SCIENTIFIC AMERICAN

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

Vol. XLI.—No. 13. [NEW SERIES.] NEW YORK, SEPTEMBER 27, 1879. [$3.20 per Annum [POSTAGE PREPAID.]

A WONDERFUL CLOCK.

A short time since we gave a brief description of a clock made by Mr. Felix Meier, of Detroit, Mich. We now present our readers an engraving of this curious piece of mechanism, which is said to eclipse all former achievements in this direction, without excepting even the Strasbourg, which for so many years has been regarded as the great clock of the world.

Mr. Meier's clock is the result of nearly ten years of patient labor and the expenditure of $7,000 in cash. The clock is eighteen feet in height, eight feet wide, by five feet deep, and weighs 4,000 lbs. It is of handsome proportions; the framework is entirely of black walnut, elegantly carved. Above the main body of the clock is a marble dome, upon which Washington sits in his chair of state, protected by a canopy, which is surmounted by a gilded statue of Columbia; on either side of Washington is a colored servant in livery guarding the doors, which open between the pillars that support the canopy; on the four corners of the main body of the clock are black walnut niches containing human figures, emblematic of the march of life; the two lower ones are supported by two female figures with flaming torches; one of them contains the figure of an infant, the second the figure of a youth, the third of a man in middle life, the fourth of an aged graybeard, and still another, directly over the center, contains a grinning skeleton representing Father Time. All of these figures have bells and hammers in their hands. The infant's bell is small and sweet toned; the youth's bell larger and harsher; the bell of manhood strong and resonant; that of old age diminishing in strength, and the bell of the skeleton deep and mournful.

The astronomical and mathematical calculation, if kept up, would show the correct movement of the planets for 200 years, leap years included.

The clock shows the time at Detroit in hours, minutes, and seconds; the difference in time at New York, Washington, San Francisco, Melbourne, Pekin, Cairo, Constantinople, St. Petersburg, Vienna, London, Berlin, and Paris. The day of the week, calendar day of the month, month of the year, and seasons of the year. The signs of the zodiac, the revolutions of the earth on its own axis and also around the sun. The revolutions of the moon around the earth, and with it around the sun; also the moon's changes from the quarter to the half, three-quarters and full. It also shows the correct movement of the planets around the sun.

There is a movement in this clock which cannot regularly be repeated more than once in eighty-four years.

The inventor has a crank attached to the clock, by means of which he can hasten the working of the machinery in order to show its movements to the public; by turning continuously twelve hours a day for sixteen days and eight hours, a perfect revolution of the planet Uranus around the sun would be made.

At the end of every quarter hour the infant in his carved niche strikes with a tiny hammer upon the bell which he holds in his hand. At the end of each half hour the youth strikes, at the end of three quarters of an hour the man, and at the end of each hour the graybeard. Death then follows with a measured stroke to toll the hour, and at the same moment a carved cupid projects from either side, with wings to indicate that time flies. At the same time a large music box, manufactured at Geneva expressly for this clock, begins to play, and a surprising scene is enacted upon the platform beneath the canopy: Washington slowly rises from the chair to his feet, extending his right hand, presenting the Declaration of Independence. The door on the left is opened by the servant, admitting all the Presidents from Washington's time, including President Hayes. Each President is dressed in the costume of his time. The likenesses are very good. Passing in file before Washington, they face, and raise their hands as they approach him, and, walking naturally across the platform, disappear through the opposite door, which is promptly closed behind them by the second servant. Washington retires into his chair, and all is quiet save the measured tick of the huge pendulum and the ringing of the quarter hours, until another hour has passed.

MEIER'S NATIONAL AND ASTRONOMICAL CLOCK

Traction Engines on Common Roads.

At a recent meeting of the Institute of Mechanical Engineers, Mr. R. E. B. Crompton, of London, read a valuable paper, showing the results and economies of traction engines, as used upon the common roads in India, derived from several years' experience. His general conclusions are:

1. That on the level roads of India traction engines can be relied on to work a service of trains with great regularity and at a fair speed; and that goods can be carried at four miles an hour, and passengers at eight miles an hour. At these speeds, the cost of a train containing 15 tons of goods, or about 7 tons of passengers, was about 2*s.* 2*d.* per train mile.

2. That the rubber tires, as used in such running, are of great service in reducing the cost of the ordinary engine repairs and in giving uniformity of adhesion, without in the least degree damaging the surface of the roads; that in return for these advantages the cost of maintaining these tires does not exceed 1½*d.* per train mile.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

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

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VOL. XLI., No. 13. [NEW SERIES.] *Thirty-fifth Year.*

NEW YORK, SATURDAY, SEPTEMBER 27, 1879.

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TECHNICAL SCIENCE IN NEW ZEALAND.

The SCIENTIFIC AMERICAN has been asked to solicit the kind offices of American inventors, manufacturers, and other friends of industrial education, on behalf of a worthy institution in far away New Zealand.

To provide "all classes and denominations" of the New Zealand population with facilities for pursuing a regular and liberal course of education, Canterbury College has been established at Christchurch, the principal town of the province of Canterbury, and is now in good working condition. In connection with this college there has been founded a scientific museum, housed in a handsome stone building erected at a cost of upward of $100,000, and comprising a valuable collection of specimens of natural history, and type collections of minerals and fossils. An effort is being made to establish in this museum a department of technical science, for which contributions of models of machinery, implements, and the like, are now solicited. The reception of such contributions, and their shipment to New Zealand (freight charges to be paid there), will be undertaken by the publishers of this paper.

So much for the message committed to us. A word or two with respect to the reasons why the request should be cheerfully and abundantly met.

New Zealand is one of the most worthy and promising of the younger members of the Greater Britain made up of all the English speaking countries of the globe. As the youngest, too, among the rising nations allied to us by blood, and bound to us by rapidly strengthening commercial ties, New Zealand is in every way deserving of all the educational assistance we can give her; and it can be safely promised that her people will be duly grateful for anything we may do in this way.

There is a lower (possibly to some a more cogent) reason why this request should be granted: it will pay commercially. Already New Zealand is one of the most inviting of foreign markets for American manufactured products; and there is no way by which American manufacturers can place their machines, implements, and other wares more effectually before the New Zealanders than by having them thus favorably placed on perpetual exhibition at the chief center of intelligence in the colony.

It is not yet forty years since the first white settlers landed in New Zealand, and already the population numbers something like half a million of wide awake, active, and intelligent English people. The islands have an area of over 100,000 square miles; a trifle less than that of Great Britain and Ireland, and something more than twice that of the State of New York. About 12,000,000 acres are fit for agriculture; 50,000,000 acres are suitable for pasturage; 20,000,000 are forest lands. The climate is much like that of England, but more equable. There is more sunshine and a smaller range of temperature. The annual mean for the North Island is 57°, that of the South Island is 52°. The mean annual temperature of London and New York is 51°. The country is rich in minerals, and its resources are being developed rapidly. In 1876 the foreign commerce of New Zealand was equal to that of Norway. It was more than that of any of the South American states except Brazil; more than that of any African states except Egypt and Algeria; greater than that of Japan; and was exceeded in Asia only by China, Java, and the Straits Settlements. It was exceeded in Australasia only by Victoria and New South Wales. In 1875 its trade with the United States exceeded $10,000,000. In 1876 the colony had 600 miles of railway, and in 1878 something like 1,000 miles. In 1875 there were in operation over 3,000 miles of telegraph lines, with a mileage of telegraph wire exceeding 7,000 miles. These are the latest statistics at hand; and the rate of progress is such that they must be largely increased to bring them up to the probable figures required to indicate the present condition of the colony.

It is to a country possessing such notable capacities for commercial developments, and offering so many inducements for the cultivation of friendly relations, that the asked for models and specimens of machinery and industrial appliances are to go, to be placed on view, as already said, under the most favorable conditions possible.

In very many instances, doubtless, the most efficient as well as most economical representation to send will be a perfect machine or implement of regular make. The photographs of the museum rooms—which may be seen at this office by any one who is interested—show an abundance of space for the proper display of contributions; and as the museum is a place of popular resort not only for the people of Christchurch, but for all visitors to that capital, a more attractive mode of exhibiting matters suitable for the markets of the colony could not be devised. We sincerely trust that our energetic, generous, and far-seeing manufacturers will take the matter in hand earnestly, and that while Canterbury College is enriched by specimens of high educational value, the industries of the United States will have in them a full and honorable presentation before the students of the institution and the public at large.

It may properly be suggested here that contributors should affix to each specimen a special tablet bearing the inscription: "Presented to the Technological Collection of Canterbury College Museum, Christchurch, New Zealand, by, etc., etc.," giving the donor's name and post office address.

An Amendment of the New South Wales Patent Law.

The conditions of the patent law of New South Wales have been amended (June 19, 1879) so that exhibitors of unpatented inventions at any International Exhibition within the colony, or any other agricultural or industrial exhibition declared to be such by the governor with the advice of the executive council, shall not prejudice the right of the exhibitor, if he be the author or designer of the invention, to apply for letters of registration for such invention under the patents act. Neither will the publication of any description of the invention during the holding of the Exhibition, nor the user of the invention elsewhere without the privity or consent of the inventor, prejudice his right to a patent on application.

THE BESSEMER STEEL INTEREST.

A correspondent calls attention to the present workings of the Bessemer steel industry in the United States, with the remark that the patent Bessemer process is owned by eleven steel plants, who have an association for mutual protection, which prevents the establishment of any more plants in the United States. The agreement of this association is also that the same uniform scale of prices shall be maintained to the public; that any plant from necessity or choice remaining idle shall receive a bounty of $5 upon each ton produced by the plants in operation. If two plants were idle the tax would be $10 per ton; if five were idle the tax on product would be $25 per ton.

But one plant is now idle, the Vulcan Iron and Steel Company of St. Louis, whose capital is about $1,500,000 (?). The product of the ten plants in operation is 700,000 tons per annum. A tax of $5 per ton would give the Vulcan Works an income of $3,500,000.

The price of rails in the United States is $45. The price of rails in England is $25, and 15,000 tons were recently sold to go to Canada at $22.50 per ton. If the Vulcan Works were running the product would probably be increased by 100,000 tons, as these works have two of the largest converters in the world, and as they were the last built in the United States they have all the improvements in the process.

The *cost* of steel rails in America is less than $20 per ton. Is it not time that there were more converters, or a lower duty on steel rails? Are not these steel plants standing in their own light and inviting opposition to the present high duty? Is it strange that large railroad men should seek to punish these companies by purchasing in England?

It is reported that the present plants are driven to their utmost double turn to supply the demand, and that there is less attention paid to the character of the product, and that many rails break in laying. This is our correspondent's complaint; how far it can be contradicted we shall be happy to be informed.

INVENTIONS IN CHINA.

For a long period the Chinese Government directly discouraged invention and all other innovations upon established conditions and customs. The result was a fixedness in social and industrial affairs which has made China proverbial. That the stimulus of western civilization has made great inroads upon this particular phase of Chinese character, is apparent on all sides. We are inclined to think, however, that nothing quite so significant has appeared in this connection as the following imperial decree published in the Pekin *Gazette*, and bearing date June 13, 1879. It reads as follows:

The Censorate has memorialized us to the effect that Tung Yü-ch'i, an expectant sub-prefect in the province of Anhwui, proposes to construct a steamboat to be impelled by steam generated without the use of fire, which shall be so superior as to supplant the one using fire. Its construction is already well nigh completed, and it is estimated that 3,000 taels will suffice to finish it. A diagram with illustrations of the invention has been presented to the memorialists for their inspection. Should the steamer invented by the officer in question be found capable of quick motion and adapted to practical use, it will, of course, be proper to adopt it. We, therefore, command Shên Pao-chên to devise means for providing the 3,000 taels required to carry the invention into execution. He is further commanded, in conjunction with Li Hung-chang and Ting Jih ch'ang, to examine the diagram and the illustrations, and to give the matter his most careful consideration. As soon as the invention has been carried to completion it will be the duty of Shên Pao-chên and the high officials associated with him to put it to the test of an experiment and to report in a memorial to us whether it has been found, after all, to be adapted to practical use. We have this same day commanded the Censorate to instruct Tung Yü-ch'i to accompany Shên Pao-chên to Nanking. We have also commanded the Censorate to hand the diagram and illustrations to Shên Pao-chên for his perusal, and to communicate this decree to the several officials concerned.

The Cincinnati Exhibition.

The Cincinnati Industrial Exhibition was formally opened Sept. 10, with an address by President Hayes. The Governors of Ohio, Kentucky, and Indiana, with their staffs and a number of military organizations, also participated. President Hayes said:

"The seventh Cincinnati Industrial Exhibition is held at a most auspicious period in the commercial history of our country. The great business depression which followed the financial crisis of 1873, after five long and anxious years of distress, embarrassment, and bankruptcy, has at last been succeeded by a revival of prosperity, which is surely and rapidly extending to every branch of useful industry, with all values measured and made steadier by a currency which

is worth its face in the markets of the world; with business no longer perplexed and crippled by an uncertain and fluctuating standard; with credit which, according to Daniel Webster, is 'the vital air of modern commerce,' upon a sound and stable basis; with restored hopefulness and confidence, shared alike by the capitalist, the business man, and by the laborer; with agricultural crops and products abundant and readily salable at fair prices; with our manufactures seeking and finding a market in foreign countries to an extent never known before; with our natural burdens of debt and taxation becoming every year less difficult to manage and carry; with our country maintaining honorable and peaceful relations with all mankind; the merchants, the manufacturers, and the working men of Cincinnati may well be congratulated that at such a time their countrymen have assembled from far and near to enjoy and be instructed by this great Exhibition. We thank you for the invitation which we in such countless numbers have accepted; for your hospitality, and for your welcome to Cincinnati, a city which, standing, as it does, nearer than any other great city to the center of the population of the United States, may be rightfully called the 'Central City of America.'"

COPYRIGHTING FRUIT.

One of our contemporaries published a long account the other day of an Illinois nurseryman who claims to have secured a copyright on the propagation of certain varieties of cherries.

