop, New Haven, Conn.

New Gear Cutting Attachment for Lathes. Lace Leather Cutter. Something new. Send for lists. Jackson & Tyler, Baltimore, Md.

Outfits for Nickel and Silver Plating, $5 to $200. Union Silver Plating Company, Princeton, Ill.

Send for Circulars of Indestructible Boot and Shoe Soles to H. C. Goodrich, 40 Hoyne Ave., Chicago, Ill.

For Sale cheap.—3 H. P. Yacht or Stationary Engine and Boiler, good as new. Aug. Franke, Wapakoneta, O.

Kinney Bros.' New Cigarette, Sweet Caporal, fine, mild, and sweet, are becoming extremely popular everywhere.

Wanted.—Information of any improved method or machinery for making Vinegar. Address 909 N. 23d St., St. Louis, Mo.

Want—3 Singer Sewing Machines; 1 Watchman's Time Detecter. Address Millstone, Indianapolis, Ind.

Brown & Sharpe, Prov., R. I. Best Gear Teeth Cutters and Index Plates at low prices. Send for catalogue.

For Sale.—Brown & Sharp Universal Milling Machine; Bement Profiling Machine; first-class 2d hand Machine Tools. E. P. Bullard, 14 Dey St., New York.

For Sale.—7 foot bed Putnam Planer, $350. A. A. Pool & Co., Newark, N. J.

Post Hand, Foot, or Power Band Saws, as good as the best, cut 7½ in. thick; price $35. G. W. Baker, Wil., Del.

Bevins & Co.'s Hydraulic Elevator. Great power, simplicity, safety, economy, durability. 94 Liberty St. N.Y.

A Cupola works best with forced blast from a Baker Blower. Wilbraham Bros., 2,318 Frankford Ave., Phila.

Shaw's Noise Quieting Nozzles and Mercury Pressure Gauges. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Vertical Burr Mill. C. K. Bullock, Phila., Pa.

H. Prentiss & Company, 14 Dey St., N. Y., Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

Case Hardening Preparation. Box 73, Willimantic, Ct.

Hydraulic Elevators for private houses, hotels, and public buildings. Burdon Iron Works, Brooklyn, N. Y.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

Galland & Co.'s improved Hydraulic Elevators. Office 206 Broadway, N.Y., (Evening Post Building, room 22.)

The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are to be sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Pulverizing Mills for all hard substances and grinding purposes. Walker Bros. & Co., 23d & Wood St., Phila., Pa.

Inventors' Models. John Ruthven, Cincinnati, O.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Best Wood Cutting Machinery, of the latest improved kinds, eminently superior, manufactured by Bentel, Margedant & Co., Hamilton, Ohio, at lowest prices.

Steel Castings true to pattern, of superior strength and durability. Gearing of all kinds. Hydraulic cylinders, crank shafts, cross heads, connecting rods, and machinery castings of every description. For price list and circular, address Chester Steel Castings Company, Evelina St., Philadelphia, Pa.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Machine Cut Brass Gear Wheels for Models, etc. (new list). Models, experimental work, and machine work generally. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Walrus Leather, Walrus Wheels; all kinds of Polishing Supplies, in quantities to suit. Greene, Tweed & Co., New York.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of this week.

Safety Linen Hose.—New machinery enables us to offer this Hose lower than ever. Greene, Tweed & Co., New York.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N.Y. Wm. Sellers & Co.

Howard's Bench Vise and Schleuter's Bolt Cutters. Howard Iron Works.

Best Power Punching Presses in the world. Highest Centennial Award. A. H. Merriman, W. Meriden, Conn.

Cutters shaped entirely by machinery for cutting teeth of gear wheels. Pratt & Whitney Co., Hartford, Conn.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Electro-Bronzing on Iron. Philadelphia Smelting Company, Philadelphia, Pa.

Excelsior Steel Tube Cleaner. Schuylkill Falls, Phila., Pa.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

Portland Cement—Roman & Keene's, for walks, cisterns, foundations, stables, cellars, bridges, reservoirs, breweries, etc. Remit 25 cents postage stamps for Practical Treatise on Cements. S. L. Merchant & Co., 53 Broadway, New York.

Needle Pointed Iron, Brass, and Steel Wire for all purposes. W. Crabb, Newark, N. J.

Two of the handsomest and best Guns ever brought to this country, but little used, for sale for less than half their cost. One a double-barreled breech-loading shotgun, and the other a double express rifle. A rare chance to procure two valuable weapons. See advertisement on back page.

"Vick's Floral Guide" contains a colored plate, 500 illustrations, 100 pages, descriptions of the best flowers and vegetables, and how to grow them; all for 5 cents; in English or German. Add. James Vick, Rochester, N.Y.

Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the SCIENTIFIC AMERICAN Export Edition. This paper has a very large foreign circulation.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

(1) H. L. B. writes: In answer to the query of "H. H. H." in the last SCIENTIFIC AMERICAN, I would inform him that the largest steamboat on the Ohio river, at present, is the Southern Transportation Line steamer, Thomas Sherlock, plying between Cincinnati and New Orleans, which is over 300 feet long, measures 1353·02 tons, and has a capacity for 2,000 tons. She has frequently had 1,500 tons on board, and at one time carried a cargo of 1,850 tons freight up the river. The steamers Robert Mitchell, Charles Morgan, and Guiding Star, of the same line, are each over 300 feet long and carry from 1,600 to 1,800 tons. The stern-wheelers, Golden City and U. P. Schenck, also carry about 1,600 tons. The Cincinnati and Louisville United States Mail Line steamer, United States, is over 300 feet long, but her extremely sharp model prevents her from carrying a large cargo. The largest vessel on the Mississippi is the St. Louis and New Orleans Anchor Line steamer, James Howard, which is 336 feet in length, 56 feet beam, 10 feet hold, and has a capacity for over 3,000 tons freight. The new lower Mississippi steamers, J. M. White, Ed. Richardson, and Henry Frank, are probably the largest cotton carriers in the world, each having a capacity for about 12,000 bales. The most powerful towboat on the western waters, the Joseph B. Williams, has frequently taken over a half million bushels of coal down the Ohio and Mississippi rivers at one time, and in March, 1878, took from Louisville to New Orleans a single tow of 34 barges, containing 601,000 bushels or nearly 22,000 tons of coal, landing it without loss at her destination. The tow and towboat made a monster fleet nearly 900 feet long and covering over 4 acres.

(2) H. H. B. writes: We have a 12x24 cast iron whistle, supplied by a 2 inch pipe 25 feet long. Under a pressure of 70 lbs. steam we do not get the heavy sound the manufacturer expected. Could we benefit it by shortening the supply pipe? A. If you desire a deeper tone lengthen the bell. The thickness of the bell may have some influence on the quality of the tone, but it does not affect the pitch. The difficulty may be in the adjustment of the bell.

(3) B. C. M. asks: 1. Is there any way to prepare paper so that it will be colored by passing a current of electricity through it? A. Saturate the paper with a solution of potassium iodide in ten parts of thin starch water well boiled, and dry; or use a solution of about 3 parts of potassium ferrocyanide in 20 of water. It is best to slightly moisten these papers before using; the latter requires an iron or steel pen or style. 2. Is it possible to adapt a carbon battery, such as is used with Edison's electric pen, so that it can be used for the electric pen described in a recent number of your paper? A. Yes.

(4) F. F. H. asks: How is "gilder's wax" made to color gold? A. Oil, 25 parts; yellow wax, 25 parts; acetate of copper, 13 parts; red ocher, 37 parts. The whole is melted, and stirred until cold.

(5) E. O. D. asks: Will plaster of Paris answer as material for making porous cells for Bunsen batteries? If so, how do such cells compare with those made of fine clay? A. It has been used, but cannot be recommended. Porous clay cells are to be preferred to anything else.

(6) W. H. H. asks: Can you refer me to a good book on refining crude petroleum oil? A. "A Practical Treatise on Coal, Petroleum, and other Distilled Oils," by A. Gesner.

(7) W. B. P. asks: Can rubber be melted and run into moulds like lead or any metal, and get a correct and true copy, such as would do for rubber stamps? A. No; rubber when melted loses its character by partial decomposition, and remains soft and sticky on cooling. Unvulcanized caoutchouc can be softened by a gentle heat, so as to copy a mould when pressed into it. See articles on vulcanized rubber, pp. 48 and 105, vol. 39, SCIENTIFIC AMERICAN SUPPLEMENT.

(8) C. H.—We think MacCord's drawing lessons contained in the SUPPLEMENT will answer your purpose. For drawing materials address dealers who advertise in our columns.

(9) E. C. R. and F. N.—For process of ebonizing wood, see vol. 39, p. 411 (2), SCIENTIFIC AMERICAN.

(10) L. H. L. asks: How much power will a current wheel give, that is 10 feet in diameter, 20 feet long, with the paddles 18 inches deep in the water? A. Multiply the weight of water in pounds passing by the immersed section of the wheel per minute, by the speed at which it moves in feet per minute, and divide the product by 55,000.

(11) J. W. T. asks: 1. Where to obtain latest and best information on the following: How to analyze soils, manures, foods, etc.? A. Fresenius' "Quantitative Analysis," contains full and complete directions for the analysis of soils and manures. There is no work having special reference to the analysis of foods. Consult also, "Agricultural Qualitative and Quantitive Analysis," by G. C. Caldwell. 2. What book or books best suited to assist in gaining a knowledge of agricultural chemistry? A. "Agricultural Chemistry," by James F. W. Johnston, F. C. S., is a most thorough and complete treatise on this subject.

