SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XL.—No. 9.] [NEW SERIES.] NEW YORK, MARCH 1, 1879. [$3.20 per Annum. [POSTAGE PREPAID.]

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.

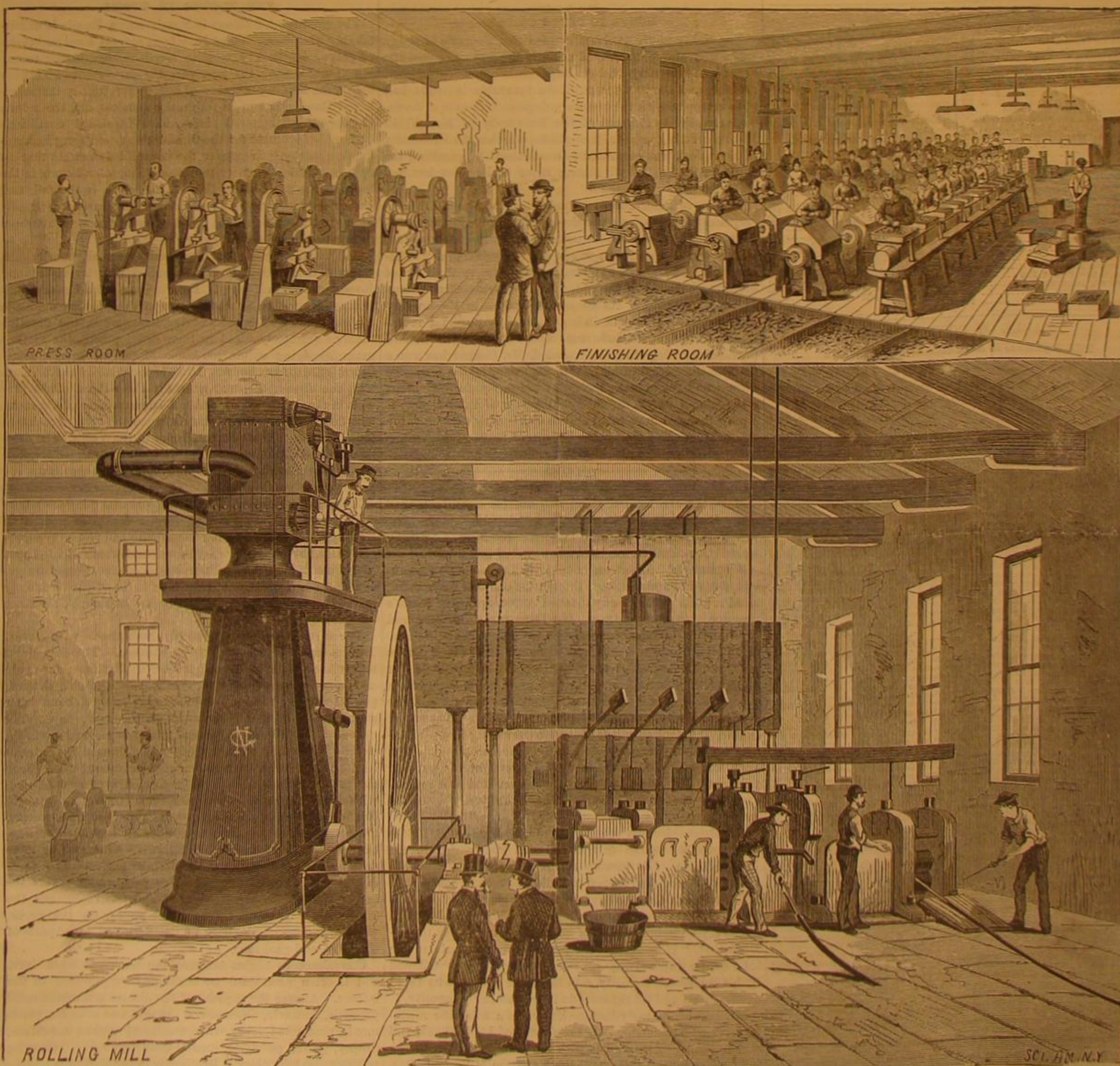
A Mr. Perkins took out letters patent in this country in 1795, for a machine which it was said had a capacity of turning out 200,000 nails a day. This machine eventually found its way to England, where it created great excitement, especially among the manufacturers of hand-made nails.

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

(*Continued on page* 130.)



THE MANUFACTURE OF HORSESHOE NAILS.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included $3 20

One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

☞ Single copies of any desired number of the SUPPLEMENT sent to one address on receipt of 10 cents.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, with handsome cover uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

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

NEW YORK, SATURDAY, MARCH 1, 1879.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF THE SCIENTIFIC AMERICAN SUPPLEMENT No. 165.

For the Week ending March 1, 1879.

Price 10 cents. For sale by all newsdealers.

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.

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*

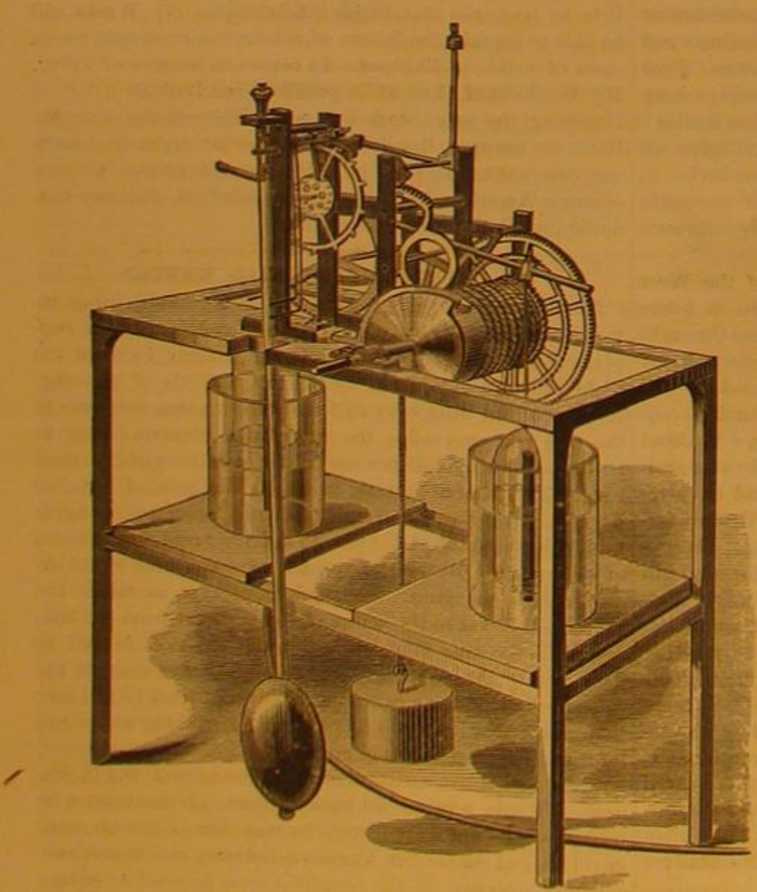


Fig. 1.—PNEUMATIC REGULATOR FOR CLOCKS.