Our newspaper neighbor copied from the nurseryman's catalogue a description of his new cherries as follows: "Please take notice that the names, description, and numbers of these cherries are copyrighted, and therefore my individual and exclusive property, and any one infringing on my rights under the copyright laws of the United States, will be prosecuted," after which follows a list of his copyrighted cherries, which he offers to sell the trees of, to nurserymen in different states after they have purchased the copyright to grow them. He describes some forty-five new varieties, and says he shall produce some twenty more next year. The advertised price of the trees is 50 cents each, but he seems to be in more doubt about the value of his copyright, for he asks fruit growers to make a bid for the latter, but adds that no offer of less than $50 for a State will be accepted. Not crediting the advertiser's statement of having a copyright on his cherries we have caused search to be made in the Library of Congress and also at the Patent Office, and we learn that no such copyright has been granted from either bureau. For many years the subject of protection to horticulturists and others for new varieties of fruits and flowers has been discussed, but the difficulty of defining such discoveries, they being gradually brought to their perfection by the experiments of different gardeners, has prevented the possibility of legislation on the subject, and there seems no practical way of affording protection to such discoveries.

Sounding Niagara River.

The United States Corps of Engineers has recently had the Niagara river sounded, a task never before accomplished, owing to the bungling and unscientific means employed by those who attempted it. Bars of railroad iron, pails of stones, and all unreasonable bulky and awkward instruments had been attached to long lines, and cast off the railway bridge and elsewhere, but positively refused to sink. The very bulk of the instruments was sufficient, no matter what their weight, to give the powerful under-current a way to buoy them up upon the surface, or near it. By means of a small lead weighing twelve pounds, however, and a slender cord, the depths from the falls to the lower bridge were easily obtained. One of the sounding party says that the approach to the falls in a small boat was made with great difficulty. Great jets of water were thrown out from the falls far into the stream, and the roar was so terrible that no other sound could be heard. The leadsman cast the line, which passed rapidly down and told off 83 feet. This was quite near the shore. Passing out of the friendly eddy which had aided them in approaching the falls, they shot rapidly down stream. The next cast of the lead told off 100 feet, deepening to 192 feet at the inclined railway. The average depth to the Swift Drift, where the river suddenly becomes narrow, with a velocity too great to be measured, was 153 feet. Just under the lower bridge the whirlpool rapids set in, and so violently are the waters moved that they rise like ocean waves to the height of twenty feet. Here the depth was computed to be 210 feet.

THE SOCIAL SCIENCE ASSOCIATION.

The annual meeting of the American Social Science Association began in Saratoga, September 9, with a fair attendance of members. F. B. Sanborn, the acting Secretary, read a report giving an account of the origin, aim, and scope of the organization, which now has members in thirty-eight States and Territories. Touching the definition of social science, Mr. Sanborn said: "By strict rules it must be admitted that the term 'science' cannot be applied to our pursuits in the same sense that it describes the researches of the geologist, the chemist, or astronomer. There is a margin, however, in social science for much besides the close inductive or deductive processes by which Newton, Agassiz, or Faraday arrived at their splendid results. The methods of acquiring all human knowledge are essentially the same. The conduct of a nation in a grave political crisis is not to be calculated like the elements in an eclipse, yet it may be foreseen within certain limits. Many problems in social science are in their nature both scientific and philanthropic. What can be more prosaic than to be inspecting the entries and drains of tenement houses, the condition of sewers and water pipes, or inquiring about the rent of dirty rooms, the cost of pauper relief, the labor or idleness of a population hanging on the verge of pauperism? Yet this is exactly what the Social Science Associations of England and America, the only ones in the world, have been doing."

The second day, President Barnard, of Columbia College, read a paper on "International Coinage," and also presented his paper on "Monometallism, Bimetallism, and International Coinage," prepared for the Association for the Reform and Codification of the Law of Nations, at the August meeting in London. Mr. Barnard proposes to make one gramme of gold the standard of value, and to have the smallest international coin of ten grammes, equal to $6 less two cents.

President Porter, of Yale College, presented an able paper on "Modern Education, its Opportunities and Perils," which was read in his absence. One of the great perils was found in the circumstance that in aiming to be too scientific in form, modern education often fails to be scientific in fact—due very largely, we apprehend, to the antecedent circumstance that the text book makers and teachers lack an adequate training in genuine scientific methods.

The regulation and control of the degree-conferring power in American colleges formed the subject of another paper by President Barnard, who thought that if the multitude of superfluous collegiate institutions were deprived of the degree-conferring power, they would do no harm, and might, perhaps, do some good. France, Germany, Italy, and other countries of Continental Europe, are full of lycées, gymnasia, and colleges, where instruction in all branches is as extensive as in the average American college, and generally a great deal more thorough, but which are without power to confer degrees. The British colleges cannot confer degrees, not even those which form a part of the great Universities of Oxford and Cambridge themselves. All England, with a population of 23,000,000, has only four universities; the State of Ohio, with 3,000,000 population, has thirty-seven. All France, with a population of 36,000,000, has only fifteen universities, which, moreover, are actually branches of a single one. Germany, with a population of 42,000,000, has only twenty-two universities, or one to 2,000,000 of inhabitants. All Europe, with a population of 300,000,000, has only 101 universities, or one to 3,000,000 people. Our own country, with a population of 45,000,000, has 425 universities, or one to every 100,000 people. Further on, he spoke of the general weakness of our over numerous degree-conferring institutions, and remarked that a university, in a proper sense of the word, is a costly establishment. It cannot be created by a mere act of legislature. A fiat university is worth no more than a fiat dollar. We have some universities in this country whose resources are in some degree correspondent to their responsibilities; but we have not one whose power of usefulness is not constantly held in check by insufficiency of means.

Professor A. P. Peabody, of Harvard, read a paper on female suffrage in connection with school elections, in which he urged that women should vote and hold office in school matters, because they in general far surpass men in educational ability, tact, experience, knowledge, and wisdom. The work is proper for women, and they ought to do it. This point was put in a decidedly novel way. He said: "When our public schools came into being they were not meant for girls, the education of women being regarded as of little consequence. The schools were then properly, necessarily, under the charge of men. Now that women are men's peers, and more, as to culture, and receive this culture chiefly at the public charge, there remains no reason why they should not render to the public the reciprocal service of control, care, and government in the educational system of which they have become the most favored beneficiaries."

Chinese immigration was discussed in a long paper by Professor S. Wells Williams, of Yale, who advocated the admission of the Chinese to citizenship when they desire it. He claimed that the Chinese here are under the strongest national sanction of any race, and ought to be protected. They came here at the invitation of our own people, and brought with them industrious and quiet habits, and have added largely to the resources and wealth of this country.

George T. Angell, of Boston, President of the Massachusetts Society for the Prevention of Cruelty to Animals, presented the results of his investigations into the manufacture and sale of poisonous and dangerously adulterated articles. At the close of the paper, Mr. Henry C. Meyer, of this city, said that he had investigated Mr. Angell's previous statements in regard to adulterations, and had tests made, and could discover no such general system of adulteration as Mr. Angell reported.

In the evening the President of the Association, Professor Gilman, of the Johns Hopkins University, Baltimore, delivered the annual address. His subject was "American Education during the last Decade." He took the ground that the American public school system never stood so firm, or worked so well, as now. The most noteworthy administrative change of the decade has been the admission of women to the local school boards of Massachusetts, and the opportunity afforded them in the same State to vote for school officers. The most noteworthy pedagogical movement has been in the introduction of kindergartens, and in the attention bestowed upon drawing and vocal music.

The subjects considered September 11 covered a wide range, embracing questions of public health, law, the protection of workmen in mills, the treatment of criminals, and the like. Resolutions were adopted favoring the metric system and a system of international coinage based on the unit proposed by President Barnard—the gramme weight of gold nine tenths fine. The sewerage of village cities was presented by Colonel George E. Waring, Jr., and discussed by several members. It was also commented on at considerable length by Professor Acland, of the University of Oxford, England. The history of the tenement house system of New York was presented in a paper on the sanitary condition of tenement houses, by Dr. Charles P. Russell, of this city.

Professor William Watson, of Boston, read a report on the "Protection of Life from Casualties in the Use of Machinery," in which he reviewed what has been done in this country and abroad toward the prevention of such accidents, and described various devices for covering dangerous machinery.

President Anderson, of Rochester, discussed the relations of Christianity and the common law; Dr. Wharton, of Cambridge, the various theories of punishment for crime; Frederick H. Betts, of New York, the policy of the patent laws; and Professor Woolsey, of New Haven, read a paper on the United States and the Declaration of Paris in 1856. All the principles of the Declaration of Paris were declared to be in accord with the spirit and policy of our government.

RECENT INVESTIGATION INTO THE ACTION OF ANÆSTHETICS.

The third report on the action of anæsthetics to the Scientific Grants Committee of the British Medical Association has been made recently, the report embracing the results of investigating the condition of the blood pressure in animals under the influence of chloroform, ethidine, and ether. The experiments were made upon rabbits and dogs, and seem to have been performed with great care. The facts obtained from the observations, says the *Medical Record*, warranted the committee in reaching the following conclusions: Ether, when administered to animals, has no appreciable effect in reducing blood pressure; chloroform and ethidine have a decided effect in that direction.

Chloroform has sometimes an unexpected and apparently capricious effect on the heart's action. The occurrence of these sudden and unlooked for effects are a source of serious danger, because the blood pressure is with great rapidity reduced to almost zero, while the pulsations are greatly retarded or even stopped.

By ethidine the reduction of blood pressure is not, so far as has been observed, through sudden and unexpected depressions. Chloroform may cause death by primarily paralyzing either the heart or the respiration. Although not free from danger on the side of the heart and the respiration, ethidine is, in a very high degree, safer than chloroform, inasmuch as the former does not compromise the heart as does the latter.

A legitimate deduction from the facts given is that ether is by far the safest of the three anæsthetics used, and that ethidine is much safer than chloroform, and equally efficient.

A Notable Feature in the Iron Trade.

Some of the features of the present advance in iron, remarks the *Iron Age*, are worthy of note. It will be found upon inquiry, that in the case of most mills the increase in the volume of business has not come from gaining new customers, but from increase in the orders of the old. There may be some exceptions to this statement, but it will hold true generally. This indicates that there has been a decided increase in consumptive demand, and that both consumers and jobbers believe that this is a good time to stock up and to place orders for future consumption. Another feature of interest is that the increase has come without much drumming for trade; that is, the buyers have sought the sellers—a most healthy indication. It will be further found that, so far as price is concerned, the sellers are more conservative than the buyers. This is a somewhat paradoxical statement, but manufacturers are holding back, and are more fearful of the effect of a too rapid advance than the consumers. The true secret of many of the advances that have taken place during the past six weeks, will be found in the offers that buyers have made for iron for immediate delivery. We have mentioned a case where 2·20 cents was offered when 2 cents was the usual selling price, for a lot of iron that was needed in ten days.

Glass Shoe Patterns.

The question sometimes arises whether a patent can be obtained for the mere substitution of a special material for another in the manufacture of a well known article. In reply, we may state that if the Patent Office is satisfied that in consequence of the substitution a new and important result is obtained, a patent will be allowed. A recent case in point is that of an applicant who asked for a patent for making shoe patterns of glass. It was alleged against the applicant that glass patterns had been previously used for cutting out photo print ovals; also that sheet metal shoe patterns were in common use; and that there could be no invention in merely substituting therefor such a well known substance as sheet glass. But the Commissioner decided that the use of glass shoe patterns was a useful novelty, sufficient to support a patent, because such patterns enabled the cutter to see any defects in the leather and move the pattern to avoid them, which he could not do with the ordinary patterns. So the patent for glass shoe patterns was allowed.

The Devil's Darning Needle.

To the Editor of the Scientific American:

Though I regret being compelled to even appear to take issue with the eminent entomologist of Washington, I must beg to assert that my statement in your issue of August 16, in regard to the finding of a thick-thighed walking-stick in early spring, and in a pool of water, is not "founded on mistaken identity." I have been perfectly familiar not only with these insects, but also with the water-boatmen referred to by Professor Riley, for several years, and certainly would not confound them even at a casual glance; and I noticed one or two characters of the walking-stick quite particularly. I observed that the alternate brown and greenish transverse bands marking the femora were unusually distinct, probably on account of being wetted; and as it occurred to me at the moment that the females might occasionally survive and deposit ova in spring, I examined it to ascertain the sex, and found the curved clasping organs of the male insect at the extremity of the abdomen.

It should not be inferred from my statement of the size of very young individuals that the adults are so diminutive, nor from the finding of this specimen in the water that the species is properly aquatic. The specimen was perhaps three inches long, exclusive of the antennæ, and is the only one I have ever seen in, or even near, water. I simply placed the matter on record in the columns of your paper as being wholly anomalous, and, to me, utterly inexplicable.

Yours truly, W. J. McGEE.

Farley, Iowa, Sept. 4, 1879.

The Catskill Mountains.

Professor Guyot has published a new map of the Catskill Mountains, the result of several summers' work in the Catskill region with his barometer and surveying instruments. He has measured the height of over two hundred places, determined by triangulation the positions of all the many summits, and discovered mountains that were not known to exist. A large part of the region, especially the southwestern, is an untracked wilderness of forests; and in several cases the only chance for making his triangulation was by climbing to the tops of the highest trees. He has found higher points than were before recorded, and many of them. His table of altitudes contains three peaks over 4,000 feet, thirteen over 3,800 feet, and thirty-six over 3,500 feet. The highest point is one of the previously unknown, Slide Mountain, in the Southern Catskills; its height is 4,205 feet above tide.