(12) J. D. writes: We desire to know what is the best method for separating gold and platinum filings, our object being to get the gold. A. Cover the scraps with warm aqua regia (nitric acid 1 part, hydrochloric acid 3 parts) and digest for an hour; pour off the solution and repeat the digestion with fresh acid as long as any residue remains undissolved. Evaporate the acid solutions nearly to dryness, dissolve the residue in warm water slightly acidified with hydrochloric acid, and add strong aqueous solution of sal ammoniac in slight excess. Collect the precipitate (ammonium platinum chloride) on a filter, wash it with water, and to the warmed filtrate (with washings) add excess of aqueous solution of copperas (ferrous sulphate). Collect the finely divided gold precipitated, dry, mix it with a few fragments of borax, and melt in a small black lead crucible. Mix the platinum precipitate with a few fragments of zinc and dilute hydrochloric acid, and when all the metal has been precipitated dry, and fuse it in a small shallow lime crucible by means of the oxy-hydrogen blow pipe.

(13) W. S. asks how to groove the edges of the spectacle lenses so as to put in the frame that has no groove? A. Use in a lathe a thin copper disk supplied with emery and water.

(14) X. Y. Z. asks: What will make a good stain (walnut) for pine, poplar, or maple wood? A. Water, 1 quart; washing soda, 1½ oz.; Vandyke brown, 2½ oz.; bichromate of potash, ¾ oz. Boil for 10 minutes, and apply with a brush, in either hot or cold state, diluted with hot water, if necessary.

(15) R. M. asks how a dark color may be imparted to rifle barrels. A. They are generally blued by heat.

(16) R. & Co.—The beetle which you send is the common "larder beetle" (*Dermestes lardarius*). It was the larva of this insect that committed the depredations of which you complain. Professor C. V. Riley recommends the sprinkling of fabrics with benzine occasionally as a remedy against the incursions of this pest.

(17) F. G. D.—For bells use copper 77, tin 23. Use borax as a flux. Pour quite hot. For the mould use the sand as dry as possible. Bells injured by cooling too quickly may be tempered by reheating them and allowing them to cool slowly.

(18) G. W. D. writes: I have a water wheel 10 feet in diameter giving me ten horse power. How much power will I get from a wheel 20 feet in diameter? The stream of water is sufficiently large for either. A friend claims that the power will be exactly doubled, which I doubt. A. It is possible to double the power with the new wheel, if you have abundance of water. You can effect the same result with the present wheel, however, by running it faster.

(19) "Reader" asks about what length of time a sheet of boiler iron three thirty-seconds inch in thickness will last in the ground before it will rust through. Also what length will it last with three coats of pitch? A. From 1 to 5 years, according to the nature of the ground. If well coated with pitch, it will last an indefinite period.

(20) T. C. C. asks: 1. What can I use to fill the pores of walnut to prepare it for varnish, and how is it applied? A. Apply several coats of alcoholic shellac varnish, and when dry rub them down with moistened pumice powder. 2. What kind of varnish is best? A. Clear copal varnish gives a fine finish. 3. How is veneering done? A. Moisten one side of the veneer with warm water, coat the other with hot glue, apply the glued side to the surface to be veneered, and clamp securely in position until the glue has set. If not sufficiently moistened on the reverse side the veneer will curl so that it cannot be smoothly applied.

(21) L. A. B. writes: 1. I am making some curved rulers of hard maple from patterns in the SUPPLEMENT. What can I soak them in to make them tough and hard? A. Soak them for about 24 hours in a strong aqueous solution of lead or aluminum acetate, and then for several hours in warm solution of soap in 48 per cent alcohol. Wash with water and dry slowly. 2. Do artists in drawing use a rest for the hand or arm, or are they entirely free from the paper? A. A rest is used for some kinds of work.

(22) F. A. W. asks how to make red impression paper, suitable for marking fretwork patterns on black water. A. Rub into a suitable tissue a mixture of 6 parts of lard, 1 part of beeswax, and a sufficient quantity. Venetian red, red lead, or vermilion, in very fine powder. The mixture should be warm, and should not be applied in excess.

(23) H. G. O. asks for the most efficient method of putting a white coating on brass, with block tin, commonly known as "white washing." A. Boil together 6 lbs. cream of tartar, 4 gallons of water and 8 lbs. of grain tin or tin shavings for half an hour in a porcelain lined vessel; put the clean brass ware in the boiling liquid for a few minutes or until properly coated. A boiling solution of potassium or sodium stannate mixed with tin turnings may be employed instead of the above.

(24) C. W. F. asks: How can I clean 10 or 12 lbs. of mercury of mechanical impurities, otherwise than by distilling? A. Pierce the apex of a dry filter (cornet) with a pin point, adjust the paper accurately to a funnel, and gently pour in the mercury. If the mercury is dry and the impurities are purely mechanical it will rarely be necessary to repeat the filtration. The metal may be freed from gross impurities by passing it through a piece of chamois skin free from holes.