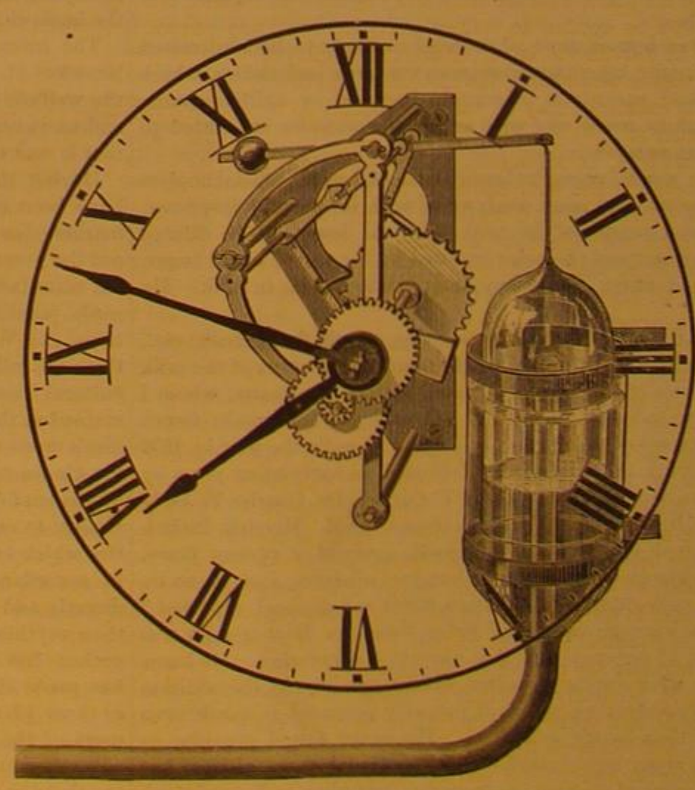


Fig. 2.—PNEUMATIC CLOCK.

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.

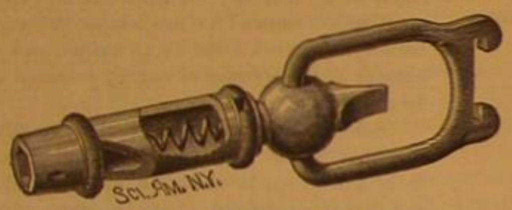
Starvation in the Nursery.

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.

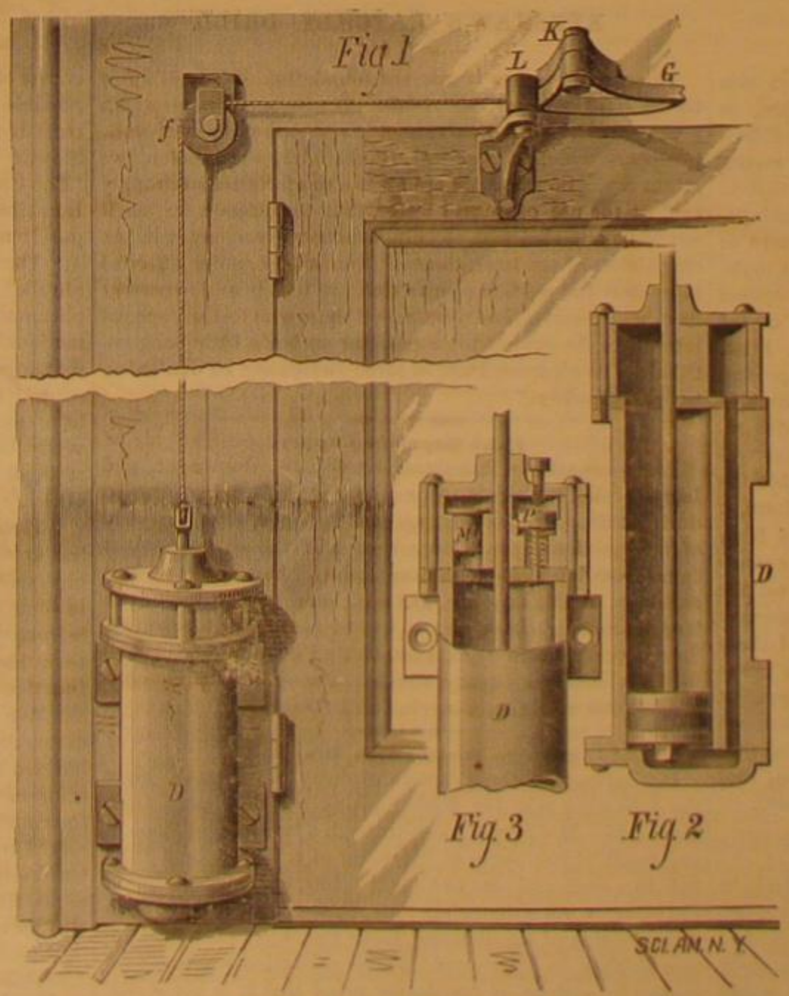
A NOVEL DOOR CHECK.

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.

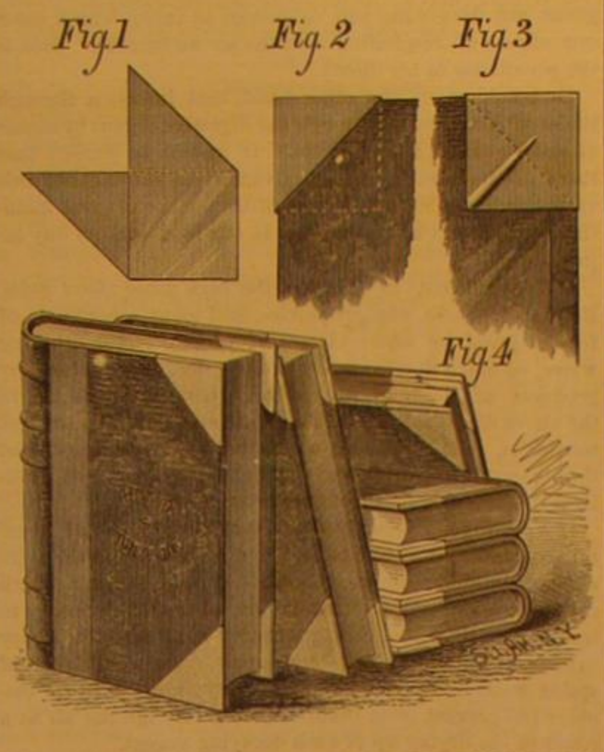
This invention was recently patented by Mr. G. S. Perkins, of Hartford, Conn., from whom further information may be obtained.



PERKINS' DOOR CHECK.

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.

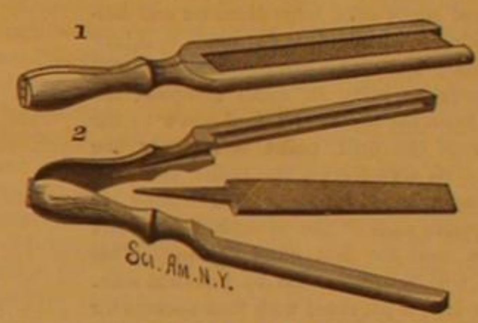
How Oysters are Freshened at Baltimore.