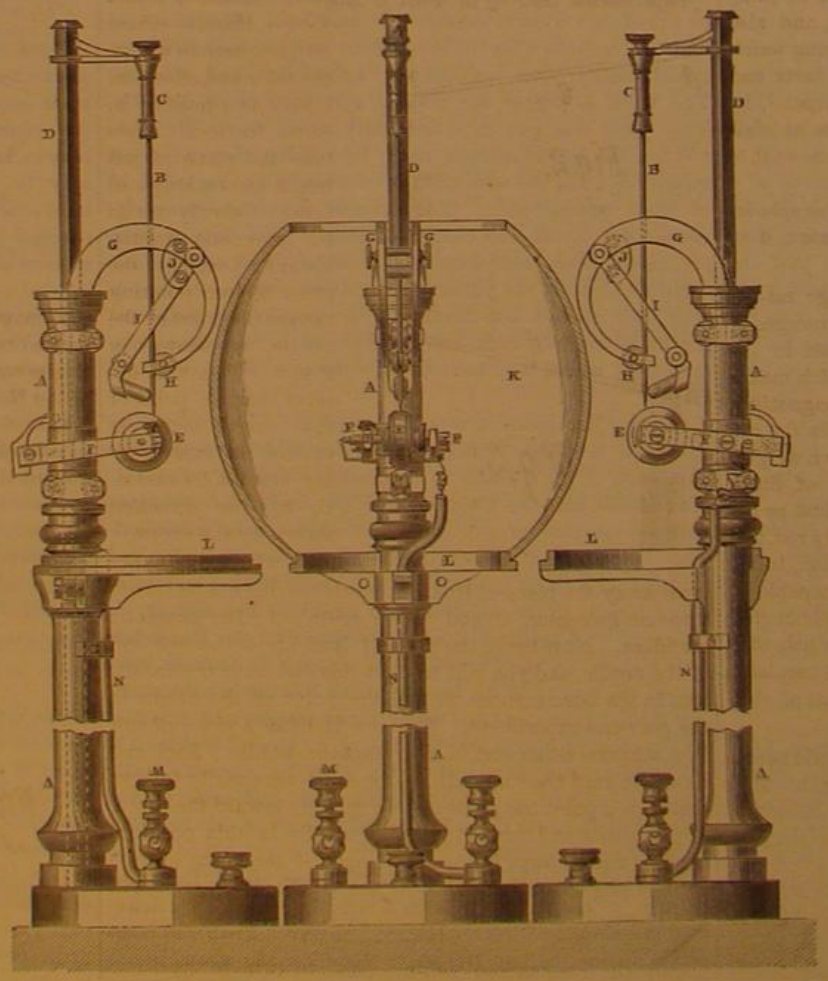
NEW FORM OF REYNIER'S ELECTRIC LAMP.

In 1878 Mr. E. Reynier observed the advantages presented by the effects of incandescence for the simple production and division of the electric light, and conceived the idea of uniting these effects with those of the voltaic arc. He therefore arranged the carbons, according to the Lodyguine system, so that it would burn at the point and furnish a small center of combustion at the point of contact. A small voltaic arc was thus produced.

In this lamp a slender rod of carbon is placed above a fixed and massive contact, either of carbon or metal, and is held in a vertical position by a heavy carbon holder. The carbon holder, by means of its weight, gradually pushes the carbon rod downward to replace the parts burned away. Cinders will collect at the point of contact if the ordinary carbons are used, but these cinders are thrown off by the rotation of the carbon disk. With this apparatus Mr. Reynier illuminated five lamps with a current from thirty Bunsen elements, and maintained the light in one of the lamps for more than a quarter of an hour with a secondary battery of three Planté elements.

Fig. 1 is a side view of the lamp without globe. Fig. 2 is a front elevation with section of globe and support. Fig. 3 is an elevation of the other side. A is the hollow supporting column with base; B is a slender carbon rod fitted to the socket, C, and retained by a screw. The vertical rod, D, supports the carbon rod, B, and slides in the column, A, on friction rollers. The carbon disk or cylinder, E, upon which the end of the carbon, B, rests, is supported in a forked arm, F. The carbon slides between the two cheeks of the curved guide, G. There is a small wheel, H, at the end of the guide, G, against which the carbon rod, B, rests, and an inclined lever, I, is pressed by the spring, J, against the carbon rod, and acts as a brake. A glass globe, K, covers the whole.

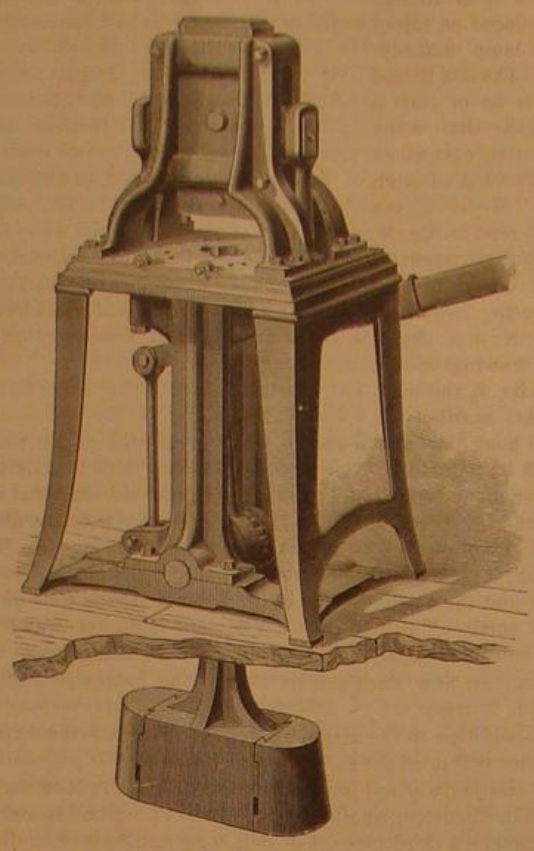
Mr. Reynier has made several models of his lamps. The last has a Carré carbon about 0·08 of an inch in diameter, held by a heavy carbon holder, which slides in a hollow column, and is provided with four friction rollers. The carbon rod rests on a carbon cylinder pivoted to a vertical arm of the column. A guide piece, provided with a brake, holds the carbon rod, and through this guide the current passes into the carbon rod, and from thence to the carbon cylinder, and returns to the battery. The point of contact is not directly over the center of the cylinder, but a little to one side, so that the cinders cannot accumulate.



REYNIER'S ELECTRIC LAMP.

A NEW COMBINED PUNCH AND SHEAR.

In our last two issues we gave brief descriptions of the new patent "Peerless" punching and shearing pendulum presses, Nos. 1 and 2, designed for comparatively light work. The one shown in the accompanying engraving is adapted to heavy work, and differs from the others in construction but not in principle. In the two presses previously described, the pendulum swings above the floor, and is actuated by treadle or hand lever. In this press the hand lever alone is used. It is designed for work as heavy as is usually done by large



"PEERLESS" COMBINED PUNCH AND SHEAR No. 6.

power presses, and is intended for railing makers, machinists, bridge builders, ship joiners, railroad contractors, and heavy iron working generally.

The work accomplished by it is astonishing, and we do not know of a hand press in the market performing as heavy work as this with but one man at the lever.

The pendulum swings below the floor, and is longer and heavier than in the presses before described. With one man at the handle, it punches easily an inch hole in three eighths bar iron, and $\frac{5}{8}\times1\frac{1}{2}$, any distance from the edge; and shears $\frac{3}{4}$ bar, $2\frac{1}{2}$ inches at a cut. It has an open back, and will admit a plate 14 inches wide, and of course any length. The opening in the bed is 7x9 inches; stroke of slide $1\frac{1}{2}$ inch; adjustment of slide $1\frac{1}{2}$ inch. It weighs about 1,200 lbs., and occupies but one foot seven inches by two feet four inches of floor space.

The cross heads and connecting rods are made of steel, and the press is apparently very strong and substantially finished. We are informed that the manufacturers intend to exhibit the machines we have illustrated, in operation, every evening at the approaching exhibition of the American Institute in this city. The novelty of these presses will, doubtless, excite the curiosity of all practical machinists.

For further information, address the Peerless Punch and Shear Company, 52 Dey street, New York city.

A Strange Collision at Sea.

The Rotterdam steamship P. Caland, which arrived at this port September 9, brought the captain and crew of a Norwegian bark which had been sunk by collision with some sea monster in mid ocean. The bark Columbia left London for Quebec, in ballast, August 8, and met with variable weather until the morning of the 4th inst., when she was sailing at the rate of from six to seven miles an hour before a fair wind. The sea was not very rough, and the bark was carrying all sail and heading westward. The captain was on deck at five bells in the morning watch, when a tremendous shock, which shook the bark from stem to stern, was suddenly felt. The men who were asleep in their bunks were awakened, and thinking that the foremast had been carried away, sprang on deck. Capt. Larsen and three of his men ran to the port side and saw the water discolored with blood, while the tail and fins of a huge monster were seen splashing about in the sea, which had become violently agitated on that side of the vessel. At this moment one of the crew cried out that a leak had been sprung, and Capt. Larsen and the carpenter hurried down into the hold to see if the bark had suffered any injuries. In the port bow, about three feet below water mark, they found that four planks had been crushed in for a space about four feet long. A large hole had been made, through which the daylight above the water could be plainly seen. The water was pouring into the vessel through this hole. Several attempts were made to stop it up, but failing, the bark was abandoned and sank soon after. The captain and his crew of twelve men were fortunately picked up by the P. Caland the same day in the afternoon. No precise description of the colliding monster could be given The Columbia was an old ship, but about two years ago was put on the stocks and thoroughly replanked. Her bow was made of solid $4\frac{1}{2}$-inch oak planking.

MECHANICAL INVENTIONS.

Mr. John J. Kendall, of Greensborough, N. C., has patented a shingle machine, which is an improvement upon the shingle machine for which letters patent of the United States No. 166,784 were granted to the same inventor, August 17, 1875. The improvement cannot be clearly described without an engraving.

Mr. John F. Rakes, of Greenup County, Ky., has patented improvements in automatic car couplings, the object of which is to furnish means for holding the link and pin in position to immediately and surely engage each other when the cars are moved up in position to be coupled.

An improved car coupling has been patented by Mr. Colin Chisholm, of Los Angeles, Cal. This is an improvement in the class of car couplings in which the pin is so pivoted as to form a gravitating latch, which is thrust back by the disk when it enters the draw head, but immediately falls into the slot of the link, and thus completes the coupling. For uncoupling, the latch is raised by a chain and lever.

An improved device for locking the adjacent ends of railroad rails securely in place, so that they cannot rise out of line with each other under the pressure of passing trains, has been patented by Mr. Elijah F. Locke, of Apponang, R. I.

An improved ice boom has been patented by Mr. John B. Hansler, of Jersey City, N. J. It is designed for keeping cut or broken drift ice from floating farther up and down stream than is desired, and also to prevent ice from descending the rivers and entering the harbors. It consists of an arrangement of net work of iron rods and cables connected to floats, and joined to the shores, piers, or docks on either side, and arranged to swing open for the passage of vessels, and possessing sufficient elasticity to yield to the force of the current and tides, and to the impact of the floating ice, without breaking.

An improvement in wagon jacks for raising the axles to take off the wheels for greasing the spindles, has been patented by Mr. Andrew McClure Jones, of Birminghan, Ala. It consists of two bars, one serving as a standard and the other as a movable extension, to the upper end of which the lifting lever is fulcrumed. The adjoining faces of the bars are ratcheted, so as to engage each other, and connected together by bolts projecting from one bar through a vertical slot in the other, and furnished with thumb nuts, by which the upper bar can be secured at any desired height.

PRACTICAL EXPERIMENTS IN MAGNETISM, WITH SPECIAL REFERENCE TO THE DEMAGNETIZATION OF WATCHES.—No. 1.

BY ALFRED M. MAYER.

The extensive uses now made of electro-magnets in telegraphy, in dynamo-electric machines, and in the many practical applications of electro-magnetism, have greatly increased the risks of damage to watches by their magnetization. I have no doubt that in any one of our larger cities there are scores of watches safely packed away in drawers regarded as past recovery from overdoses of magnetism. They are looked upon by their owners as bullion kept in reserve for "a rainy day."

To be aware of the danger is not a sufficient guard against *accidents*. My own experience is a case in point: I had already silenced one watch, saturating it with magnetism by approaching an electro-magnet in my laboratory which had been allowed to remain in action by the person who had that day used it in his experiments. After purchasing another watch, I always took the precaution to place it on my office table before I approached the large electro-magnet of the Stevens Institute of Technology. I always did this, no matter whether the magnet was or was not in action. But one day I was suddenly called out of the room and detained by a visitor for a half hour or more. I took my watch from the table as I passed out of the room. I returned to my laboratory with my mind entirely engrossed with the experiments I had in hand, walked up to the magnet, rearranged the apparatus, and charged the magnet. My watch at the time was not 3 inches from the pole of this huge magnet! I was only aware of my "accident"—call it, if you will, thoughtlessness about the watch or thoughtfulness about the experiments—when that afternoon I leisurely walked to the station to take a train, and was informed that "it had gone over half an hour." My watch had lost half an hour in about three hours! Persons more cautious than I have had the same experience, for it is impossible, without idiocy supervening, to be constantly thinking of a watch. I have also remarked that out of the two or three dozen owners who have had watches apparently ruined by this same large magnet, each one considered "the other feller" a careless and *thoughtless* person until his turn came to do the same thing, when he was in a really *thoughtful* mood—about something, *which was not his watch*.

My last magnetic accident turned my thoughts to ways of taking the magnetism out of watches. I have succeeded perfectly, and the process which I have finally adopted as the best is so simple that any one can practice it, and that, if you wish, without even detaching your watch from its chain.

Though the process is simple, yet, of course a knowledge of the elementary facts and laws of magnetism is required to understand *how* it is done; and I know that every intelligent American mechanic really wishes to understand the reasons for performing the operations that he may be called on in practicing any new process.

To render clear to all the operations used in *demagnetizing* (that is, in taking the magnetism out of) a watch, I will assume that I am addressing those who have little or no practical experience as experimenters in magnetism, and also those who wish to be at the least expense in practicing watch demagnetization. I will, therefore, explain the facts and principles of magnetism on which the operations depend, by describing actual experiments made with apparatus which is so cheap and homely that it can be made by any one with a very little trouble and at a trifling expense.

I will at once proceed to show how to make the simple instruments required in our preliminary experiments and in the demagnetization of a watch.

The Magnet may be made out of a piece of a large rat-tail file. The one I have used is 7 inches long and averages ⅜ of an inch in diameter. There is something either in the quality of the steel or the temper of these files which makes them capable of receiving powerful charges of magnetism. The most powerful magnet I have ever examined is the rat-tail file just spoken of. It lifts several times its own weight. If a large rat-tail file cannot be had, then a piece of Stubs steel, 10 inches long and ½ inch in diameter, must be obtained. This steel rod must be first heated to cherry red, and then lowered gradually, while in an upright position, into a bucket of water. This will render it hard and capable of receiving and retaining a magnetic charge. The file or steel rod is magnetized either by drawing it over the pole of a powerful electro magnet, or by wrapping around it insulated copper wire, and passing through the wire a current of electricity from a galvanic battery.