(25) S. D. M. writes: 1. The expression of a horse power is 33,000 lbs. raised 1 foot high in 1 minute. What is the expression of a two horse power? A. 66,000 foot pounds per minute. 2. Theoretically will the principle of the hydrostatic press remain the same if air be substituted for water? A. Yes. 3. By increasing the blast through a blow pipe, the heating effect where the flame impinges is augmented. Does an increase in the combustion of the spirits take place, or is it entirely accounted for by the increase of oxygen in the blast? A. The temperature is augmented through the more rapid oxidizement of the combustible. The blast also mechanically concentrates and impels the highly ignited gas against the object to be heated. An excess of blast, however, cools or extinguishes the flame. 4. Is there a good pocket book on mechanical engineering published, similar in character to those used by civil engineers in their profession? A. There are several, Nystrom's, Spon's, and others.

(26) H. F. D. asks: Do plants make air pure or impure in a room? A. It depends somewhat upon the character of the plants, and their number. If the plants are few in number and the apartment is properly ventilated, ordinarily no danger need be apprehended. 2. Does zinc get harder to melt the more you melt it? If so, why? A. No. 3. What is the best mould made of to cast lead in? A. A well dried plaster of Paris mould does very well for small castings. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 17. 4. Would a steam engine of ¾ horse power be sufficient to run a sewing machine or turning lathe? A. Yes.

(27) "Old Subscriber" asks: What coating or varnish can I use to make *papier maché* fireproof? A. Apply a hot saturated aqueous solution of commercial tungstate of soda or of waterglass. Repeat the application several times.

(28) F. G. P. asks if there are any chemicals that would act like a loadstone. A. No; several of the compounds of iron besides magnetite are magnetic, but the property is not sufficiently marked in any of these to satisfy your requirements. Have you tried small steel magnets or magnetized needles? See "Phil. Trans.," 1855 and 1856, also "Watts's Dictionary of Chemistry," vol. iii. p. 776.

(29) "Reader" asks: What will remove the crust from the inside of a boiler? It collects on the flues almost half an inch thick. A. The use of fresh water is the most ready means of removal, though there are some patented compounds in the market that are well spoken of.

(30) H. L. S., referring to the electric pen described in our issue of February 22, states that there is no need that the writing slab of metal should be insulated; and if well connected with the ground and one of the poles of the coil, it may be handled with impunity while the coil is working. The sparks will now pass quite as well from the stylus connected with the other pole, as though the metal plate on which the paper rested was insulated.

(31) J. R. D. asks: 1. Can ordinary paraffine, such as is used in making so-called wax candles, be dissolved by heat or made to fuse with boiled linseed oil, and if so fused will it remain? What will dissolve the same, and how can it be made into a liquid or semi-liquid form and remain in that form? A. Stir the paraffine into the hot oil—this will afford an emulsion, if not a true solution. Paraffine is quite soluble in benzole. 2. What is the substance used in making the gloss on rubber shoes? A. A benzole solution of asphaltum and caoutchouc is used, we believe.

(32) A. L. S. asks: 1. Would a Leclanche battery with a proper induction coil give a spark the required length for an electric pen? A. Yes, but it is hardly constant enough for continued use. 2. How large a coil should I need? A. A coil that will yield an eight inch spark will do. For full directions for making induction coils, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 160.

(33) J. L. C. writes: With feed water at a temperature of 208°, I am burning 142,000 lbs. of coal in a given time. What per cent of fuel can I save if I increase the temperature of feed water to 225°, the increase of temperature to be effected by conveying the water through pipes located at or near base of chimney, or flue leading to same? A. One and seven tenths per cent nearly.

(34) D. P., Jr., writes: We have a 36 inch crosscut circular saw which is geared as follows: line shaft 240 revolutions to minute, 32 inch pulley on line shaft running on 12 inch pulley on counters, 18 inch pulley on counter connecting with 11½ inch pulley on mandrel. We think this should give the saw a speed of 1001 revolutions, but it evidently has not that speed. Is the fault in the counter pulleys being too small? We have tried working tight belts, yet the desired speed is not attained. A. If there be no slip to your belts you should obtain the speed named, but the first pair of pulleys are small for their work, and the slip is probably 5 to 8 per cent. Substitute a 34 or 36 inch pulley for your 32 inch one.

(35) F. A. S. asks: 1. Is it a fact that building paper is merely a nest for rats, mice, and various pestiferous vermin? A. No; when of sufficient thickness, and well lapped and nailed at the joinings, it is beneficial in keeping a house warm. 2. Do you know of any way of using battens, in the construction of a cottage, and still make the building as warm as if siding were used? A. Yes; by tonguing and grooving the boards, and driving them tight together, before covering the joint with the batten. 3. Is a house, framed as is the custom when battens are used, rigid enough for this climate? A. Yes, if the posts and studs are placed close enough together and well braced. More studs, of course, should be placed on the sides of the house that support the ends of the floor beams, than there need be in the front and rear. 4. Is there any way of preventing the battens from warping, or in case they do lose their shape, exclude the air from the house? A. Make them quite narrow and nail them well. Should any battens show a tendency to warp and spring loose, secure them again with screw nails driven with the hammer.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

COMMUNICATIONS RECEIVED.