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.

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.

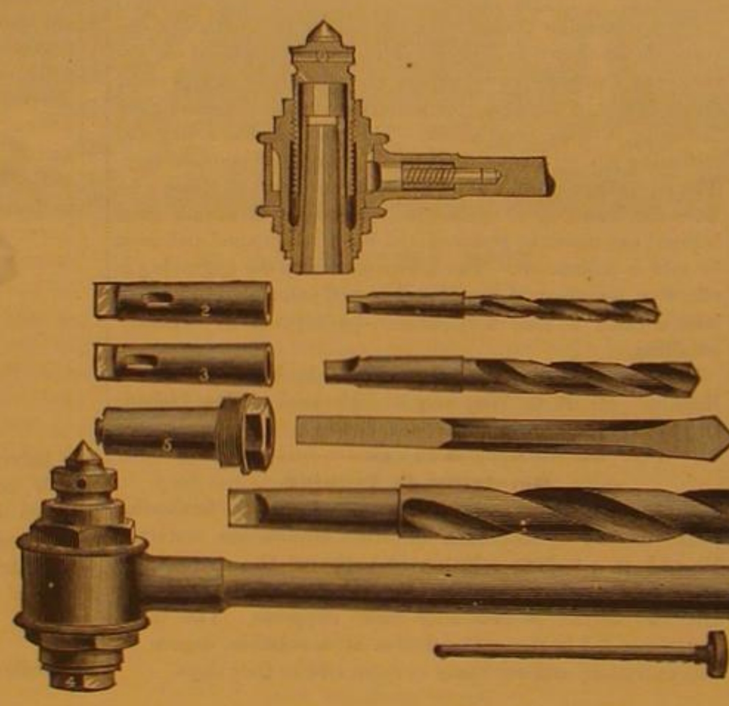
Does Invention Discourage Labor?

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 mechanics 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 1872 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.

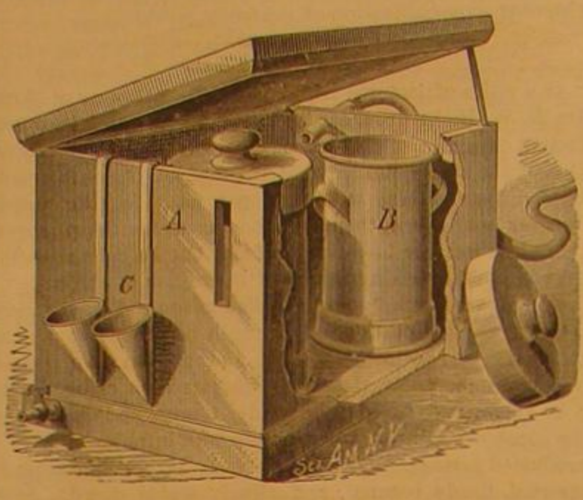
There are three cylinders for carrying the goods. They revolve slowly in journals formed on two large wheels, one cylinder only being exposed to the action of the hammers at a time. The goods may be removed from or adjusted on two of the cylinders while the fabric is being treated on the third, without 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.

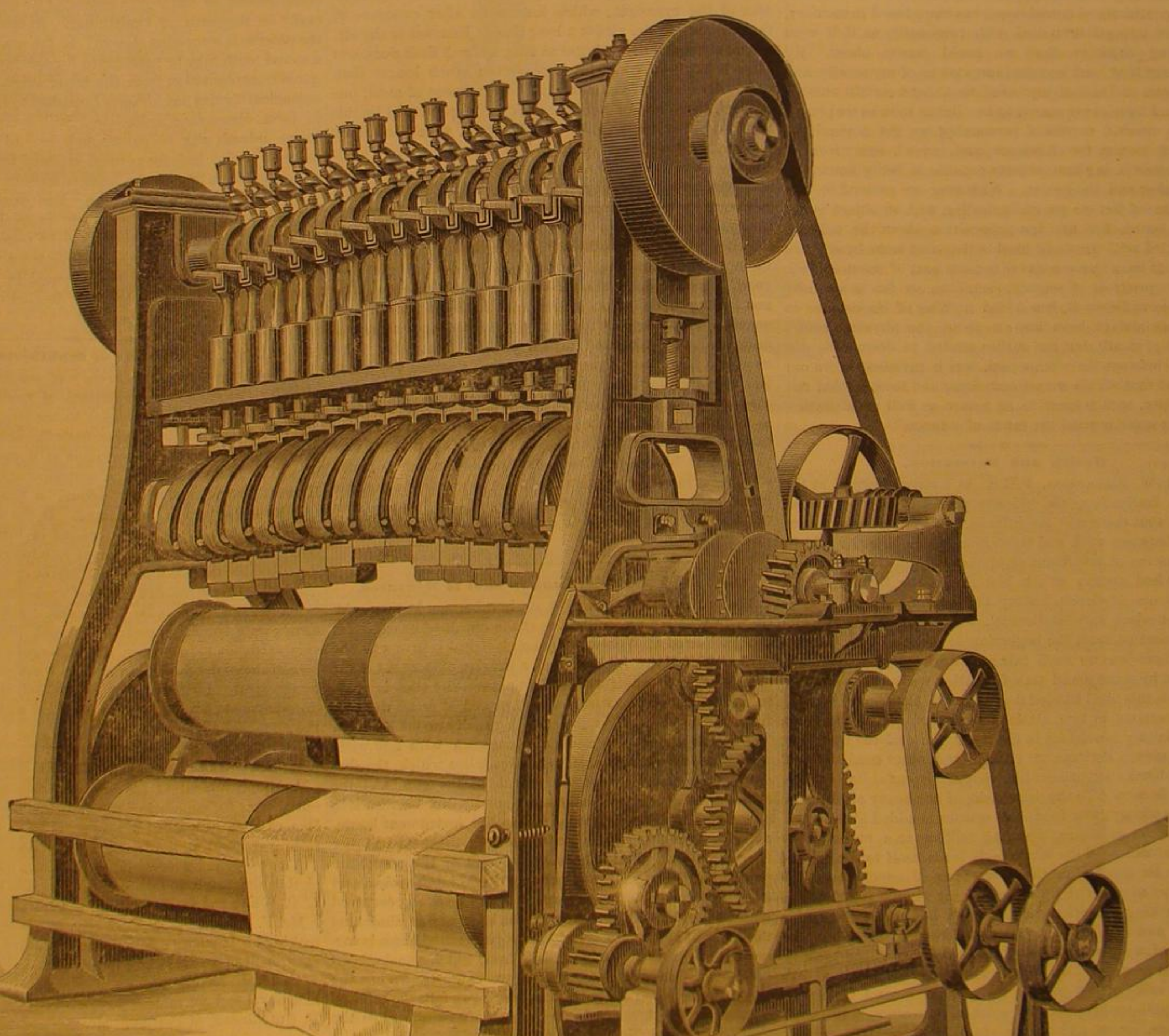
A wind motor for the heavier kinds of work, such as pumping large quantities of water, operating stamp mills, etc., is the invention of Mr. L. Brayman, of Gilbert Station, Ill. It consists of two series of wind wheels placed on horizontal shafts, which are arranged at right angles to each other and geared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