The Magnetometer.—We call thus the small magnetic needle suspended in a glass shade by a fiber of silk, Fig. 1. It is made thus: Take a No. 4 or 5 needle, and draw it several times, from point to eye, over the N. end of your magnet. This operation will magnetize the needle, and when suspended from its middle, its pointed end will point toward the north. Now, on to a piece of wood, B, which is 3 inches square, glue and screw the slips, A and A, across its grain, so that it cannot warp. Then on its upper side paste a piece of damp white drawing paper. When this has dried it will be tightly stretched on the piece of wood. Draw on the paper a circle slightly larger in diameter than the length of the No. 4 needle. Divide one half of this circle off into 180 parts of one degree each; or, if that be too tedious, divide the semi-circumference into ninety equal parts of two degrees each. To suspend the needle, you get a skein of floss silk, such as is used in embroidery. This silk is untwisted, and from it you can readily draw a thread formed of a few fibers, which is very delicate and without the slightest twist or torsion in it. To suspend the needle, stick to its middle a small dot of wax. Then press the end of the silk thread into the wax and work the wax over it with the fingers. The other end of the thread is passed through the eye of a large No. 1 or 2 needle. This needle is then passed through a hole in a piece of cardboard, C, placed on top of the lamp chimney, L. The silk thread must be of such a length that when the needle is pushed downward through the hole in C, the magnetic needle, N, may be brought to rest on the paper covering the block, B. Now, on slightly drawing up the needle, S, the magnetic needle, N, will hang just above the board, B, and will swing round with its pointed, or N., end toward the north of the horizon. After many oscillations the needle will come to rest and will point in a direction which is called the *magnetic meridian*. This direction is different for different places. Here, in New York, it makes an angle of 7° with the true north and south line, and the N. end of the needle points 7° to the west of the true north. This pointing of a suspended needle away from the true N. is called its *magnetic declination*, or magnetic variation. In New York and its vicinity the magnetic declination is 7° west.

Fig. 1.

In addition to the magnet and magnetometer the experimenter will need the following materials:

Three pieces of soft iron. One piece 12 inches long and ⅜ inch in diameter; another piece, 3 inches long and ¼ inch in diameter; a third piece, 1¼ inch long and ⅜ inch in diameter. These pieces of iron should be made very soft by heating them to bright redness and then allowing them slowly to cool in hot ashes.

A piece of steel wire, 6 inches long and $\frac{1}{16}$ inch in diameter.

Iron filings, made from soft iron and passed through a fine sieve.

Pieces of window glass. Two 12 inches by 6, and two pieces 6 inches square.

A small bottle of spirit varnish, such as photographers put over their negatives.

Needles, nails, and tacks of various sizes.

With the above simple and cheap things a great many interesting and beautiful experiments can be made; and we will now show how to obtain from these homely instruments much information that is really sound and useful.

Experiments showing in what a Magnetic Substance differs from a Magnet.—Place the magnetometer on the table and allow the magnetic needle to come to rest. Now take the piece of soft iron 3 inches long and bring it slowly up to the magnetic needle, always keeping the piece of iron pointing toward the point of the needle, as shown in Fig. 2. You will observe that the point of the needle moves toward the iron, turning around its center, C, in the direction shown by the arrow.

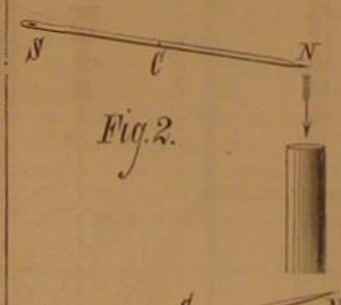


Fig. 2.

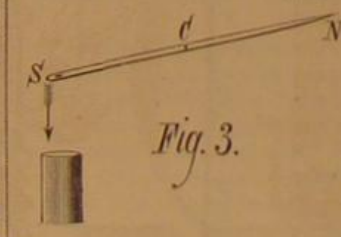


Fig. 3.

Slowly and steadily draw away the piece of iron. As you do so the needle slowly turns on its center, C, and comes again into the magnetic meridian. Now bring the piece of iron up to the eye end of the needle, and you will see that this end turns toward the iron in the same manner as did the point of the needle in the previous experiment. Thus we find that a piece of soft iron attracts either end of the magnetic needle. Each end moves toward the iron. If this be so, it necessarily follows that if you point the piece of iron directly toward the center of the needle and bring it up to the needle in this position, keeping care always to have the length of the piece of iron at right angles to the length of the needle, the needle will not move, but remains steadily pointing in the magnetic meridian. Each end of the needle is equally attracted toward the iron, and as each end tends to turn in the direction shown by the arrows in Fig. 4, it remains at rest under the action of two equal forces tending to rotate the needle in opposite directions.

Now we will make some experiments similar to those just described, but differing in this: we use a magnetized No. 1 sewing needle instead of the piece of soft iron. Take a No. 1 sewing needle and draw it from point to eye over the N. end or pole of your rat-tail file magnet. You will, by this operation, have converted the needle into a magnet, and if you suspend it, as I wish you now to do, like the needle of your magnetometer, you will find that *it points in the magnetic meridian with its point toward the north.* The ends of magnets, or, more accurately speaking, certain points in the center of magnets and *near* their ends, are called *the poles of the magnet.* To distinguish these two poles, they are respectively called north pole or south pole, corresponding to the end of the needle which points toward the north or south geographic pole. The points of our magnetized needles are, therefore, north poles, while their eye ends are south poles.

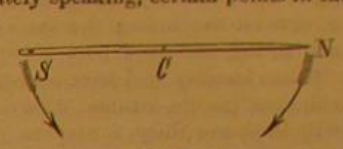


Fig. 4.

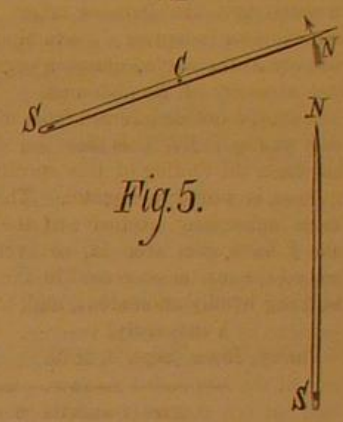


Fig. 5.

Bring the No. 1 needle up to the needle of the magnetometer, with its point toward the point of the magnetometer needle and with its length always at right angles to the magnetic meridian, as shown in Fig. 5. The N. pole of the needle moves away from the north pole of the No. 1 needle, and we here have *repulsion* instead of attraction, as we had when the piece of iron was placed in the same position. Now point the north pole or point of the No. 1 needle toward the eye end, or south pole, of the magnetometer needle, as shown in Fig. 6. In this position of No. 1 needle, the S. pole of the suspended needle moves toward the N. pole of the No. 1 needle. So in this experiment we have attraction of the S. pole toward the N. pole. Thus we have found out that the north poles of magnets repel each other, while the north pole of one magnet attracts the south pole of another magnet. This being the case, it follows that the No. 1 needle, attracting the S. pole of the suspended magnet and repelling its N. pole, must, when pointed at right angles to the suspended needle and directed toward its center, C, cause the suspended needle to rotate, its S. pole moving toward the point of the No. 1 needle, as shown in Fig. 7.

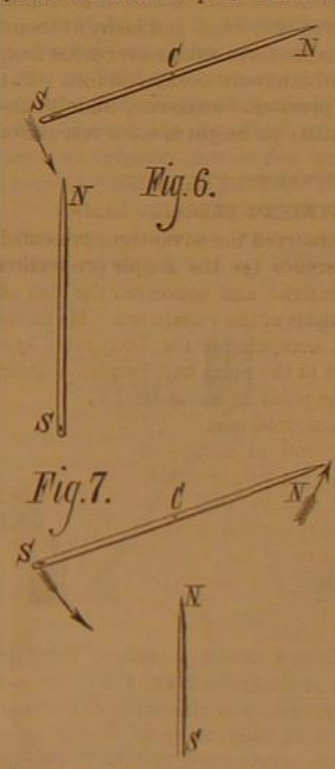


Fig. 6.

Fig. 7.

The experimenter must now compare this experiment with the similar one with the piece of iron. The iron when pointed toward the center of the magnetic needle did not rotate it, but when the magnetized needle is placed in the same position the suspended needle rotates and its N. pole moves away from the N. pole of the No. 1 needle.

Let us vary these experiments by pointing the eye end, or south pole, of the needle first toward the N. end and then toward the south end of the magnetometer needle, and then

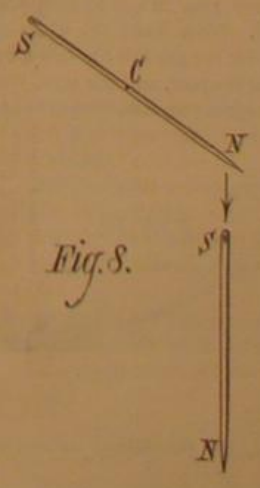


Fig. 8.

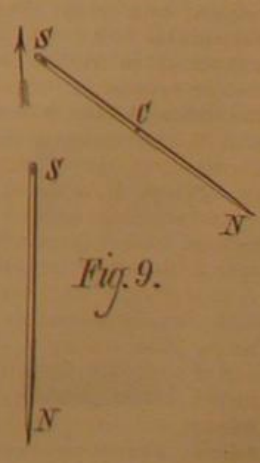


Fig. 9.

toward the center of this needle. Figs. 8, 9, and 10 show the results of these experiments. They differ from those of Figs. 6, 7, and 8 in this: the south pole of the magnetized No. 1 needle acts on the suspended needle in place of the north pole. The results are as follows: The S. pole of the No. 1 needle repels the S. pole of the suspended needle and

attracts its N. pole; and consequently when its eye end is pointed toward the center, C, of the suspended needle the latter has its N. end pulled toward the No. 1 needle and its S. end repelled. It necessarily turns around its center, C., its N. pole moving toward the eye end or S pole of the No. 1 needle.

These are very simple experiments, yet they have already given us the knowledge of an important law, which may be summed up thus:

Like poles repel each other, while unlike poles mutually attract each other.

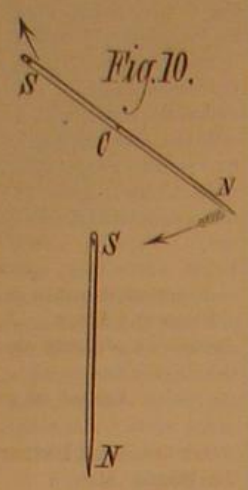


Fig. 10.

These experiments also give us a practical and easy method of determining whether a body is merely *a magnetic substance* like our piece of soft iron, or a piece of nickel or cobalt; or is a magnet like our No. 1 magnetized needle.

Each end of a bar of a magnetic substance attracts either the N. or S. pole of a suspended magnet; but *a magnet has poles*, and one of its ends acts to attract one end of a suspended magnet, while the other end of the magnetic bar will repel the same end of the suspended magnet. Hence to tell whether a certain bar is a magnetic substance or a magnet, we place it with its length at right angles to a suspended magnet and pointing toward its center. If in these circumstances the suspended magnet remains at rest then the bar is formed of a magnetic substance, or one which has no action whatever on a magnet. To determine whether the latter is the nature of the bar, we bring one of its ends near an end of the suspended magnet; if the latter remains at rest, then the bar is formed of a substance which has no sensible magnetic action on the suspended needle. If, however, the suspended magnet turns when the bar is placed at right angles to its length, then the bar is a magnet, and the end of it which is toward the needle is the pole which is of the same name as the pole of the suspended magnet which moves away from the bar.

With the magnetometer we may, therefore, determine the name of the pole of a magnet by the direction in which the magnetometer needle moves, and we can compare its intensity with another magnet by observing the number of degrees of the circle over which the needle rotates.

These experiments on the mutual attractions and repulsions of magnets may be modified in a very pleasing manner

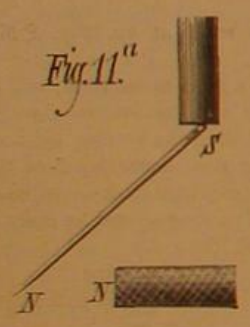


Fig. 11a.

Fig. 12.

by allowing a No. 1 magnetized needle to adhere from the end of a piece of soft iron, and approaching to the free end of the needle first one pole and then the other of the magnet. Figs. 11*a*, 12, 13, and 14 may serve to clearly show the different phases of these experiments without further explanation.

Experiments in Magnetic Induction.—Pour some iron filings on a sheet of paper and roll your rat-tail file in them. Lift the magnet from the paper and you will see that the filings stick in the form of bristles or brushes to the two ends, and at some distance from the two ends of the magnet, but to the middle portion of the magnet no filings adhere, as is shown in Fig. 11.

Stick the end of the piece of soft iron in the filings; you will see that they do not adhere. Now stand the piece of iron upright in the filings and bring the rat-tail file down on the upper end of the iron. Lift the magnet, and the iron, you will find, adheres to the magnet; also, you will observe that

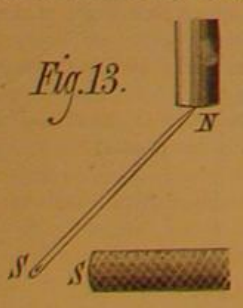


Fig. 13.

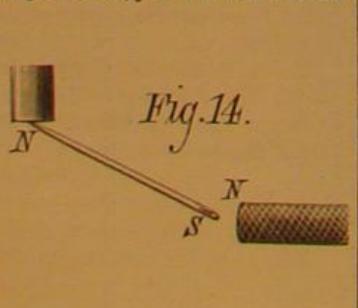


Fig. 14.

the iron itself is now magnetic, for the filings adhere to it, as shown in Fig. 15.

If you take hold of the piece of iron with one hand and then detach the magnet, lifting it above the iron, you will see that the iron loses its magnetism, for the filings fall when the magnet is removed to a distance from the iron. Yet it is not necessary that the magnet should actually touch the iron to render it magnetic, for you will find that the iron will attract the filings and cause them to adhere to it even when the magnet is held at a short distance above the end of the iron, as shown in Fig. 16, though the quantity of iron filings which it is capable of holding, and consequently the strength of its magnetism, is less than when the iron adhered directly to the magnet.

The above experiment is modified in an interesting manner by using different sized nails, brads, and tacks in place of the filings.

In this experiment, represented in Fig. 17, the magnet has directly adhering to it a large nail. This nail is thus made a magnet, and it in turn holds up a smaller nail, and this a yet smaller one, which in turn supports a brad, and this brad a smaller one, and to this sticks a tack, and to the tack adheres some iron filings. Each nail in turn acts on the nail or tack which adheres to it, just as the magnet acts on the large nail directly adhering to it.

Thus it is seen that the magnet *induces* the iron to become a magnet like itself when it touches the iron or is held near it; hence this action of a magnet on soft iron is called *induction*.

We will now repeat these experiments in induction, but we will use a piece of steel in place of the soft iron. Select a short thick sewing needle that contains no magnetism. Of this you may be sure if, when the needle is pointed toward the center of the magnetometer needle, and at right angles to its length, it does not cause the latter to rotate. If the needle, when dipped in iron filings, does not cause them to adhere to its ends it will be free enough of magnetism for our experiments.