Electric Motor. By W. E. S.
Liquid Fuel. By A. S.
Telegraphic Writing Machine. By M. W. C.
On a Problem. By C. T.
On Lice. On a Cheap Turning Lathe. By S. E. T.
On Ice Cave. By H. M. W.
On Warming. By H. B. F.
Action of Culinary Substances, Vessels of Pottery Ware. By E. H. S. B.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

R. G.—A test of the sample revealed neither gold nor silver; it is a piece of red sandstone containing a small quantity of lime carbonate.—E. A. M.—It is not a meteorite, but marcasite embedded in quartz. The brown coloration is due to the conversion of ferric sulphide into ferric oxide.—T. B. F.—No. 1 is a weathered sedimentary rock, consisting principally of aluminous silicate, lime, and oxide of iron. No. 2 is limonite—hydrous iron sesquioxide—an iron ore. No. 3 contains magnetic and ferric sulphides.—J. V. R.—No. 1 is orthoclase. No. 2, chert. No. 3, serpentine or greenstone. None of these are of value. We cannot judge of the possible mineral value of the properties from the samples.—J. K. B.—No. 1. Chalcocite or copper glance—when pure composed of copper 79·8, sulphur, 20·2. No. 2. It contains altered serpentine, quartz, and ferropyrite. No. 3. Calcite—crystallized calcium carbonate—with serpentine. No. 1 may be of some value.—C. S. W.—The substance consists of iron oxide and black oxide of manganese—the latter is of some commercial value.—W. R. R.—The small fragments consist chiefly of iron sulphide. It contains traces of gold. Some of this ore may prove of value.—W. B. M.—It is mica schist of no value.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 11, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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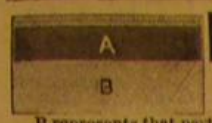

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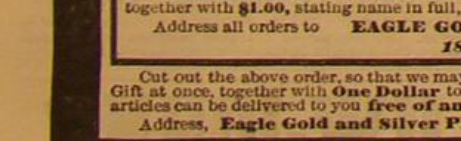

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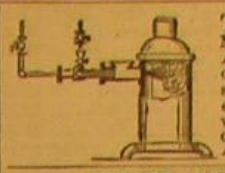

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New Illustrated Circular of Novelties free.

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THE WORTHINGTON DUPLEX PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water-Works Stations.
STEAM PUMPS—Duplex and Single Cylinder.

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...aker Rotary Pressure Blower.
(FORCED BLAST)

Warranted superior to any other.
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HOOPES, BROTHER & THOMAS,
CHERRY HILL NURSERIES, West Chester, Pa.

OUR NEW-YEARS GIFT.

A $6.00 NEW YEAR'S GIFT
—OF—
COIN-SILVER TABLEWARE
Given Away

CONSISTING OF

An Elegant Set of Warranted Extra Coin-Silver Plated TEA-SPOONS that retails at $4.50 per Set, and an Elegant Extra Coin-Silver Plated BUTTER-KNIFE that retails at $1.50, and one Elegant FIVE-BOTTLE CASTER that retails at $7.00, thus making a valuable and useful Gift, that all should receive at once.

Under a very favorable proposition from the old established and reliable **Eagle Gold and Silver Plating Co.,** Cincinnati, O., you will be supplied with this valuable Silver Tableware as a New-Year's Gift. This **elegant set of**

SILVER TEASPOONS AND BUTTER-KNIFE

are of the latest style pattern, and **each article is to be engraved with your name or initials,** if desired, **FREE,** thus making the most useful and beautiful Gift ever presented. Don't neglect to send your Initial or name with orders to be engraved.

Cut out the following order and send it to the **Eagle Gold and Silver Plating Co.,** at Cincinnati, for redemption, together with sufficient to pay boxing, packing, postage, or express charges. **This Silverware is to cost you nothing,** except the packing, postage, or express charges, (which is one dollar,) which you are required to send, and the Silverware is then

DELIVERED TO YOU FREE.

☞ Please cut out the following New-Year's Gift Silverware Order, and send same to **Eagle Gold and Silver Plating Co.,** 180 Elm Street, Cincinnati, Ohio.

☞ *Cut Out this Order, as it is worth $6.00.* ☜

NEW-YEAR'S GIFT SILVERWARE ORDER.

On receipt of this order and **$1.00,** to pay postage, packing, or express charges, we will mail you FREE one Set of Extra Coin-Silver Plated Teaspoons worth $4.50, also one Elegant Butter-Knife worth $1.50, with your monogram initial engraved upon same in good style—thus making the Elegant Set of $6.00

TEASPOONS AND BUTTER-KNIFE

a valuable and useful FREE New-Year's Gift to you. Send for Silverware at once, together with **$1.00,** stating name in full, with post-office, county, and State.

Address all orders to **EAGLE GOLD AND SILVER PLATING CO.,**
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Cut out the above order, so that we may know you are entitled to it, and send for the Gift at once, together with **One Dollar** to pay postage and packing charges, so that the articles can be delivered to you **free of any expense.**

Address, **Eagle Gold and Silver Plating Co., 180 Elm St., Cincinnati, O.**

OUR NEW-YEARS GIFT.