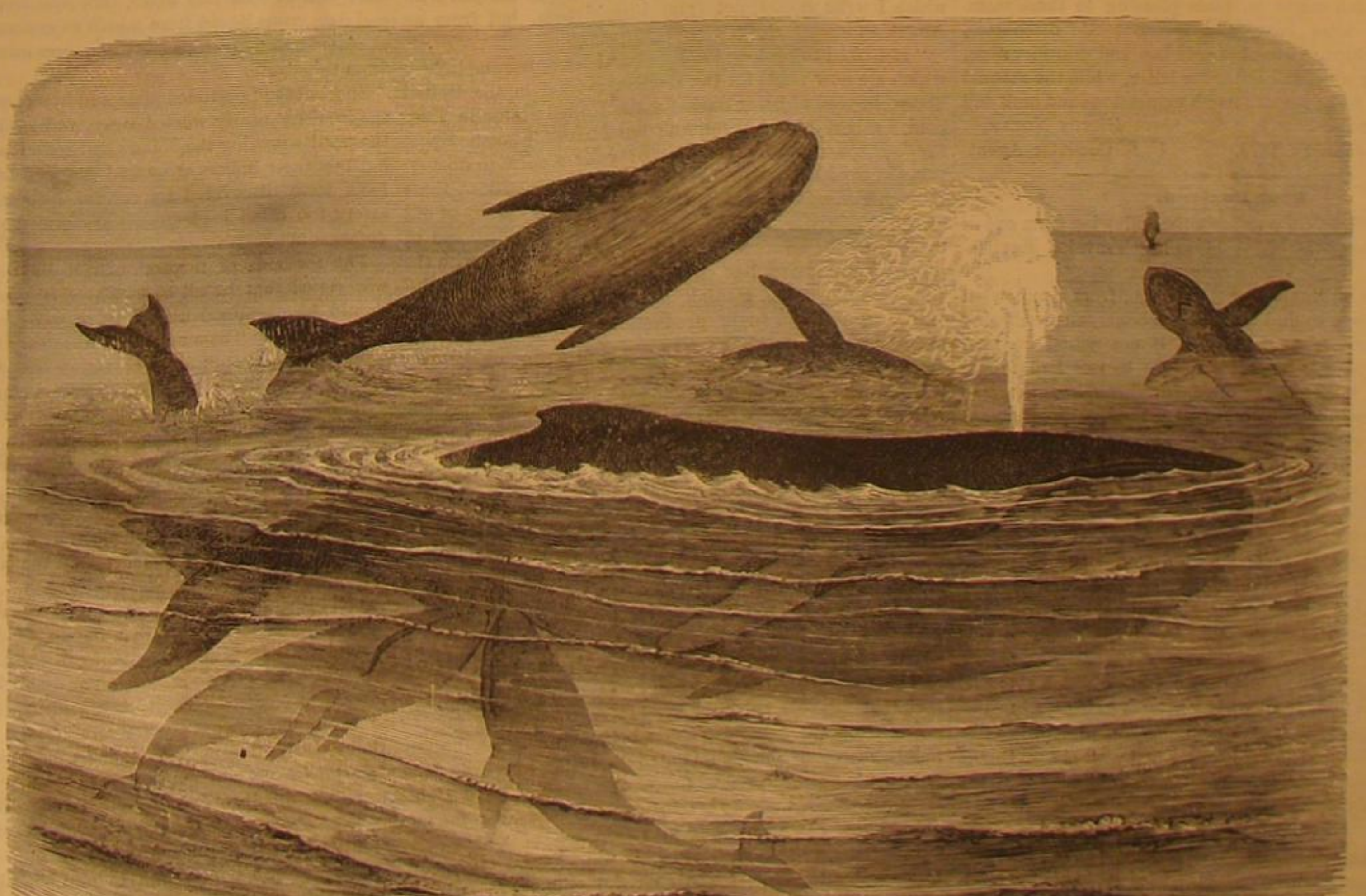
Few whales appear in larger numbers in the arctic and antarctic regions than the humpback, but it is not confined to these regions, as it is found in all latitudes. It is most probable that the polar zones are its home, and that the animals undertake annual journeys from the poles to the equator and 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 *pinnularia* 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 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 woodman'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 tem-po-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 $1 + n$, and the light emitted by each lamp becomes diminished by $1 + n^2$. 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 experimenters 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 mouey. 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.

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 size of 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.

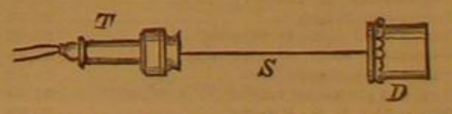
2. How to correct sour sirup. A. Heat the sirup to the boiling point, strain through a piece of linen, and stir in a little calcium sulphite; or, filter the hot sirup through fresh boneblack.

(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 gobletful 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 "fool'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.

[OFFICIAL.

INDEX OF INVENTIONS

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.