Having tested the needle and found it free of magnetism, you now hang it to the end of the rat-tail file magnet and bring its free end into the filings. They now adhere to the needle, as shown in Fig. 18.

Hold the needle between the fingers of one hand and remove the magnet to a distance with the other hand. You now see that the needle behaves differently from the piece of soft iron, for when the magnet was removed from the latter the iron filings dropped from its end, but in the case of the needle the filings remain suspended. In other words, the

Fig. 15.

Fig. 16.

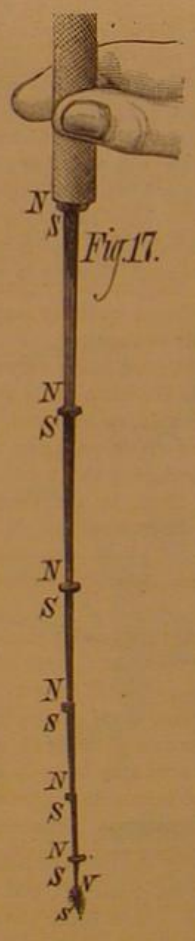


Fig. 17.

iron is only temporarily magnetized by induction; that is to say, it remains magnetized only while in contact with the magnet. On the other hand, the needle is permanently magnetized by induction; that is, it remains magnetized after the magnet has been removed from it. This difference in the after effects of induction on soft iron and steel is best observed in the following experiment.

Take a piece of the softest iron, and having ascertained that it is entirely free of magnetism, draw it repeatedly over the end of the magnet; if the iron is really soft you will find that even repeated stroking on the magnet cannot give it the power of attracting the filings. However, generally the iron will retain a slight, though often very slight, amount of magnetism, and will cause a few particles of filings to adhere to it. Now perform the same experiment with a large sewing needle, and observe how powerful a magnetic charge has been given to it. When rolled in the filings large tufts adhere to its ends, surprising those who have never seen before how strong a magnet may be thus made of a large sewing needle.

This retention of a magnetic charge by steel enables us to readily fashion magnets of any form and size. If steel or some other easily worked body had not this property we would be obliged to construct our mariner's compass needles out of the hard and brittle calamite or loadstone. Indeed, it would be difficult to select from the whole range of the special properties of matter one more valuable to man, or more necessary to his present high and widely spread civilization, than this one of the capability of steel to receive and retain the properties of the loadstone.

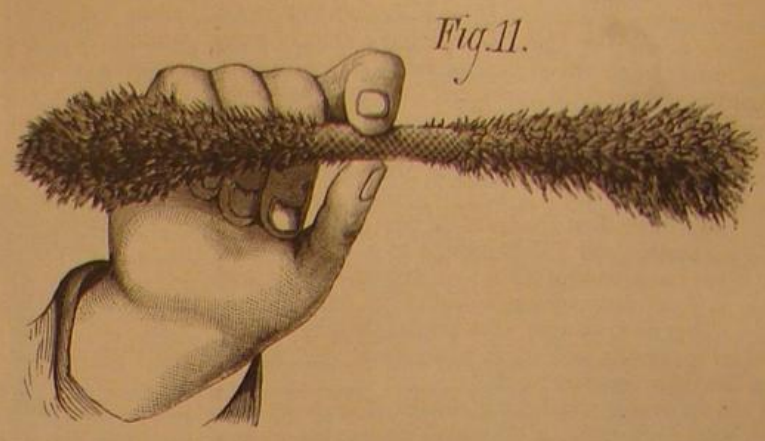


Fig. 11.

Further Experiments in Magnetic Induction.—Let us, by means of other simple experiments, examine more minutely into the nature of this magnetic induction.

Take two pieces of very soft iron wire and suspend them by silk fibers, as shown in Fig. 19. Hold the ends of the fibers separated, between the thumb and forefinger, so that the wires may hang a quarter of an inch or so apart. Now bring them slowly down toward the N. end of the magnet, as shown in Fig. 19. They now no longer hang parallel to each other,

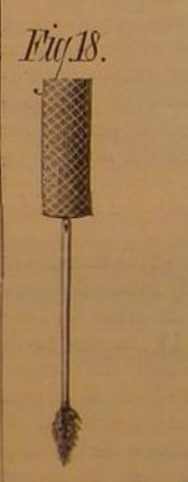


Fig. 18.

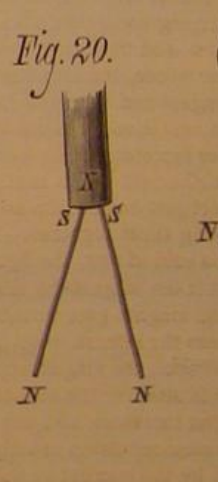


Fig. 20.

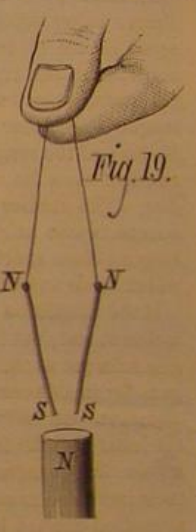


Fig. 19.

but are inclined, the upper ends of the wires repelling each other, so that the two suspending threads are forced outward and no longer hang vertically. This repulsion between the upper ends of the soft iron wires is caused by their having the same magnetic polarity. We have already seen that like poles mutually repel. (See experiments described in Figs. 5 to 14.) If the N. pole of the magnet is pointing upward, as shown in Fig. 19, then the lower ends of the suspended iron wires are of S. polarity and their upper ends are of north polarity.

The experiment just described may be modified by simply

Fig. 22.

Fig. 21.

holding the two wires parallel to each other between the thumb and forefinger and bringing their ends to touch the end of the magnet. They will adhere to the magnet, and on relieving the wires between the thumb and finger they will at once fly apart, from their mutual repulsion, as shown in Fig. 20.

Take seven pieces of iron wire, each about 1 inch long, and run them through small corks, about $\frac{1}{4}$ of an inch long and $\frac{1}{16}$ inch in diameter. Throw these pieces of wire into a

bowl of water and they will float vertically. They will come to rest at various hap-hazard positions on the water. Evidently there is no order in their arrangement. Now take your rat-tail file magnet and, holding it in a vertical position, bring it over the water in the bowl. At once the pieces of wire sail toward the magnet, and after many motions among themselves they at last take up the definite figure of a hexagon with a floating wire in its center, as shown in Fig. 21.

This is a beautiful illustration of magnetic induction, and this experiment tells the whole story when viewed in the light which another gives, and which will be at once described before speaking further of the one just made.

Take seven sewing needles; "Milward's No. 6 betweens" are good for this experiment. At the N. Y. Cork Cutting Co., 45 Fulton street, New York, you may buy a gross of corks, of ½ inch in length and ⅛ inch in diameter, for 10 cents. Magnetize each needle by drawing it from point to eye end over the N. end of your rat-tail file magnet. Then run each needle through the center of a cork made by halving one of the corks just described. In other words, the corks which will float these needles are ¼ inch long and ⅛ inch in diameter. Now throw these needles in the bowl of water. They repel one another, and if time enough be given them they will at last reach the edge of the bowl and will arrange themselves at equal distances apart around the border of the water. They do so because when floating upright their like poles are opposed to each other, as shown in Fig. 22, and these like poles mutually repel.

While the needles remain on the border of the water in the bowl, bring down vertically the rat-tail file over the center of the water, with its N. pole pointing downward. The magnetic needles at once rush toward the middle of the bowl, and after moving about each other for a while they end by forming the same regular geometric figure of the hexagon, with a needle in its center, as happened in the experiment with the floating iron wires, shown in Fig. 21. In the experiment with the magnetic needles we know the exact magnetic conditions of the experiment. We know that the needles are magnets, and that their south poles are pointing upward and their north poles are down in the water. The like poles of these needles being opposed, they mutually repel, and keep apart till the N. end of the magnet has been brought over them; then this strong north pole attracts the upper or south poles of the needles, and they draw toward the N. pole of the magnet. In other words, the attraction existing between the N. pole of the magnet and the south poles of the needles is stronger than the repulsive force existing between the needles. The needles therefore move toward the magnet and approach one another till their mutual repulsive actions keeping them apart just balance the attraction of the magnet which tends to bring them together.

If the magnet be held at rest, the figure of the hexagon remains at rest; but if the magnet be slowly raised, the hexagon enlarges as the magnet goes further off from the hexagon, for in this case the attractive action of the magnet diminishes. If, however, the magnet approaches the hexagon, the latter shrinks in size, for the attractive force of the magnet on the hexagon increases, and the needles approach till their increased mutual repulsion exactly equals the increased attraction exerted by the magnet on them when the magnet is nearer the hexagon.

If the reader's interest should be excited by the description of these new experiments in magnetism, he will find in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 129, an extended description of them and of the phenomena which they may serve to explain and illustrate, with a full set of the various figures found by different numbers of floating magnets.

Now let us return to our experiments with the floating iron wires. These wires were not magnetized, therefore they did not repel one another when thrown into the bowl of water. They differed from the magnetic needles in this, and hence did not drive one another toward the border of the bowl. But when the magnet was brought over them they acted precisely like the magnetic needles, and formed the same regular hexagon with a floating wire in its center. The force acting on the wires and the needles was the same. It was the N. pole of the magnet. We know that the needles will only move toward the N. pole of the magnet when their south poles are upward and their north poles are down in the water. The wires did the same, and we therefore have a right to assume that when they moved toward the N. pole of the magnet their upper ends were made south poles by the inductive action of the magnet, and their lower ends, under the water, were made north poles by the same action.

We can now understand the condition of the polarity in the magnetic chain formed by the suspended nails, brads, etc., in the experiment shown in Fig. 17. To the N. pole of the magnet is attached a nail. The end of the nail touching the magnet is made its south pole by induction, while its other end is made its north pole. This nail now acts just like the magnet which magnetized it, and the nail in turn magnetizes by induction nail No. 2, and this nail No. 3, and so on to the end of the magnetic chain, which is terminated by the magnetized iron filings.

(To be continued.)

A New Blue Dye.

Reichenbach's wood-tar color, pittacal, has been resuscitated by A. Grätzel, and it is now an article of commerce at the price of £4 per kilo, under the formidable name of "German-Imperial-Flower-Blue," with reference probably to the blue corn flower, which is said to be the favorite cognizance of the German Emperor. The pure base is insoluble in water, but dissolves in every acid, and the solutions can be diluted to any extent. The acetate is generally used for dyeing, dissolved in a little acetic acid diluted with water, and almost neutralized with ammonia. In this bath, silk and wool take a fine reddish blue without the aid of any mordant. Cotton and other vegetable fibers are prepared with a solution of tannin, followed by a solution of tartar emetic. The colors produced are perfectly fast.—*Reimann's Färber Zeitung.*

Gelatine Photo Plates.

Many amateurs—and, for that matter, professionals also—who would otherwise practice the gelatino-bromide process, are deterred from so doing by a consideration of the difficulties which attend the preparation of the emulsion in hot weather, its limited keeping qualities, and the consequent necessity for making repeated small batches instead of "going in" for a large quantity at once, and thus securing, at least, a fair chance of uniformity throughout a large number of plates.

The plan I am about to describe is one which removes these difficulties; and I can recommend it on the score of efficiency, having for some time worked it myself. But to the users of small quantities of emulsion it offers especial advantages, as it enables them to emulsify a considerable quantity of silver bromide at one operation, and keep it in a convenient form for adding to the requisite quantity of gelatine just when the emulsion may be required for use.

The operator is thus relieved of the trouble of having continually to attend to the "cooking" arrangements of his emulsion, and, what is of equal importance at this season, the gelatine itself is for so short a time in contact with moisture that the chances of decomposition are reduced to a minimum, and the tendency to frilling and other evils diminished.

To make the emulsion proceed as follows: Dissolve 300 grains of gum arabic in ten ounces of distilled water; put the water in a wide-mouthed bottle, and the gum—together with a piece of chalk the size of a hazel nut—in a piece of muslin suspended therein. The chalk is to prevent any tendency on the part of the gum solution to turn acid. Take of the above four ounces, and dissolve in it eighty grains of ammonium bromide. To sensitize, dissolve 125 grains of silver nitrate in two ounces of water, and add a little at a time to the bromized gum solution, shaking well between each addition. When all the silver has been added put aside to digest.

A gelatine emulsion may be made at any time by adding to each ounce of the above thirty grains of gelatine; when soaked dissolve in a water bath, allow it to set, wash, redissolve, and coat. Or the gum emulsion may be dialyzed to remove decomposition salts, in which case it may be kept for a very considerable time without any change in its sensitiveness or general character. It would, however, be then advisable to reduce the proportion of gum, as it must be borne in mind that there is no washing to remove the gum, which, therefore, remains in the gelatine film.

To sum up, the advantages are:

1. Emulsification may be prolonged to any extent.
2. The bromide of silver will remain perfectly in suspension in the temporary menstruum.
3. A large quantity may be made, and portions taken at intervals as required.
4. The gum being very soluble, and permeating the jelly, the salts are more easily got rid of in washing.
5. Heat is not required, except to dissolve the gelatine.

Those whose patience is being tried by the vagaries of gelatine during this weather should try the foregoing, which will, I think, in the majority of cases, prove an effective cure.—*Peter Mawdsley, in British Journal of Photography.*

Combination of Cyanogen with Hydrogen and with Metals.

The author having measured the heat of the formation of hydrocyanic acid and of cyanogen from their elements (— 14·1 and — 38·3), concludes that the synthesis of hydrocyanic acid from cyanogen and hydrogen ought to evolve a considerable quantity of heat. He finds that gaseous hydrocyanic acid may be heated to 550° for three or four hours in a sealed tube without betraying any marks of decomposition or dissociation. The author effected the direct combination of cyanogen and hydrogen by heating the pure dry gases in equal volumes in a sealed tube of hard glass to 500° to 550° for several hours. On opening the tube a loss of about one seventh of the volume was apparent, due to the formation of a certain quantity of para-cyanogen. Potassa absorbed five sevenths of the gas, and the residual one seventh was found on analysis to consist of water almost pure. The volume of this residual hydrogen being sensibly equal to the original condensation (representing the change of a certain quantity of cyanogen into para-cyanogen) it follows that the gas absorbable by potassa is hydrocyanic acid exempt from free cyanogen. At a lower temperature the synthesis is less complete, and at greater heats a portion of nitrogen is set free. At 300° cyanogen combines with zinc, cadmium, iron if brought in contact in a sealed tube.—*M. Berthelot.*

Laws of Atmospheric Electricity.