STEAM AND HYDRAULIC
Passenger and Freight Elevators,
STEAM ENGINES AND BOILERS,
WHITTIER MACHINE CO., Boston, Mass.

B. W. Payne & Sons, Corning, N. Y.
Established in 1840.

Eureka Safety Power.

h.p.	cyl.	ht.	space.	wt.	price.
2	3½x4	48 in.	40x25	900	$150
4	4x6	56	46x30	1600	250
6	5x7	72	72x42	2700	400

Also, SPARK ARRESTING PORTABLES, *and* Stationary Engines *for Plantations.* Send for Circulars.

$7 A DAY to Agents canvassing for the **Fireside Visitor.** Terms and Outfit Free. Address P. O. VICKERY, Augusta, Maine.

MACHINIST GOODS
And Small Tools of all kinds. Catalogues sent free.
A. J. WILKINSON & CO., Boston, Mass.

RIVAL STEAM PUMPS. JOHN H. McGOWAN & Co $35. & UPWARDS CINCINNATI OHIO.

Soft, Strong, and Smooth Iron or Brass **CASTINGS** Plain, Galvanized, Bronzed or Nickled to order promptly.
Also patterns and models. Light work a specialty.
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FOR SALE—A patent Fan Attachment for Sewing Machines; also, a patent arrangement for drawing Mosquito Bars. For particulars, address L. A. Abbot, Natchez, Miss.

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E. & F. N. SPON, 446 Broome St., New York.

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Moss' Process.
Photo Engraving Co.
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A SUPERIOR SUBSTITUTE FOR WOOD-CUTS
AT MUCH LOWER PRICES.

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They have a perfectly smooth printing surface, and the lines are *as deep, as even,* and *as sharp* as they could possibly be cut by hand.

Electrotypes may be made from them in the same manner as from wood-cuts.

Copy. The engraving is done either from prints or pen-drawings. Almost all kinds of prints can be re-engraved directly from the copy, provided they be in *clear, black lines* or stipple, and on *white* or only slightly tinted paper.

Pen drawings, suitable for engraving by us, must be made with *thoroughly* BLACK ink, on *smooth, white* paper. They should usually be made twice the length and twice the width of the plates desired.

When such drawings cannot be furnished us, we can produce them from photographs, pencil sketches, or designs of any kind accompanied with proper instructions. Photographs taken in the usual way, and of any convenient size, we can use.

Change of Size.—Wood-cut prints of the coarser kind may often be reduced to half their lineal dimensions, while others will admit of very little reduction, and some of none at all.

Most lithographic and steel-plate prints will admit of no reduction.

Very fine prints of any kind may be *enlarged* moderately without detriment.

Any prints which cannot be satisfactorily reduced or enlarged may be *redrawn* and thus brought to any desired size.

In all cases of reduction and enlargement, the relative proportions remain unchanged.

Proofs.—Whenever desired, we will furnish tintype proofs of the drawings made by us, for approval or correction, before engraving. A printed proof is furnished with each plate.

Time.—We cannot usually engage to fill an order for a single plate in less than from three to six days; larger orders will require longer time.

Estimates will be promptly furnished when desired. That these may be definite and correct, the copy to be used—whether print, photograph, sketch, or drawing—should always be submitted for our examination, together with a distinct statement of the size of plate wanted, and of any other details to be observed.

Terms.—To insure attention, all orders must be accompanied by an advance of half the price charged, the balance to be paid on delivery.

Electrotyping and Printing.—We have recently added to our establishment excellent facilities for making electrotypes, and also three power presses specially fitted for printing plates of all sizes in the finest manner.

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Our General Circular contains a few specimens of the various kinds of our work, and will be sent on receipt of stamp. We have just prepared five special circulars, as follows:

No. 1. Portraits and Figures.
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" 3. Machinery and Apparatus.
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" 5. Reproductions from Wood-Cuts, Steel-Plate Prints, and Lithographs.

These will be furnished at *ten cents* each.

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STILES & PARKER PRESS CO., Middletown, Ct.

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MALLORY, WHEELER & CO.,
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Roots' Rotary Hand Blower,

FOR ALL KINDS OF BLACKSMITHING.
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SEND FOR PRICED CATALOGUE.

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We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing, specially adapted to Flour Mills. Send for catalogue.
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Portable and Stationary, at Low Prices.
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"New and Improved Patterns." 20 per cent. off list.
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ACUTE OR CHRONIC
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OF PARIS AND LEIPZIG.

IMMEDIATE RELIEF WARRANTED. PERMANENT CURE GUARANTEED. Now exclusively used by all celebrated Physicians of Europe and America, becoming a staple, Harmless, and Reliable Remedy on both continents. The Highest Medical Academy of Paris report 95 cures out of 100 cases within three days. Secret—The only disadvantage of the poisonous Uric Acid which exists in the Blood of Rheumatic and Gouty Patients. $1.00 a Box; 6 Boxes for $5.00. Sent to any address on receipt of price. ENDORSED BY PHYSICIANS. SOLD BY ALL DRUGGISTS. Address
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Only Importers' Depot, 212 Broadway, cor. Fulton St., New York.