Air compressor, M. B. Harvey 211,570
Amalgamator, J. B. Reynolds 211,588
Anchor, C. E. Marshall 211,474
Axle box lid, car, O. J. Miller 211,579
Axle box lid, car, A. R. Tiffany 211,533
Axle lubricator, vehicle, F. C. Wright 211,539
Bed bottom, W. Weaver (r) 8,552
Bee hive, T. P. Williamson 211,537
Bell, call, E. W. Brettell 211,494
Bier and elevator, D. W. & L. W. Althouse 211,542
Bird cage, A. B. Hendryx 211,511
Blowing engine, P. L. Weimer (r) 8,545
Bolting cloths, repairing, J. B. McFall 211,518
Boot and shoe, F. Richardson 211,524
Boot and shoe heel, V. Kuebrich 211,478
Boots and shoes, lasting, G. W. Copeland 211,459
Bosom board, S. M. Brown 211,553
Bosom board, F. Deming 211,461
Bottle, G. B. Sanborn 211,536
Bottle stopper and fastener, W. Silvester 211,529
Bottle stopper fastener, T. B. Atterbury 211,490
Bran duster, Lawton & Arndt 211,576
Brick kiln, A. W. Duty 211,463
Brick machine, Z. X. Smith 211,481
Bronzing metals, N. W. Williames 211,610
Buckle, J. F. Molloy 211,580
Burglar alarm, A. Crosby 211,556
Calendar and time piece, M. H. Paddock 211,583
Car coupling, Baker & Sowle 211,458
Car coupling, C. F. Brem 211,551
Car door, W. O. Davies (r) 8,548
Car window dust guard, J. H. Reynolds 211,523
Card and ticket case, P. F. Tarbutt 211,604
Carpet sweeper, Gates & Potter 211,467
Cigar package, M. W. Prager 211,586
Cigarette machine, Block & Koch 211,548
Cigarette machine, G. H. Hayden 211,509
Clasp, J. W. Smith 211,530
Clothes drier, R. E. Rye 211,593
Clothes drier, J. N. Valley 211,483
Clothes rack and ironing board, H. C. Woodworth 211,613
Clover seed separator, J. Stine 211,603
Coffin, C. W. Tubbs 211,534
Coin press, T. Scott 211,595, 211,596
Colors derived from nitraniline, Roussin & Poirrier 211,525
Cotton and hay press, R. T. Smithson 211,599
Cotton separator, R. R. Gwathney 211,566
Cutter head, reversible, S. J. & G. J. Shimer 211,480
Demijohn, swinging, Graves & Partrick 211,469
Desk, school, J. S. Rankin 211,521
Die for serrating uppers, Woodward & Brock 211,612
Ditching machine, M. W. Farber 211,560
Door securer, M. J. Hine 211,573
Dovetailing machine, C. Stengel 211,531
Drop light for gas fixtures, A. C. Gould 211,478
Drier for straw boards, etc., Whealen & Knerr, Jr. 211,485
Edger and planer, A. S. Hapgood 211,569
Explosive fluid can, J. L. Firm 211,466
Farm gate hanger, W. Peck 211,565
Faucets, measurer for, T. F. Longaker 211,577
Feed water heater, T. Murphy 211,519
Fence, J. H. Bailey 211,491
Fence gate, I. S. Cory 211,496
Fence, portable, C. D. A. Curry 211,494
Fiber from mixed fabrics, treating, J. Wilkins 211,609
Finger ring, R. W. Edwards 211,558
Fireplace, W. Childers 211,457
Flat iron, etc., W. McCarty 211,517
Garbage cremator, H. R. Foote 211,503
Gas burner, G. P. Ganster 211,504
Gas generator, T. F. Rowland 211,592
Gas lighter and extinguisher, G. P. Ganster 211,505
Gas retort, T. F. Rowland 211,591
Grain separator, J. F. Hatfield 211,571
Gun swab, H. Comstock 211,555
Hams, etc., preparing boned pork, A. Warner (r) 8,544
Harness pad, R. M. Selleck 211,478
Harvester, cotton, W. T. Read .... 211,5[illegible]
Hat bodies, sweat leathers for, J. Bigelow 211,547
Hat ventilator, C. Schuffler 211,527
Hides, hair and grease remover, C. J. Tinnerholm 211,532
Hoe, J. W. Ellis 211,502
Horse detacher, F. B. Hewitt 211,470
Hub, vehicle wheel, J. N. Meyer 211,581
Hydrometer and liquid meter, J. M. Cayce 211,554
Ladder, step, E. M. Benjamin 211,546
Lamp burner, D. Seawright 211,597
Lamp burner, M. B. Wharton 211,484
Lasting machine, C. W. Glidden 211,506
Liniment, N. Sailvail 211,477
Mechanical movement, J. F. Snediker 211,600
Metallic can, G. L. Merrill 211,578
Microscope, E. Gundlach 211,507
Middlings separator, G. H. Doane 211,501
Millstone dresser, P. M. Haas 211,567
Mowing machine, A. J. Berryhill 211,454
Package for transporting merchandise, J. Gilberds 211,503
Pantaloons protector, R. Dillon, Jr. 211,500
Paper box, J. L. Dole 211,462
Paper, ornamental, J. F. Marsh (r) 8,543
Peanut cleaner, B. H. Vellines 211,535
Pen, fountain, J. Holland 211,575
Pen, fountain, W. A. Somers 211,482
Pencil, Allen & Crane 211,489
Plane, bench, J. H. Lewis 211,516
Planter, corn, J. Case (r) 8,547
Planter, corn, E. Emmert 211,559
Plow, J. I. Eavenson 211,557
Plow, swivel, F. Holbrook *et al.* (r) 8,551
Pocket cup, L. Bailer 211,568
Potato digger and hiller, C. Oehrlein 211,476
Railway crossing, W. Wharton, Jr. 211,607
Railway switch, J. H. Ainsworth 211,541
Railway track, W. H. Hall 211,508
Refrigerating, etc., food dish, M. L. Brisbane 211,552
Refrigerator and water cooler, M. Greenebaum 211,565
Refrigerator, porous, W. Galloway 211,562
Rod and bolt cutter, S. G. Wilcox 211,608
Roofing material, T. New (r) 8,546
Rotary engine, R. Bazin 211,545
Rule joint, carpenter's, E. H. Bowers 211,455
Sand moulder, S. J. Adams 211,488
Sand papering machine, B. S. Atwood 211,543
Sash fastener, S. L. Chase 211,456
Sash fastener, S. P. Jackson 211,513
Saw mill carriage attachment, J. D. Wilson 211,538
Saw mill log carrier, J. Torrent 211,605
Scarf ring, A. Schofield 211,594
Scraper, road, M. W. Farber 211,561
Seed drill tooth, H. Springer 211,601
Semolino, etc., sorter and cleaner, J. Woerner 211,487
Sewing machine feeder, H. A. Gorn 211,564
Sewing machine pulley, C. Westling 211,536
Sewing machine hemmer, Hoffman & Meyers 211,574
Show box, S. Zemansky 211,540
Sowing machine, broadcast, L. Coller 211,495
Spark arrester, P. H. Grace (r) 8,549
Stocking supporter, C. C. Shelby 211,479
Stoves, ranges, etc., broiler for, F. S. Bissell 211,492
Stoves, ranges, etc., broiler for, G. J. Born ..211,549, 211,550
Telephone, mechanical, Willard & Cheney 211,486
Textile fabric stamper, J. Patterson 211,520
Thrasher and huller, clover, Jones & Grubbs 211,472
Time lock, S. A. Little (r) 8,550
Tobacco, yoke for carrying, R. A. Corn 211,460
Tongs, smith's, F. Eberhard 211,464
Tool, bench, J. H. Lewis 211,515
Tool handle, J. Barr 211,544
Towing canal boats, D. Stearns 211,602
Toy building block, G. G. Shelton 211,528
Track clearer, J. Matthews 211,475
Truss and abdominal support, C. J. Wolff 211,611
Tube welder, T. H. Roberts 211,589
Valve, center seal purge, T. F. Rowland 211,590
Vault light, etc., J. I. Healey 211,510
Vessels, etc., raising sunken, W. Raydt 211,587
Wagon box irons, King & Campbell 211,514
Wagon seat, Heymann & Kiehl 211,512
Wagon, side bar, H. M. Curtis 211,499
Wash boiler, W. Finley 211,465
Washing machine, J. C. Crawford 211,497
Washing machine, A. Shidel 211,598
Watch dust cap regulator, S. G. Parker 211,584
Water meter, piston, Blount & Gilbert 211,493
Water meter, rotary, M. J. Hinden 211,572
Water meter, rotary, L. H. Nash 211,582
Wells, piston rod adjuster for oil, D. J. Hurley 211,471
Windmill, H. M. Underwood 211,606
Wire, manufacturing, H. Chisholm 211,458

TRADE MARKS.