Atmospheric electricity presents daily in Piedmont two maxima following the rising and setting of the sun, at an interval of some hours. These two maxima are separated by a minimum which follows the passage of the sun over the meridian of the place. As regards the annual fluctuation the maximum value of the atmospheric tension falls in February, and the minimum in September. Before and after storms the electrometer almost always marks zero, but during their passage or proximity the tension is very great. Rain and snow increase tension more slightly, and are often preceded and followed by electric diminution. The action of fogs, hoar frosts, and of the formation of clouds increases atmospheric electricity, though to a less extent than that of rain and snow. In calm and hot weather the lowest values are observed. South and especially southeasterly winds increase the electricity of the air; north winds have an opposite effect. Rain and snow are accompanied by negative electricity, at least as often as by positive. The same proportion holds good for storms and to a less extent for rain and snow. Negative electricity is generally due to storms or rain at a distance, to the formation of clouds, or to a polar aurora. In the normal conditions of the atmosphere electric tension decreases with altitude.—*P. F. Denza.*

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

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

M. M.

POSITION OF PLANETS FOR OCTOBER, 1879.

Mercury.

On October 1 Mercury rises at 5h. 41m. A.M., and sets at 5h. 38m. P.M.

On October 31 Mercury rises at 8h. A.M., and sets at 5h. 27m. P.M.

Venus.

On October 1 Venus rises at 5h. 14m. A.M., and sets at 4h. 34m. P.M.

On October 31 Venus rises at 3h. 11m. A.M., and sets at 3h. 9m. P.M.

The motions of Venus can be watched by referring the planet's places to the stars in Leo, and it will be seen that Venus moves toward the west until the 14th, and toward the east after that date. Venus is near the waning moon on the 12th, and at its greatest brilliancy on the 30th.

Mars.

Mars is coming into better position for evening observers.

Mars rises on October 1 at 7h. 57m. P.M., and sets at 10h. 12m. of the next day.

On October 31 Mars rises at 5h. 39m. P.M., and sets at 7h. 56m. A.M. of the next day.

After October 6 the motion of Mars among the stars will be toward the west; it can be compared with the stars of the Pleiades. Mars is in conjunction with the moon on the 30th.

Jupiter.

Jupiter, Saturn, and Mars are brilliant in the evenings of October.

Jupiter rises first: on October 1 at 4h. 25m. P.M., on October 31 at 2h. 24m. P.M.

An ordinary ship's glass, or a good opera glass, will show the varied positions of Jupiter and its four moons. If we take the hours between 8 and 10 in the evening for our observations we shall see Jupiter rise, unaccompanied by its first satellite, on the 5th, in consequence of the satellite coming in front of the planet and passing across the disk. The same will occur on the 21st and 28th.

The first satellite will be invisible at some time during these hours on the 6th and 29th, because it is in the shadow of the planet. On the 20th it will not be seen, because behind the planet.

The smallest satellite of Jupiter, the second in order of distance from the planet, will not be seen until near 10 P.M. on the 7th, when it passes from the face of the planet. It will disappear about 9 P.M. on the 14th, because it passes between the planet and the earth and is thus projected upon the face of Jupiter.

The third satellite of Jupiter, which is the largest, will disappear by going behind the planet, October 9. The approach of the satellite and planet can be watched, and its motion around Jupiter can be followed; it will reappear after midnight. This satellite will pass across the disk of Jupiter between 6 and 10 P.M. of the 27th; it will be seen to pass from the face of Jupiter between 9 and 10 P.M.

The fourth satellite of Jupiter will reappear from the shadow of Jupiter on the 25th, between 8 and 9 P.M.

Saturn.

Saturn comes to its best position early in October. A small telescope will show the ring projecting on each side the planet.

Saturn rises on October 1 at 6h. P.M., and on October 31 at 3h. 56m. P.M.

Saturn is in conjunction with the moon on the 27th at midnight, Saturn being about 8° south of the moon.

Uranus.

On October 1 Uranus rises at 3h. 20m. A.M. On October 31 Uranus rises at 1h. 29m. A.M.

Uranus is very near the star Rho Leonis.

Neptune.

Neptune rises on October 1 at 7h. 7m. P.M., and on October 31 at 5h. 7m. P.M.

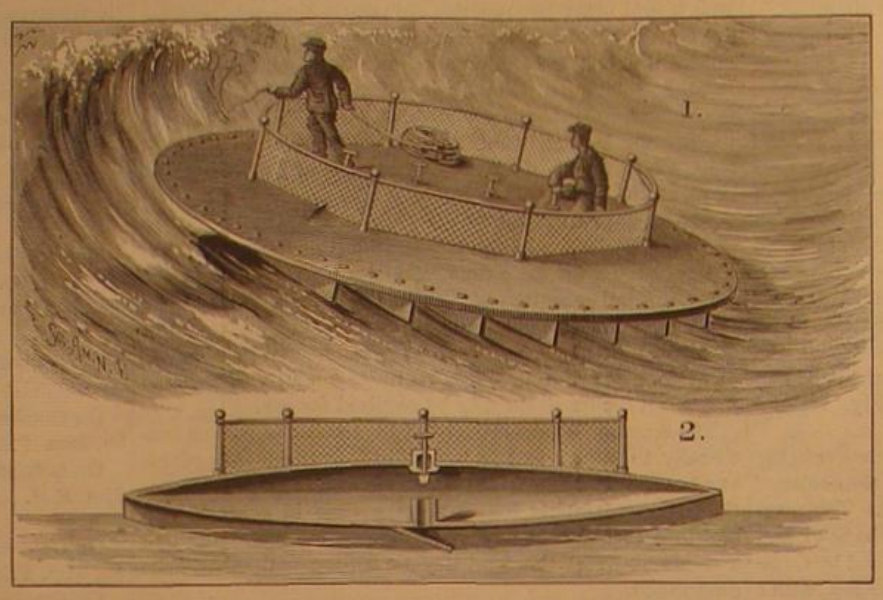
Between 4 and 8 P.M. of October 1, Jupiter, Saturn, Neptune, and Mars come above the horizon; and on the 31st the same planets rise between 2 and 6 P.M.

AN immense steel bridge is now in progress over the Frith of Forth, in Scotland.

A NEW SURF BOAT.

The accompanying engraving represents a novel surf boat recently patented by Mr. Richard H. Tucker, of Wiscasset, Me. The boat is circular in form, with convex upper and lower surfaces, and its entire interior forms a reservoir for holding compressed air to be used in the propulsion of the boat. The propelling device is very simple. It consists in air nozzles projecting toward the stern, one being placed in each between the keels, of which there are several. The air nozzles are provided with valves which are operated from the deck. The boat is steered by closing the air valves on one side or the other as may be required.

This boat is not designed for long distances, but it is claimed that it has propelling power sufficient for ordinary requirements. It certainly contains no machinery which can become impaired either by use or rest, and it possesses sufficient buoyancy and is of the proper form to maintain its proper position in the water.



TUCKER'S SURF BOAT.

Reaping 20 Square Miles of Wheat.

The poetry of the harvest field will have to be rewritten. A correspondent of the Chicago *Tribune*, writing from the Dalrymple farm, furnishes the rough materials for one canto.

"Just think," he says, "of a sea of wheat containing twenty square miles—13,000 acres—rich, ripe, golden; the winds rippling over it. As far as the eye can see there is the same golden sunset hue. Far away on the horizon you behold an army sweeping along in grand procession. Riding on to meet it you see a major general on horseback—the superintendent; two brigadiers on horseback—repairers. No swords flash in the sunlight, but their weapons are monkey wrenches and hammers. No brass band, no drum beat or shrill note of the fife, but the army moves on—a solid phalanx of twenty-four self-binding reapers—to the music of its own machinery. At one sweep in a twinkling, a swath of one hundred and ninety-two feet has been cut and bound—the reaper tossing the bundles almost disdainfully into the air—each binder doing the work of six men. In all there are 115 self-binding reapers at work. During the harvest about 400 men are employed, and during thrashing 600—their wages being $2 a day with board."

EDISON'S LATEST TELEPHONE.

Some weeks since we described Professor Edison's electro-chemical telephone as it first appeared in practical shape; since then it has passed through a succession of changes until it has finally assumed the compact and convenient form shown in the accompanying engraving. The form, however, is not the only change. In the first electro-chemical telephone, it will be remembered, the chalk cylinder was supplied with moisture by a movable roller which dipped in the exciting fluid and supplied it with moisture. This movable roller is now dispensed with, and the chalk cylinder is inclosed in a vulcanite box, seen at the end of the movable arm. The cylinder, when once moistened, remains in that condition for an indefinite period, as the box is practically airtight.

The small shaft that runs parallel with the iron arm extends through the side of the box and carries the chalk cylinder. Upon the opposite end there is a small pinion moved by a worm, the crank of which is turned by the finger. The diaphragm of the receiving instrument is covered by the front of the box, excepting a small central portion which is quite sufficient for the exit of the sound.

The arm which supports the receiving instrument is jointed so that it may be raised vertically out of the way when the telephone is not in use.

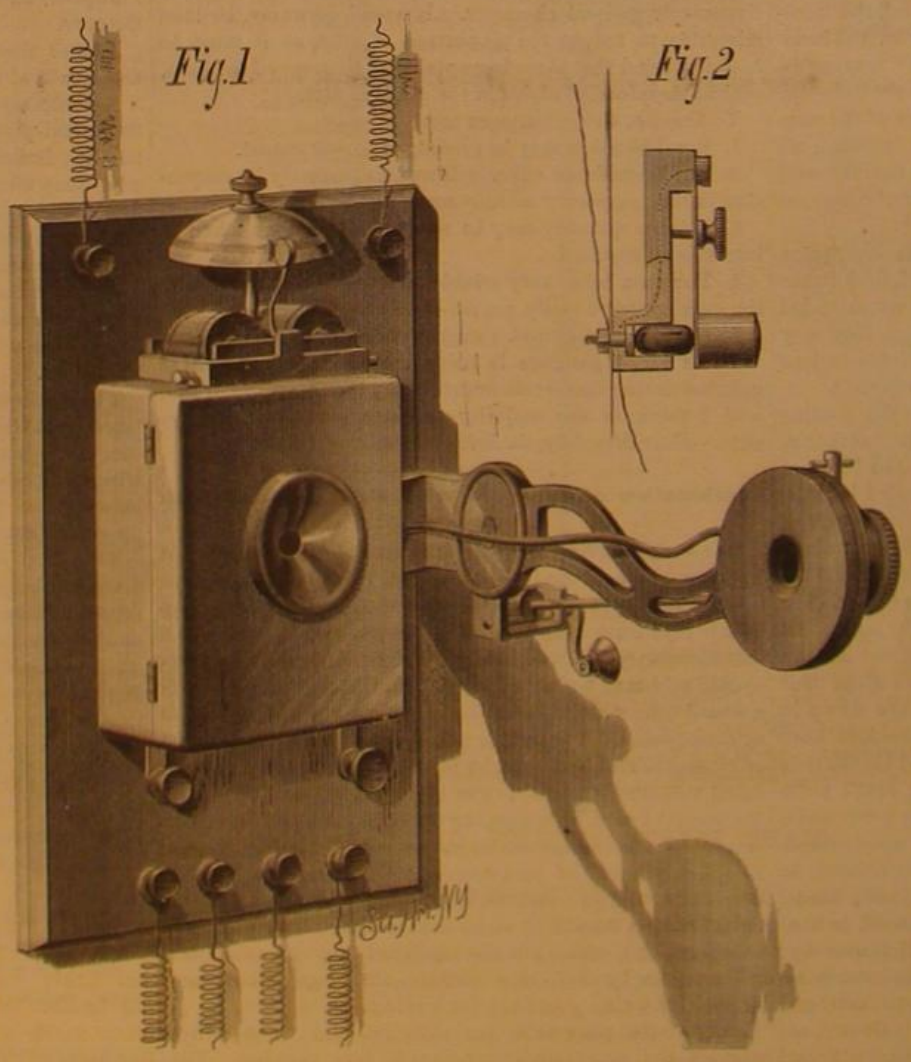
The transmitter is contained in the stationary rectangular box; its mouthpiece projects slightly, and the diaphragm, which is of mica, is supported by a metal frame and springs inside the box cover. This transmitter is quite different from the carbon transmitters now so largely in use in this country, and it will be new to many of our readers; but it is one of Prof. Edison's earliest and best telephones or microphones. It is exceedingly simple and does not require frequent adjustment, while it is equally as sensitive as existing forms of transmitter. The details of its construction will be understood by Fig. 2. A vulcanite arm is secured to the center of the mica diaphragm by means of a small bolt, which is connected with one pole of the battery by a piece of metallic foil or very thin copper wire. The head of this bolt is platinum-faced, and sunk deeply in the vulcanite arm, the same cavity containing also a piece of carbon pencil, such as is used for electric candles. The carbon fits the cavity loosely and is rounded at both ends. Its outer end is pressed by a platinum-faced spring secured to the outer end of the vulcanite arm. The spring carries at its free end, exactly opposite the piece of carbon, a brass weight, and the pressure of the spring upon the carbon is regulated by the small set screw. A wire or piece of copper foil, connecting with the spring, completes an electrical circuit, which includes the primary of an induction coil contained by the rectangular box. The secondary wire of the induction coil is connected with the telephonic line, and a tertiary coil which envelops the secondary is connected with the rubber and chalk cylinder of the receiving instrument. Below the transmitter box are two keys, the right hand one being used for signaling, the left hand one for completing the tertiary circuit when a message is received.

The cylinder of the receiving instrument is made of precipitated chalk solidified by great pressure. The fluid now used to saturate the chalk is a dilute solution of hydrogen disodic phosphate. Professor Edison has found by a long series of experiments that the solution employed must be that of an alkali or the phosphate of an alkali, and the hydrogen disodic phosphate is found to be superior to all others.