J. LLOYD HAIGH,
Manufacturer of
WIRE ROPE
of every description, for Railroad and Mining Use, Elevators, Derricks, Rope Tramways, Transmission of Power, etc. No. 81 John St., N. Y. Send for price list. Plans and Estimates furnished for Suspension Bridges.

19th Annual Statement of the EQUITABLE Life Assurance Society of the U. S.
HENRY B. HYDE, President.
For the Year Ending December 31, 1878.

AMOUNT OF LEDGER ASSETS, JAN. 1, 1878		$32,477,991 97	
Less Depreciation in Government Bonds, and Appropriation to meet any depreciation in other assets		369,553 27	
		32,108,438 00	
INCOME		8,217,943 24	
		$40,326,381 84	
DISBURSEMENTS.			
Paid Policy Holders for Claims by Death, Dividends, Surrender Values, Discounted and Matured Endowments and Annuities	4,935,171 43		
Other Disbursements as per extended statement	1,196,841 88		
NET CASH ASSETS, December 31, 1878		$34,195,368 53	
ASSETS.			
Bonds and Mortgages	$12,437,584 93		
Real Estate	6,534,904 96		
United States Stocks	5,638,768 54		
State, City, and other Stocks authorized by the Laws of the State	6,301,978 16		
Loans secured by United States and other Stocks	928,000 00		
Cash and other Ledger Assets as per extended statement	2,154,131 94		
		$34,195,368 53	
Market Value of Stocks over Cost	129,796 41		
Accrued Interest, Rents, and Premiums, as per extended statement	1,128,927 42		
Total Assets, Dec. 31, 1878		**$35,454,092 36**	
TOTAL LIABILITIES, including legal reserve for reinsurance of all existing policies	28,560,268 00		
Total Undivided Surplus		**$6,893,824 36**	

Risks assumed in 1878, 6,115 Policies, assuring $21,440,213 00.
N.B.—For the details of the above statement, see the Society's "Circular to Policy Holders," and other publications for 1879.
JAMES W. ALEXANDER, Vice-President.
E. W. SCOTT, Superintendent of Agencies.
SAMUEL BORROWE, Secretary.

Harris' Corliss Engine,

Built by WM. A. HARRIS, Providence, R. I. The ONLY place where this engine can be obtained. Send for pamphlet containing full details; also list of sizes with H. P. For the convenience of Western parties meaning business and wishing to confer with me at any stated time at their mill or works, I will visit them by receiving notice and giving me a latitude of 2 to 4 weeks. Those visiting New York and wishing to confer with me there by appointment, will find me or my agent every Wednesday (or Thursday if so stated in appointment) at H. T. Brewster's office, 97 Liberty Street.
WM. A. HARRIS, Proprietor.

WARRANTED THE BEST.
1 H. P. Boiler & Engine, $150.
2 H. P., $175. 3 H. P., $200.
Tested to 200 lbs. Steam.
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152 N. 3d St., Philadelphia, Pa.,
Builders of Engines and Boilers, 1 to 100 horse power. Send for circulars and prices, and state size and style you want.

FOR SALE CHEAP.
A very handsome Westley Richards Breech-Loading Shot Gun.

Weight, 8 lbs. 6 ozs.; 10 gauge; central fire; Brazier locks. A first-class gun in every respect, and but slightly used. A gun suitable for general shooting.
Also a very fine double-barreled, central fire
EXPRESS RIFLE,
No. 577 bore. Weighs about 8 lbs. English sole leather case with tools complete. A splendid weapon for deer and bear shooting. Built by E. M. Riley & Co., London.
Address HODGKINS & HAIGH,
296 Broadway, New York.

Retail **9 CENTS** per pound.
Warranted of the hardest temper, and never to settle.

Established 1843.
Steel Horn, warranted not to break, and Face of *Best Cast Steel.*
Better than any English make, and only one that is fully
!! WARRANTED !!
50 sizes, from 1-2 lb. to 800 lbs.
Catalogues furnished on application.

THE
CAMERON STEAM PUMP,
Also known as the "SPECIAL" PUMP, is the standard of excellence at home and abroad. For Price Lists, address
CAMERON PUMP WORKS,
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SHEPARD'S CELEBRATED
$50 Screw Cutting Foot Lathe.
Foot and Power Lathes, Drill Presses, Scrolls, Circular and Band Saws, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.
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ENGINEER and MACHINIST. Flax, Hemp, Jute, Rope, Oakum and Bagging Machinery, Steam Engines, Boilers, etc. I also manufacture Baxter's New Portable Engine of 1877. Can be seen in operation at my store. A one horse-power portable engine, complete, $125; two horse-power, $225; two and a half horse-power, $250; three horse-power, $275. Manufactured exclusively by
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10 Barclay St., New York, or Paterson, N. J.

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Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York.
Wheels and Rope for conveying power long distances. Send for circular.