Boots and shoes, Reed, Jones & Co. 6,961
Cigars, cigarettes, smoking and chewing tobacco, and snuff, F. W. Felgner & Son 6,957
Guano, R. W. L. Rasin & Co. 6,969
Leaf tobacco, L. Friedman 6,958
Liniment, H. C. Snitcher 6,966
Liver medicine, D. J. Duffy 6,955
Lubricating oils, Olney Brothers 6,964
Medicinal preparations, Scott & Bowne 6,973
Medicinal preparation of cinchona bark, C. T. White 6,967
Mustard and ground spices, D. Ghirardelli 6,959
Natural mineral waters, L. Somborn & Co. 6,968
Pepper relish, E. T. Cowdrey 6,954
Record and ledger papers, Jessup & Laflin 6,962, 6,963
Smoking and chewing tobacco, cigars, and cigarettes, M. W. Prager 6,972
Soap, Lautz Bros. & Co. 6,960
Soap, J. S. Kirk & Co. 6,970, 6,971
Stationery, E. Faber 6,956
Whisky, C. Rebstock & Co. 6,965

DESIGNS.

Carpets, T. J. Stearns 10,986, 10,987
Stoves, J. Van Buskirk Carter 10,985
Pencil cases, J. C. Aikin 10,984

English Patents Issued to Americans.

From January 24 to January 28, inclusive.

Axle box bearings.—J. R. Baker, Jersey City, N. J.
Baths.—W. Wasson *et al.*, Carson City, Nevada.
Electric light.—E. Molerd *et al.*, San Francisco, Cal.
Gas lighting apparatus.—G. P. Ganster, Reading, Pa.
Knitting machines.—L. E. Salisbury, Providence, R.I.
Knitting machines.—O. Twombley, Lake Village, N. H.
Lock for doors.—N. Thompson, Brooklyn, N. Y.
Middlings purifier.—W. J. Fender, Minneapolis, Minn.
Register for watchmen.—M. D. Johnson, Chicago, Ill.
Sash fastener.—J. B. Morris, Cincinnati, Ohio.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - - $1.00 a line.
(About eight words to a line.)

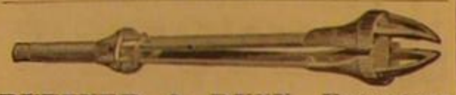
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Founded by Mathew Carey, 1785.

BAIRD'S BOOKS FOR PRACTICAL MEN.

Our new and enlarged CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS, 96 pages, 8vo; a Catalogue of Books on DYEING, CALICO PRINTING, WEAVING, COTTON and WOOLEN MANUFACTURE, 4to; Catalogue of a choice collection of PRACTICAL, SCIENTIFIC, and ECONOMIC BOOKS, 4to; List of Books on STEAM AND THE STEAM ENGINE, MECHANICS, MACHINERY, and ENGINEERING, 4to. List of Important Books on METALLURGY, METALS, STRENGTH OF MATERIALS, CHEMICAL ANALYSIS, ASSAYING, etc., 4to; two Catalogues of Books and Pamphlets on SOCIAL SCIENCE, POLITICAL ECONOMY, BANKS, POPULATION, PAUPERISM, and kindred subjects sent free to any one who will forward his address.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 WALNUT STREET, PHILADELPHIA.



RUFFNER & DUNN. Patentees and Sole Manufacturers of the Excelsior Steel Tube Cleaners. Price $1.00 per inch. Send for circular.
SCHUYLKILL FALLS, PHILA., PA.

JUST PUBLISHED.

Text Book of the Steam Engine.

By T. M. GOODEVE, M.A.
Intended for use in Science Schools and Polytechnic Institutions.
One volume, crown 8vo, cloth, 296 pages, Illustrated. Price $2.
D. VAN NOSTRAND, Publisher, No. 23 Murray St., New York.
*** Copies sent by mail on receipt of price.

WANTED One Live Man for each State to sell goods by sample. Fair salary paid. LA BELLE MFG CO., 93 Clark St., Chicago.

Messrs. McDOWALL & BARBOUR,
ENGINEERS & MILLWRIGHTS,
"Vulcan Works," Piræus, Greece,
Having used a great many American-made machines in the various Mills they have erected, are desirous of dealing direct with American makers of all classes of Grain Cleaning and Flour Dressing Machines, either as agents or by special contract. Should this meet the eye of any one interested, they would be happy to receive catalogues and lowest prices.

ON CHRONIC MALARIAL POISONING.—By Alfred L. Loomis, M.D. A Highly instructive Clinical Lecture, delivered at the University Medical College, N. Y. According to Professor Loomis the effects of malarial poisoning are manifested in a surprising variety of forms and symptoms; so numerous and various, in fact, that they cannot be tabulated. They embrace enlargement of the spleen, neuralgias of different forms, that may or may not be periodical; dyspeptic troubles which cannot be relieved by dyspeptic remedies; headaches that are often treated as cerebral diseases; confusions of mind; staggering gaits; loss of power in portions of the body; impairment of mental faculties; inability to do work of any kind; not sick enough to go to bed, but too ill and habitually too tired to perform anything that requires the least exertion; shortness of breath; rapid, weak, irregular pulse; sleepless nights, etc. The infection appears to be far more widely spread than is commonly supposed; and all who have ailments that fall within the category here mentioned will do well to read the excellent lecture. SUPPLEMENT 102. Price 10 cents.

NO MORE RHEUMATISM OR GOUT ACUTE OR CHRONIC
SALICYLICA
SURE CURE.

Manufactured only under the above Trade-Mark, by the

European Salicylic Medicine Co., 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 dissolver 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. INDORSED BY PHYSICIANS. SOLD BY ALL DRUGGISTS. Address

WASHBURNE & CO.,
Only Importers' Depot, 212 Broadway, cor. Fulton St., New York.

---

110 ORANGE STREET, NEW HAVEN, CONN.
CONN. NOVELTY CO.
Novel, Useful, Economical articles.
Send 10c. for cat. and sample of salable goods.

Steel Stamps.
N.Y. STENCIL WORKS, 87 Nassau St. N.Y.

JUST PUBLISHED.

The STRENGTH of MATERIALS.
BY
WM. KENT, M.E.
Forming No. 41 of the Science Series.
One volume, 16mo. 139 pages. Illustrated, 50 cents.
D. VAN NOSTRAND, Publisher, 23 Murray St., New York.
*** Copies sent by mail on receipt of price.

NEW YORK BELTING AND PACKING COMP'Y.

The Oldest and Largest Manufacturers of the Original

Emery Wheel.

SOLID VULCANITE EMERY WHEELS.

All other kinds Imitations and Inferior. Our name is stamped in full upon all our standard BELTING, PACKING, and HOSE.
Address NEW YORK BELTING AND PACKING CO.,
JOHN H. CHEEVER, Treas. NEW YORK.

SPARE THE CROTON AND SAVE THE COST.

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.