The operation of this telephone will be understood by those who are familiar with the first electro-chemical telephone. The vibration of the diaphragm of the transmitting instrument varies the contact between the carbon and the two electrodes, so that a varying current is sent through the primary of the induction coil; this of course produces a secondary current of varying intensity in the secondary wire of the induction coil, which being in circuit with the secondary wire of the induction coil of a distant instrument produces a current in the tertiary wire wound around the secondary coil. The tertiary current passes through the chalk cylinder and the platinum faced rubber, and as the chalk cylinder revolves the friction of the rubber is varied according to the variation of the primary, secondary, and tertiary currents. The platinum faced rubber is connected with the diaphragm, and the friction of the rubber is sufficient, when no current passes, to pull the diaphragm forward as the cylinder is turned; but when the slightest current is sent through the primary coil, the induced tertiary current transforms the frictional surface of the chalk into a frictionless surface and the diaphragm springs back. All this to describe a single vibration of the diaphragm, thousands of which are required for the utterance of a single sentence. It is not essential that the current should be broken to produce the effect in the receiver. It is probable that an absolute break never occurs in the ordinary use of the telephone.

An ordinary call bell is adopted in this system as a means of giving an alarm.

This telephone is unrivaled for loudness of speech, and an electro-magnet is not required in its construction.



EDISON'S NEW TELEPHONE.

MISCELLANEOUS INVENTIONS.

An improved hose coupling has been patented by Mr. Frederick Stewart, of St. Louis, Mo. The object of this invention is to construct hose couplings so that the water passage will be unobstructed and of the full inner diameter of the hose; also, to render the joint of the coupling water tight without using packing rings.

An improvement in electric lamps has been patented by Mr. Norborne B. Gantt, of Louisville, Ky. This invention relates to the construction of the supports for the carbon holders, by which, as the carbon burns away, the carbon holders are automatically adjusted to maintain the electric arc at one point.

An improved shuttle spindle has been patented by Mr. Henry A. Boyington, of Manchester, N. H. The invention consists in shuttle spindles made in two semi-cylindrical parts, placed one above the other, with their flat sides toward each other, having semi-conical heads formed upon their forward ends, having inclined projections or cams formed upon the middle parts of their adjacent sides, and pivoted at their rear ends to the shuttle by two pins, so arranged that the upper pin may be in the rear of the lower one.

Mr. Thomas H. Hicks, of London, Ontario, Canada, has patented an improvement in the class of cylindrical drums or blowers used with carbureters, and which are provided with gudgeons, and rotate in water or other liquid, so that the latter alternately seals and opens the induction and exit orifices for the air or gas passed through the blower or drum. The force of the current of gas flowing to the burners is the motive power which turns the blower or drum on its axis, and the inventor utilizes this force for inducting atmospheric air into a portion of the rotating drum which exactly corresponds in construction to that part of the drum through which the gas passes.

Mr. Orlando Cleaveland, of Middlesex, N. Y., has invented an improved ironing table, which is readily adjustable in height, and may be used for various other purposes than for ironing—for example, as a work, or lunch, or a lamp table.

An improved gate and door closing device has been patented by Mr. William H. Williams, of Mineola, N. Y. This improvement relates to gate and door hangings wherein the gate is closed by a weight. It consists in a novel means by which the weight is shifted to change its purchase and obtain the greatest effect when the gate or door is closed.

Mr. David E. Wilson, of Darlington, Md., has invented an improvement in cattle fasteners, which consists, mainly, of a crank rod or eccentrically pivoted bar, which is arranged close to the inner side of a series of mangers, so that when turned up or revolved a part revolution it will clamp against the manger the ends of the chains or halters which are pendent from the necks or heads of the cattle, and thus secure them. When turned down, it will release all the neck chains or halters at the same time.

An improvement in harness has been patented by Mr. Charles R. Stanhope, of Ashtabula, Ohio. The object of the invention is to furnish an improved means for connecting the belly band or girth and the martingale of a harness, the use of which will allow them to be disconnected without unbuckling the belly band or girth to prevent the horse from being chafed by the martingale interposed between the belly band or girth and his body.

THERE is deposited in the San Francisco Mint a collection of ancient and modern coins valued at $100,000. Among them is a silver shekel of King David's time. This is the oldest coin extant. Another is the Roman penny, with the twins and their foster-mother, the wolf, date 700 B. C.

Poisonous Fishes.

The question of poisoning by eating certain kinds of fishes is one not well understood, and there are several reasons why this is so. Grave and even fatal accidents of this nature have usually occurred in the less civilized portions of the globe; and the phenomenon itself is very complex. There are a large number of suspected species; and in some of these certain individuals alone seem to be possessed of the toxic property, and even in these the danger resulting from using them as food disappears at certain seasons of the year. Finally, ichthyology is such a difficult study that few physicians are well enough acquainted with the subject to accurately determine the genera or species of the poisonous fishes that they meet with in their travels. We translate and condense the following notes on this subject from the *Annales d'Hygiène Publique:*

In the medical report published by the Inspector General of Chinese Customs, residing at Pekin, we find, among the maladies that afflict Europeans living in Japan, that of fish poisoning. The editor of the report, Dr. Stuart Eldridge, states that the salmon is doubtless the most common toxic fish of Japan. From the spring onward this fish is out of season, and if eaten after that period of the year occasions the same accidents as follow the eating of tainted meat. In Japan, the same dangers follow the eating of the *katsuo* (bonita) and the *maguro*, although the sickness they occasion is rarely fatal. A few strange symptoms have been observed, however, such as severe congestion of the brain and face, and nervous derangements difficult of explanation on the theory of the decomposition of the animal matter. In one case the cerebral disturbances were very serious. Several theories have been proposed to explain this remarkable property of the fishes. Some writers believe that it is a morbid element which is developed in the animals at certain seasons. But no such fatal element has as yet been discovered. Others think the idiosyncrasies of the patient have something to do with it. This explanation cannot be accepted; for if there is any idiosyncrasy about it, it exists in the fish and not in the consumer, since it has been proved that certain fishes—the *Lethrinus nambo*, for instance—can be eaten with impunity until it attains a certain size, say a length of 5 to 5½ inches, after which it becomes poisonous. The age of the fish, then, would seem to have something to do with its toxic qualities.

Fishes of very diverse genera have been the occasion of grave and even fatal accidents, and they are found in all parts of the globe, but more especially in the torrid zone. Pappenheim gives a list of more than forty poisonous species. Among these we find mackerels, perches, herrings, sea pikes, and a large number of species belonging to the order *Plectognathes*. The latter order contains five genera that are poisonous. The most common genus of the order in Japan is the *tetrodon* or swell fish, the species of which are all known by the general name of *fugu*, and are considered the most dangerous of the poisonous fishes, so much so, in fact, that their sale at certain seasons is forbidden by law. Dr. Goërtz, of Yokohama, in a memoir read before the German Asiatic Society of Japan, has given a description of the symptoms observed in these cases of poisoning by the *fugu*. One of these was rapidly fatal, the other two were more alarming, but recovered under prompt treatment. At the beginning of the attack there were violent headache and nausea, quickly followed by great muscular weakness; the pulse, the respiration, and temperature all fell at the same instant, thus denoting the very energetic action of the poison upon the nervous centers with special effect upon the pneumogastric. Dr. Houghton, of Savannah (*Lancet*, 1876, page 939), mentions thirteen cases of poisoning by the *Tetrodon hystrix*—one of the Japanese *fugus*—in which the results were identical with those reported by Dr. Goërtz. It is somewhat remarkable that in the three cases given by the latter, and in the thirteen of Dr. Houghton, the subjects are stated to have eaten the eggs of the fish.

Congers, pikes, and barbels have long been recognized in Europe as poisonous at certain seasons, and the eggs of the barbel as especially so.

In Japan the liver of the *fugu*, immediately after the spawning season, is considered the most dangerous part of the fish. A few cases of death caused by eating the liver of the fish have also been reported from the Cape of Good Hope, the poison having proved fatal in some instances in less than seventeen minutes.

GIANT INSECTS.

The insect shown in the accompanying engraving is of such extraordinary dimensions as to justify the name of "giant among insects." It belongs to the family of *Phasmedæ* (specters), which are distinguished from grasshoppers and crickets by their long slender hind legs, which are adapted for walking and not for leaping.

GIANT INSECT OF NEW GUINEA.—(*Kerocrana Papuana.*)

Many of the phasmedæ are wingless, and when wings exist (in the males) their structure is very peculiar. The wing covers are quite small and useless for protecting the wings, which are broad and ample. The wings are plicated longitudinally in a multitude of folds, the folds being narrower toward the base and increasing regularly toward the edge, so that the wings close like a fan. The wings lie along the body of the insect, and in consequence of their many folds do not break the outline of the stick-shaped body. The outermost fold of the wing is stiff and strong, and when the wing is closed it protects the delicate folds of the wing in the same manner as a fan stick protects a fan.

Some of these insects are as thick as a man's thumb, and fifteen inches long. The color of the insect is greenish-brown, and may be readily mistaken for the twigs of the shrubs on which it feeds.

The engraving, which we have taken from *La Nature*, is incorrect in one particular, the legs of the insect being somewhat shorter than is natural.

Railway Speeds.

The daily express mail train from London to Holyhead makes the distance, 268 miles, in 4½ hours, being at the speed of a little over 59 miles an hour, stoppages included. The distance between New York and Washington is 228 miles, and the fastest train makes it in 6 hours and 20 minutes, or 36 miles an hour, stops included. But most of the trains occupy from 8 to 9 hours.

In this wide country, where railway engineering exhibits such great triumphs, it would seem as if we ought to be able to run trains between our important cities as fast as the Britishers do. If we had a Holyhead express between New York and Washington, the time of transit would be reduced nearly one half, to wit, to 3 hours 40 minutes. This would enable passengers to leave New York in the morning, have an entire official day for business before the departments in Washington, or attend a session of Congress, and still be home again in time for the evening tea.

Ailantus Wood.

Persons who know the ailantus only as a shade tree, with its nauseous blossoms and uncouth growth, will be glad to learn that it possesses invaluable qualities of strength, durability, beauty of finish and color for carpentry and cabinet work, freedom from warping and shrinkage, ease of being worked without injury to tools and with little or no waste. It is a rapid growing tree, as all know, upon poor soils as well as good ones, in exposed situations on the sea coast, and in the interior. It seasons readily, and when dry is free from the unpleasant odor which characterizes the wood when green. It has a higher value as fuel than most of the wood in general use. Experiments made in the French dockyard at Toulon showed that the ailantus broke with a weight of 72,186 lb. where the elm yielded to a weight of 54,707 lb., and the oak to a weight of 43,434 lb. The small second growth is said to make very durable grape stakes, to which it seems well adapted. A set of furniture, made of this wood, has been in use in Providence, R. I., for about twenty years. It takes a high polish, and may be cut so as to present a satin luster which is very pleasing. It is regarded by some cabinet-makers as equal to mahogany and superior to black walnut in the matter of shrinking. For the treads of stairs, for floors of offices, mills, and other buildings, where a hard, strong wood is required, it is regarded by many as superior to most of the woods thus employed. Its warm color makes it an effective finish when used with both lighter and darker woods, and as wainscoting is again becoming fashionable, the case of producing this wood where other woods are not readily obtainable, will recommend this style of interior finish. The tree grows more rapidly when young than when it has attained considerable age.

Chloral in Whooping Cough.

Dr. C. H. Smith reports that in two hundred cases of this disease treated with chloral, he has in every case noticed a marked alleviation of the symptoms and shortening of the period of the disease. Only one case lasted seven weeks, and the majority of the cases were well in from two to six weeks. No other remedy was given.—*N. Y. Medical Journal.*

Hay Fever.

At the present time there are probably nearly 50,000 people suffering from what is called hay fever.

When this affection was first recognized it was supposed that it depended upon the irritation produced by the pollen of certain flowers and grasses which floated in the air in the months of May, June, July, and August of each year.

Subsequently is was claimed that two distinct forms of the disease existed, and to one was given the name of "June cold," while the other received the name "autumnal catarrh."

Further observation revealed the fact that an affection characterized by symptoms essentially the same as those seen in connection with hay asthma, hay fever, June cold, rose cold, autumnal catarrh, etc., occurred in seasons of the year in which none of the supposed exciting causes of the hay fever could operate, and for some time the reasoning was that it must be some other disease than that produced by the pollen of plants. It was also observed that certain persons were peculiarly affected when brought in contact with certain animals, such as the cat, and by the vapor from certain animal substances, such as warm milk. These observations, and others of like character, have from time to time led to modifications of former opinions regarding the nature of hay fever, and, at last, have given rise to a theory which has been promulgated as one capable of explaining all the phenomena of the disease whenever and wherever occurring.

In this country two books have been written on hay fever: one—the oldest, and for a long time the only systematic monograph upon the subject—by Dr. Jeffries Wyman, of Boston; the other by Dr. Geo. M. Beard, of New York. In Dr. Beard's book we find the first open announcement of the theory to which we have already referred, namely, the "nerve theory." This theory is the result of the study of one hundred cases, and it is that hay fever is a neurosis. According to this theory, the disease is subjective instead of objective; external irritants, which are exceedingly numerous, such as rag weed pollen, etc., are of a secondary and a tertiary character and powerless in themselves to produce the disease, and produce the disease only when acting on a nervous idiosynerasy.

This author has described a new form of the disease, which he calls the July cold, or middle form, which links the early form, or June cold, with the later form, or autumnal catarrh. It seems to us that the nerve theory explains many of the cases which have heretofore been regarded as very obscure; for example, those in which the symptoms peculiar to hay fever have continued from May to November, or during the winter months, or all the year round. If the nerve theory be true—and it seems to be fairly sustained—it revolutionizes the treatment of the disease. It must be attacked from a new point of view; yet it cannot be successfully claimed that all cases are to be treated alike, or that any specific can be found for it. The remedies to be employed are those which are not painful—not even disagreeable. Of course, removal from the exciting cause is the primary factor in obtaining prompt relief; but, when this cannot be effected, the symptoms can be greatly relieved, and many cases cured, by such remedies as arsenic, nux vomica, carbolic acid, belladonna, tonics and sedatives, electricity, etc., and their combinations.—*Medical Record.*

Typhoid Fever from Diseased Meat.

An epidemic of typhoid fever, interesting in its etiology, followed a musical festival at Zurich, in May, 1878. Out of some 700 assistants, 500 were attacked by the disease, of whom 100 died. The symptoms could not be mistaken, and the autopsies confirmed the diagnosis. A minute inquiry into the circumstances left but little doubt that the epidemic was due to the use of bad veal furnished by an innkeeper of the place. It may be claimed by those who attribute to general causes the power of originating specific diseases, that the typhoid fever was due to a septic poison present in the veal, depending possibly on a beginning fermentation, which was not destroyed by the cooking to which it had been submitted. On the other hand, as the animal from which the meat was taken was sick, it may be asked whether it might not have been suffering from typhoid fever, although this disease has never yet been recognized among animals. It is a remarkable fact that in 1839 a similar but much less fatal epidemic occurred in a neighboring locality. After a reunion that took place under similar circumstances, 440 persons were taken sick with all the symptoms of typhoid fever. It is probable that in this case also the meat of a sick calf gave rise to the disease.—*Journal de Médecine.*

Ammoniacal Sulphate of Copper in Neuralgia.