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Builder of Harris-Corliss Engines, Providence, R. I.

SALESMEN WANTED $125 A Month and Expenses willing to DEALERS SAMPLES FREE. Send 3c. STAMP to CIGARS
J. FOSTER & CO., Cincinnati, O.

BEST AND CHEAPEST FOOT POWER SCREW CUTTING ENGINE LATHES
$100.
SEE FULL DESCRIPTION IN SCIENTIFIC AMERICAN, JULY 27
SEND FOR ILLUSTRATED CATALOGUE
GOODNOW & WIGHTMAN
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WAREHOUSE, 98 WILLIAM ST., NEW YORK.
JOHN W. QUINCY, Manager.
Unequaled for strength, durability, and uniformity. Send for circulars for proof that it will do 50 per cent. more work than any other Cast Steel and that it is cheapest and best to use.

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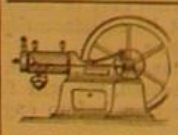

An engine that works without Boiler. Always ready to be started and to give at once full power.
SAFETY, ECONOMY, CONVENIENCE.
Burns common Gas and Air. No steam, no coal, no ashes, no fires, no danger, no extra insurance. Almost no attendance.
THE NEW OTTO SILENT GAS ENGINE.
Useful for all work of small stationary steam engine. Built in sizes of 2, 4, and 7 H. P. by SCHLEICHER, SCHUMM & CO., 1045 Chestnut Street, Phila., Pa. H. S. Manning & Co., 111 Liberty St., N. Y., Agents.

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Such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, and Wood-Working Machinery generally. Manufactured by
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WM. D. ANDREWS & BRO.,
NEW YORK.

FOR TEN DOLLARS CASH,
we will insert a seven-line advertisement one week in a list of 260 weekly newspapers, or four lines in a different list of 337 papers, or ten lines two weeks in a choice of either of four separate and distinct lists containing from 70 to 100 papers each, or four lines one week in all four of the same lists, or one line one week in all six lists combined, being more than 1,000 papers. We also have lists of papers by States, throughout the United States and Canada. Send 10 cents for our 100 page pamphlet. Address GEO. P. ROWELL & CO., Newspaper Advertising Bureau, 10 Spruce Street, New York.

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The only Machines giving a solid core showing exact nature of rocks passed through.
THE AMERICAN DIAMOND ROCK BORING CO.
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No Sawdust! No Planing!

Thin lumber, 1-16 to ¼ inch thick, cut and seasoned by our recently patented machines, equal if not superior to the sawed and planed wood, being smooth, flat, and in all cases perfectly seasoned. Used by the largest manufacturers in the country, and giving entire satisfaction. In addition to our specialty, our usual complete stock of sawed Hardwood, Lumber, and Veneers, figured and plain, Burls, etc.
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STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
GEO. PLACE, 121 Chambers St., New York Agent.

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MANUFACTURED BY BURLEIGH ROCK DRILL CO.
SEND FOR PAMPHLET. FITCHBURG, MASS.

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Pyrometers, For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc.
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NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
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WOOD WORKING MACHINERY.
PLANING, MATCHING, MOLDING, MORTISING, TENONING, CARVING, MACHINES, BAND & SCROLL SAWS, UNIVERSAL AND VARIETY WOOD WORKERS, &c. &c.
J. A. FAY & CO.
CINCINNATI, O. U. S. A.

TELEPHONE Works 1 mile. Price $4. Pat'd. Circulars free. HOLCOMB & CO., Mallet Creek, Ohio.

The George Place Machinery Agency
Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.

IMPORTANT FOR ALL CORPORATIONS AND MANF'G CONCERNS.—**Buerk's Watchman's Time Detector,** capable of accurately controlling the motion of a watchman or patrolman at the different stations of his beat. Send for circular.
J. E. BUERK, P.O. Box 979, Boston, Mass
N. B.—The suit against Imbaeuser & Co., of New York, was decided in my favor, June 10, 1874. A fine was assessed against them Nov. 11, 1876, for selling contrary to the order of the court. Persons buying or using clocks infringing on my patent will be dealt with according to law.

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The great fall which has taken place in the prices of Iron, and especially in Beams used in the construction of FIRE PROOF BUILDINGS, induces us to call the special attention of Engineers, Architects, and Builders to the undoubted advantages of now erecting Fire Proof structures; and by reference to pages 52 & 54 of our Book of Sections—which will be sent on application to those contemplating the erection of fire proof buildings. THE COST CAN BE ACCURATELY CALCULATED, the cost of Insurance avoided, and the serious losses and interruption to business caused by fire; these and like considerations fully justify any additional first cost. It is believed, that, were owners fully aware of the small difference which now exists between the use of Wood and Iron, in many cases the latter would be adopted. We shall be pleased to furnish estimates for all the Beams complete, for any specific structure, so that the difference in cost may at once be ascertained. Address
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The PICTET ARTIFICIAL ICE CO.,
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Driven or Tube Wells
furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 414 Water St., N.Y., who control the patent for Green's American Driven Well.

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