Fine Pamphlets printed for **75c. a Page** per 1,000. 1,000 Fine 9x12 Circulars, $2.50. Price list or estimate and samples for stamp. 250 Bill Heads, $1. "Local" Printing House, Silver Creek, N. Y.

RIVAL STEAM PUMPS. JOHN H. McGOWAN & Co. CINCINNATI OHIO. $35 & UPWARDS

Gold, Silver, and Nickel Plating. A trade easily learned. Costs little to start. The Electro Plater's Guide, a 72 page book, sent for 3 stamps. Scientific instruments and books bought, sold, exchanged, or loaned. Price list free. F. Lowey, 90 11th St., Brooklyn, N. Y.

LAP WELDED CHARCOAL IRON Boiler Tubes, Steam Pipe, Light and Heavy Forgings, Engines, Boilers, Cotton Presses, Rolling Mill and Blast Furnace Work.
READING IRON WORKS, 261 South Fourth St., Phila.

THE FORSTER-FIRMIN GOLD AND SILVER AMALGAMATING COMP'Y of Norristown, Pa., will grant state rights or licenses on easy terms. This system works up to assay, and recovers the mercury rapidly. Apply as above.

BOLT CUTTERS.

Send for Catalogue of
Schlenker's Automatic Bolt Cutters and Screw Cutting Machines.
HOWARD IRON WORKS Buffalo, N. Y.

Paris, . . 1878
Australia, 1877
Phila., . . 1876
Santiago, 1875
Vienna, . 1873

J. A. FAY & CO'S WOOD WORKING MACHINERY

was awarded at the Paris Exposition over all competitors THE GOLD MEDAL OF HONOR. Also highest award at Phila., Santiago, Australia, and Vienna. It is **Original in Design, Simple in Construction, Perfect in Workmanship, Saves labor, Economizes lumber, and Increases products of the highest standard of Excellence.**

Railroad, Furniture, and Agricultural Implement Shops, Planing Mills, etc., equipped at short notice, and the lowest cash prices. Send for Circulars.

J. A. FAY & CO., Cincinnati, Ohio, U. S. A.

No Sawdust! No Planing!

Thin lumber, 1-16 to ½ 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.

GEO. W. READ & CO., 186 to 200 Lewis St., New York.

Send 25 cts. to L. D. SNOOK, Barrington, Yates Co., N.Y., for his "Inventor's Helper for 1879." It is a new and good thing—just what every inventor wants.

Park Benjamin's Scientific Expert Office.

Circulars and descriptive pamphlets written, illustrated, and printed for inventors and manufacturers. Recipes and practical directions for mechanics. Briefs on scientific questions and expert testimony for lawyers in State Courts. Machinery designed and tested. Books selected and procured for mechanical students. Terms low. Estimates and particulars promptly sent. PARK BENJAMIN, Ph.D., Editor Appleton's Cyclopædia of Applied Mechanics. 37 Park Row, New York.

PATENT COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS,
Try Street, 2d and 3d Avenues, Pittsburgh, Pa.
190 S. Canal Street, Chicago, Ill., and Milwaukee, Wis.
☞ Stocks of this shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass.
Geo. Place Machinery Agency, 121 Chambers St., N. Y.

"The 1876 Injector."

Simple, Durable, and Reliable. Requires no special valves. Send for illustrated circular.
WM. SELLERS & CO., Phila.

Shafts, Pulleys, Hangers, Etc.

Full assortment in store for immediate delivery.
WM. SELLERS & CO., 79 Liberty Street, New York.

BIG PAY to sell our Rubber Printing Stamps. Samples free. Taylor Bros. & Co., Cleveland, O.

REGISTERED

TRADE MARKS

"Phosphor-Bronze."

Phosphor-Bronze, for General Machine Castings, Pinions, Cog Wheels, Propeller Screws, Hydraulic Press and Pump Barrels, Piston Rods, Screw Bolts for Steam Cylinders, Hardware, Bearings, Valves, Bells, Steam Whistles, Hammered Piston Rods, Wire, Rods, Sheets, Bolts, Tubes, Plates, etc. Apply to the PHOSPHOR-BRONZE SMELTING CO., Limited, 2038 Washington Ave., Philadelphia, Pa., Sole Manufacturers in U. S.

Wood-Working Machinery,

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
WITHERBY, RUGG & RICHARDSON, 26 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

ALL KINDS OF WOOD WORKING MACHINERY IRON WORKING TOOLS & SPECIAL TOOLS, MANUFACTURED BY THE H.B. SMITH MACHINE Co. SMITHVILLE, BUR. CO. N.J. CIRCULARS FREE.

BLAKE'S STONE AND ORE BREAKER AND CRUSHER.

For breaking hard and brittle substances to any size. Indorsed by the leading **Mining, Manufacturing, and Railroad** corporations in the **United States** and **Foreign Countries. First Premium** wherever exhibited, and hundreds of testimonials of the *highest character.*
A NEW SIZE FOR PROSPECTING AND LABORATORY USE.
☞ ALL STONE CRUSHERS not made or licensed by us, containing vibratory convergent jaws actuated by a revolving shaft and fly-wheel, are infringements on our patent, and makers and users of such will be held accountable. Address

BLAKE CRUSHER CO., New Haven, Conn.

VEGETABLE AND FLOWER SEEDS
WE SELL EVERYTHING FOR THE
GARDEN
Descriptive Catalogues of 175 pages sent Free
PETER HENDERSON & CO.
35 Cortlandt St., New York.
SEEDS — PLANTS
FLOWER AND FRUIT PLANTS

---

250 MARYLAND FARMS, in Tracts from 30 to 300 acres. Near railroad and navigable Salt Water (with all its luxuries), in Talbot Co., Md. Climate mild and healthy. Titles good. New Pamphlet and Map showing *location*, free. Address C. E. SHANAHAN, Atty., Easton, Md.

THE BROTHERS CHARLES AND JULIUS Roswall (Mentzer), Mechanics, from the City of Wisby, Gottland, Sweden, will please send in your address to "C. A. W. E.," in care of Dr. C. A. Jackson, Hooper, Dodge Co., Nebraska, Box 8.

THIS NEW **ELASTIC TRUSS**

Has a Pad differing from all others, is cup-shape, with Self-Adjusting Ball in center, adapts itself to all positions of the body, while the BALL in the cup PRESSES BACK the INTESTINES JUST AS A PERSON WOULD WITH THE FINGER. With light pressure the Hernia is held securely day and night, and a radical cure certain. It is easy, durable and cheap. Sent by mail. Circulars free. **Eggleston Truss Co., Chicago, Ill.,**

Automatic Fire and Water Alarms.

FOR SALE—Rights to introduce the above patents of this company in England, France, Canada, or in the States and Cities throughout the United States. For particulars and pamphlets, address
AUTOMATIC SAFETY CO., P. O. Box 775, New Orleans, La.

ELEVATORS
HAND POWER AND HYDRAULIC
FREIGHT & PASSENGER
SHAFTING PULLEYS & HANGERS
S. GRAVES & SON ROCHESTER N.Y.

---

50 Perfumed Chromo and Motto Cards, 10c. *Name in Gold and Jet.* Seavy Bros., Northford, Ct.

THE **Eclipse Engine**

Furnishes steam power for all *Agricultural* purposes, *Driving Saw Mills*, and for every use where a first-class and economical Engine is required. Eleven first-class premiums awarded, including Centennial, '76. Refer to No. 7, issue of '77, No. 14, issue of '78, of SCIENTIFIC AMERICAN, for Editorial Illustrations.

FRICK & CO., Waynesboro, Franklin Co., Pa.
When you write please name this paper.

INVENTORS' MODELS C. E. Jones & Bro., Cincinnati, O.

THE BEST STEAM PUMP in AMERICA

More than 4500 in use. **THE DEANE** Send for reduced Price List. Deane Steam Pump Works, 85 LIBERTY ST., NEW YORK.
Made by HOLYOKE MACHINE CO.

STEAM PUMPS.

HENRY R. WORTHINGTON,
239 Broadway, N. Y. 83 Water St., Boston.
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.

Price list issued Jan. 1, 1879, with a reduction exceeding 30 per cent.

WATER METERS. OIL METERS.

$77 a Month and expenses guaranteed to Agents. Outfit free. SHAW & CO., AUGUSTA, MAINE.

THE DINGEE & CONARD CO'S BEAUTIFUL EVER-BLOOMING ROSES

THE BEST IN THE WORLD.

Our Great Specialty is *growing* and *distributing* these **Beautiful Roses.** *We deliver* **Strong Pot Plants,** suitable for *immediate* bloom, *safely by mail* at all post-offices. **5 Splendid Varieties,** *your choice*, all labeled, for **$1; 12 for $2; 19 for $3; 26 for $4; 35 for $5; 75 for $10; 100 for $13.** ☞ Send for our **New Guide to Rose Culture**—60 pages, elegantly illustrated—and *choose* from over **Five Hundred Finest Sorts.** Address
THE DINGEE & CONARD CO., Rose Growers, West Grove, Chester Co., Pa.

SCROLL SAWS, Small Tools, Bellamy Chucks, etc. Send stamp for large catalogue. G. Webster Peck, Manuf'rs' Agent, 110 Chambers Street, New York.

WHEELER'S PATENT WOOD FILLER fills the pores of wood perfectly, so that a smooth finish is obtained, with one coat of varnish. Send for circular. Mention this paper. BRIDGEPORT WOOD FINISHING CO., 136 Mercer Street, New York.

FOR SALE—the Boyd & Pease Foundry Facings Mills, in complete running order. Also one 12x30 Allen Cut-off Engine. BOYD (Admin.), 107th St. and 1st Av., New York.

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.

MOSELEY IRON BRIDGE AND ROOF CO.
CORRUGATED IRON
Buildings, Roofs, Shutters, Doors, Iron Sashes, Skylights, etc.
5 Dey Street, New York.

Send for our Priced and Illustrated Catalogues.

Part 1st—**Mathematical Instruments.** 160 pages; contains list and prices of Drawing Instruments, Drawing Materials, Pocket Compasses, Surveying Compasses, Engineers' Transits and Levels, Surveying Chains, Tape Measures, Pocket Rules, and Books relating to Drawing, Engineering, and Mechanics.

Part 2d—**Optical Instruments.** 144 pages; contains list and prices of Spectacles, Eye Glasses, Lenses, Spy Glasses, Telescopes, Opera and Field Glasses, Graphoscopes, Stereoscopes, Camera Obscuras, Camera Lucidas, Microscopes, Microscopic Preparations, and Books on Optics and Microscopy.

Part 3d—**Magic Lanterns and Slides.** 112 pages; contains list and prices of Magic Lanterns for Toys, for Public and Private Exhibitions, Sciopticons, Stereopticons, Scientific Lanterns, and accessory apparatus to be used with them; Magic Lantern Slides, both colored and uncolored.

Part 4th—**Physical Instruments.** 188 pages; contains list and prices of Instruments to illustrate Lectures in every department of Physics and Chemical Science, Air Pumps, Electric Machines, Galvanic Batteries, Barometers, Thermometers, Rain Gauges, Globes, Spectroscopes, Auzoux's Anatomical Models, and Books relating to Scientific Subjects.

JAMES W. QUEEN & CO., Optical and Philosophical Instrument Makers, 924 Chestnut St., Philadelphia.

TO MANUFACTURERS AND CAPITALISTS. Flower Pins, new article of light wire, recently patented. First patent of its kind. Owing to the competition to obtain the American patent I offer it at private sale to the highest cash bidder whose bid is received before 10 o'clock P. M. on the 28th day of Feb., 1879. Bids can be sent by letter or telegraph, prepaid, no postal cards. Price, terms, and all necessary information as to invention sent, on application, to responsible parties desiring to compete. Address
J. H. PLUMMER, 1276 Pacific St., Brooklyn, N. Y.

Baker Rotary Pressure Blower.

(FORCED BLAST.)
Warranted superior to any other.
WILBRAHAM BROS.
2318 Frankford Ave.
PHILADELPHIA

SCIENTIFIC BOOKS

Descriptive Circulars Free.

Pocket-Book for Chemists, Chemical Manufacturers, Metallurgists, Dyers, Distillers, Brewers, Sugar Refiners, Photographers, etc. By THOS. BAYLEY. Gilt edges, $2.00.

A Descriptive Treatise on Mathematical Drawing Instruments. By H. F. STANLEY. Illustrated, 8vo, cloth, $2.00.

Useful Information on Practical Electric Lighting. By K. HEDGE. Paper, 40 cents.

Ornamental Penman's, Engraver's, Sign-Writer's and Stone Cutter's Pocket-Book of Alphabets. 32 plates, 20 cents.

Cleaning and Scouring. A Manual for Dyers, Laundresses, and Domestic Use. By S. CHRISTOPHER. Paper, 20 cents.

Electric Lighting. Its State and Progress. By JOHN T. SPRAGUE. Paper, 40 cents.

E. & F. N. SPON, 446 Broome St., New York.

Make Your Own Perfumes. Will send recipe for GERMAN COLOGNE for 25 cts. Dr. W. S. NAY, Underhill, Vt.

L. F. STANDISH & CO., **Screw Manufacturers,** Builders of Small Machinery and Fine Tools. 26 Artisan St., New Haven, Ct.

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. SUPPLEMENT No. 59. Price, 10 cents.

FOR SALE.—A MACHINE WORKS,

in a city of this State of 100,000 inhabitants. This shop, which is one of the best known in the State, is now running, and has been for 23 years successfully, and has made a fortune for its owner. The principal business has been manufacturing Engines, General Machinery, and a number of specialties. In one specialty, which is patented, there is a fortune. The whole establishment, with buildings, can be bought for $22,000 on liberal terms. Address, for particulars, P. O. Box 236, Albany, N. Y.

NAIL EXTRACTOR.—THE INVENTOR wishes to correspond with parties who would manufacture and sell on Royalty. See notice on page 134. Address C. T. KNAUER, Urach, Wurtemberg, Germany.