Dr. Féréol having found several times obstinate cases of neuralgia of the fifth nerve, tic-douloureux, which had resisted a variety of other means, rapidly and completely cured by the administration of ammoniacal sulphate of copper, reports to the Académie de Médecine on the subject (*La France Médicale*, April 5th). The first case is that of a strong man, aged thirty-two, who had suffered so atrociously from terrible neuralgic crisis that on some days he was scarcely free for a few minutes at a time. Six teeth had been vainly extracted, and anti-neuralgic medication exhausted. He then tried ammoniacal sulphate of copper. The amelioration was considerable on the first day; on the second, the patient slept all night for the first time in two months; and at the end of ten days he left the hospital cured. A second case of supra-orbital neuralgia in a strong young man, occurring every morning and ceasing at noon, had been vainly treated by leeching, blistering, and full doses of quinine. The ammoniacal sulphate of copper, given in a dose first of all of 0·10 and then 0·15 centigramme daily, produced an immediate amelioration of pain, and the patient described himself as cured. The medication was continued for a week, and the neuralgia did not return. Similar effects were obtained by M. Féréol in a lady, aged forty-three, delicate, nervous, but not hysterical, suffering from persistent right hemicrania, with atrocious pain in the fifth pair of nerves, which drove her almost wild, and for which she had vainly tried quinine, aconite, morphia, hypodermic injections, etc. Similar results were obtained in an old man, aged sixty, suffering for eighteen months from a horribly painful neuralgia, starting from the nasal branch of the fifth, and in whom local and general treatment by the oldest of anodynes and antiperiodics had been vainly tried. In this case the results were not permanent, the patient having an invincible dislike to the sense of nausea produced by the sulphate of copper. The formula employed is the following: Distilled water, 100 grammes; sirup of orange flower or peppermint, 30 grammes; ammoniacal sulphate of copper, 0·10 to 0·15 centigramme, to be taken in the course of twenty-four hours, especially during food, in order to avoid irritating the stomach. In one patient, the dose was raised to 60 centigrammes a day without any other inconvenience than slight gastric pain and a little diarrhea. The medium dose was 0·10 to 0·15 centigramme, which should be continued for from ten to fifteen days, even after the complete disappearance of the pains.—*London Medical Record.*

Late Views of the Age of the World.

Geologists, astronomers, and physicists alike have hitherto been baffled in their attempts to set up any satisfactory kind of chronometer which will approximately measure geological time, and thus give us some clew to the antiquity of our globe. It is therefore worth noting that Mr. Mellard Reade, of Liverpool, has lately contributed to the Royal Society a very suggestive paper, in which he endeavors to grapple with the question by employing the limestone rocks of the earth's crust as an index to geological time. Limestones have been in course of formation from the earliest known geological periods, but it would appear that the later found strata are more calcareous than the earlier, and that there has been a gradually progressive increase of calcareous matter. The very extensive deposition of carbonate of lime over wide areas of the ocean bottom at the present day is sufficiently attested by the recent soundings of the Challenger. According to the author's estimate, the sedimentary crust of the earth is at least one mile in average actual thickness, of which probably one-tenth consists of calcareous matter. In seeking the origin of this calcareous matter, it is assumed that the primitive rocks of the original crust were of the nature of granite or basaltic rocks. By the disintegration of such rocks, calcareous and other sedimentary deposits have been formed. The amount of lime salts in water which drain districts made up of granites and basalts is found, by a comparison of analyses, to be on an average about 3·73 parts in 100,000 parts of water. It is further assumed that the excessed areas of igneous rocks, taking an average throughout all geological time, will bear to the exposures of sedimentary rocks a ratio of about one to nine. From these and other data, Mr. Reade concludes that the elimination of the calcareous matter now found in all the sedimentary strata must have occupied at least 600,000,000 of years. This, therefore, represents the minimum age of the world. The author infers that the formation of the Laurentian, Cambrian, and Silurian strata must have occupied about 200,000,000 of years; the Old Red Sandstone, the Carboniferous, and the Poikilitic systems, another 200,000,000; and all the other strata, the remaining 200,000,000. Mr. Reade is, therefore, led to believe that geological time has been enormously in excess of the limits urged by certain physicists; that it has been ample to allow for all the changes which, on the hypothesis of evolution, have occurred in the organic world.—*London (Eng.) Academy.*

Engraving of Copper Rollers with Chromic Acid.

Copper printing rollers are engraved in two ways, only one of which is actually engraving proper, namely, the impression of the pattern by means of a steel die, a process which sometimes, as in the case of heavy furniture patterns, is supplemented by direct engraving with a graving tool by hand. The other plan frequently employed is etching, the substance of the copper being eaten away by the application of acids. This process gives very nice shading, and when judiciously employed is of much use.

Generally this method consists in covering the roller with a mastic or varnish, which protects the places which are not to be acted upon, and which leaves the pattern to be engraved open. The roller thus prepared is then plunged into a bath of nitric acid of 15° B., or stronger. Sometimes a little hydrochloric acid is added to favor the dissolving action of the acid. The operation generally takes not more than five or six minutes.

This process has grave inconveniences, especially in places where there is not a sufficiently strong ventilation to immediately carry off the fumes which are formed in large quantities. This free acid is not only dangerous for the workpeople, but, spreading in the room, soon affects the machines. There is also this drawback, that the acid acts underneath the varnish, resulting in unclean edges of the engraving.

A German chemist has for some time employed chromic acid in place of nitric acid, and from all accounts with very satisfactory results, especially in damp localities. The attack of this acid upon the metal is a little slower, but the engraving is sharper and clearer. The solution is the following: 5 oz. of commercial bichromate of potash are dissolved in 26 oz. hot water, after which 12 oz. sulphuric acid of 66° B. are carefully added, and the whole well mixed.

This bath gets brown by usage; if after a few days' use it becomes much so it must be thrown away. It is necessary, in order to obtain good results, to slightly heat the bath, which is done by placing the trough containing it into a bath of tepid water (?).

The cost of working with chromic acid is even cheaper than with nitric, and altogether it appears to have many qualities to recommend it to calico printers.

RECENT DECISIONS RELATING TO PATENTS, TRADE MARKS, ETC.

By the Commissioner of Patents.

GRAIN DRILLS.—BERLEW *vs.* BERLEW & SMITH.

1. In courts of law judgment may be rendered upon admissions and stipulations of parties to actions involving purely private rights, and acts whereby one party induces another to adopt a course which would result in his detriment, unless the representations and promises involved in such acts are made good, present safe grounds for judicial decisions; but the law grants patents to first and original inventors, not to those who are conceded or admitted by others to be first and original inventors in the face of proof that they are not such; and parties cannot, by admissions or by concessions, or by acts constituting estoppels, determine the grant of patents in defiance of the facts. Subject to the modifications necessarily resulting from these differences in the subjects of adjudication, the rules of equitable estoppel apply in the Patent Office as in the courts.

2. If one or two joint applicants could by his acts estop himself from denying that the other was a joint inventor, the Commissioner would not by such an estoppel be authorized to declare the other a joint inventor when the facts showed that he was not; but he might be authorized to protect the other from fraud by making him a joint patentee.

By the Acting Commissioner of Patents.

BAG FASTENER.—MCKENNA *vs.* REDDEN.

1. The applicant who conceived the idea of an invention in 1869, and from that time forward until 1876 simply had conversations about it and made one or two experimental models, then patented an invention of the same class, but of entirely different construction, held not to be the first and original inventor as against another who, although subsequent to conceive, had patented the invention in controversy, and put the same in extensive public practice a year before the former applicant had filed his application for a patent for the same invention.

2. It is a well settled doctrine that an inventor of a device must not only be the *first* inventor, but that he must also exercise diligence in reducing the same to practice in order to invalidate the title of a patentee, or to obtain a patent as against such a patentee, who, although subsequent to invent, was diligent in putting the invention before the public, while the one first to devise was making no effort to that end.

GLASS PATTERNS.—EX PARTE REES.

1. A mere change of material in the construction of a machine or an article, where the superiority attained is due alone to the nature of the material employed, unaccompanied by changes of adaptation, or useful results not before contemplated, is not invention.

2. A pattern made of glass, from which the vamps, quarters, and other parts of boots, shoes, etc., are cut, held patentable, in view of certain new and valuable results attained, notwithstanding the fact that such patterns had heretofore been made from paper, iron, brass-bound boards, etc.

A Caution about Shot in Game.

This being the season when game killed by shooting, and probably containing the pellets, is eaten, it may be worth while to caution those who consume the flesh of birds with avidity that the proportion of instances in which shot is found is probably small in comparison with the number of cases in which the pellets are unwittingly swallowed. It is a matter of speculation how much mischief a shot may do when passed into the intestines, but the fact that anomalous diseases have been set up by the presence of very small bodies which have become entangled in folds of the mucous membrane renders it desirable to put the public on their guard. Occasionally the most disastrous results have followed such small causes.

We have in recollection the case of a physician who died after prolonged and unexplained sufferings, from the impaction of a very small nail which had found its way into a pudding, and was inadvertently swallowed. A little care will avoid this contingency, but, remembering that the bird had been shot, some pains ought certainly to be taken to avoid swallowing the missile.—*Lancet.*

STEEL.—The production of steel effected by Great Britain last year was 807,527 tons. In the same year the United States made 732,226 tons of steel; Germany, 240,000 tons; France, 140,000 tons; Belgium, 75,000 tons; Sweden, 20,000 tons; and Austria, 25,000 tons. The aggregate steel production of the world was thus something over 2,000,000 tons last year.

Glass Railway Sleepers.

A new and somewhat singular material for railway and tramway sleepers has lately been introduced into England, this material being glass toughened by a process discovered by Mr. Frederick Siemens, of Dresden. Owing to Mr. Siemens' patents for the most recent improvements in his process not yet being completely secured, we must postpone for the present any details of the toughening process itself, but we may state that its effect appears to be to secure a product differing essentially from glass toughened by the well known process of M. De la Bastie, inasmuch as when broken it does not fly to pieces like glass treated by the last mentioned process, but merely fractures somewhat like cast iron.

The material used by Mr. Siemens for his sleepers is glass of the commonest kind moulded to any desired form. The sleepers are being introduced into this country by Mr. Hamilton Lindsay Bucknall, who has lately laid some of them on the line of the North Metropolitan Tramways at High street, Stratford. The sleepers in this case are of exactly the same section as the wooden longitudinal sleepers they have replaced, namely rectangular, 4 inches wide by 6 inches deep, the upper side being moulded so as to accurately fit the rails. They are laid in lengths of 3 feet, and to avoid the danger of settlement at the joints, bearing plates, 10 inches by 5 inches by 1⅛ inch, are placed at these points, these plates being also utilized for effecting the securing of the rails by a fastening which obviates the necessity of moulding any hole in the glass. We may add that samples of the sleepers above mentioned have been tested by Mr. Kircaldy, and their average breaking weight when resting on supports 30 inches apart has been found to be about five tons, this being probably about two thirds of the resistance which would be afforded by a good pine sleeper of similar dimensions. It must, however, be borne in mind that, whereas the timber would become depreciated by use, the glass promises to be practically indestructible by moisture, etc.

At the works of Mr. William Henderson, a plate of Mr. Siemens' toughened glass, 9 inches square by 1⅛ inch thick, embedded in gravel ballast 9 inches deep, and having on its top a wood packing ⅛ inch thick, and a piece of rail, was subjected to the action of a falling weight, the blows being delivered on the rail. The weight was 9 cwt., and blows were successively delivered by letting this weight fall from heights of 3 feet, 5 feet 6 inches, 7 feet, 10 feet, 12 feet 6 inches, 15 feet, 17 feet 6 inches, and 20 feet. Under the last mentioned blow the rail broke, the glass, however, being uninjured. As a higher fall could not be obtained, and a greater weight was not available, a smaller section of rail was substituted for that previously employed, and the glass was broken by a second blow of the 9 cwt. falling 20 feet, the plate being driven through the ballast into the hard ground. A cast iron plate, 9 inches square and ½ inch thick, tested in a similar way, broke with a blow from the 9 cwt. weight dropped 10 feet.

The cost of the toughened glass is stated to be about the same per ton as that of cast iron, but as its specific gravity is only about one third that of iron, the cost of any article of given dimensions is of course materially less. The material has as yet been too recently introduced, and too little is known of its characteristics, to enable any very decided opinion to be formed as to its future capabilities; but the results of the experiments so far made with the material are certainly of an exceedingly promising character, and the further development of its application will be watched with much interest.—*Engineering.*

Refrigerated Storehouses.

A large six story building, belonging to the Massachusetts Chemical Refrigerating Company, located on North street, Boston, has been fitted up with machinery for generating and distributing cold air, and compartments for the storage of provisions. Ammonia is employed as a chemical agent to produce cold air, the same as is used in the ice-making machines of the South. After the storehouse has been rendered as nearly as possible impervious to outside atmospheric changes, the heat and gases are drawn off from the interior by a powerful exhaust fan, condensed, purified, and returned to do the work of refrigeration. By this continuous process the air is undergoing constant renovation, and is pure, cold, and dry to an extent not attained by other methods of refrigeration. The building referred to contains 94,000 cubic feet, of which 80,000 feet are now occupied by no less than 10,000 packages of butter, 300 barrels of beef, 650 cases of pork, 3,500 dozen eggs, 7,800 lb. evaporated apples, and about two tons of cheese, the property of different produce and commission houses. Similar refrigerators may be soon erected at several mercantile centers, and a line of steamers be fitted up to connect with trains of cars which shall all be similarly furnished.—*American Manufacturer and Exporter.*

Moral and Mental Effects Produced by Foods.

Dr. Bock, of Leipsic, writes on the effect of food and drink:

"Beer is brutalizing, wine impassions, whisky infuriates, but eventually unmans. Alcoholic drinks, combined with a flesh and fat diet, totally subjugate the moral man, unless their influence be counteracted by violent exercise. But with sedentary habits they produce those unhappy flesh sponges which may be studied in metropolitan bachelor halls, but better yet in wealthy convents. The soul that may still linger in a fat Austrian abbot is functional to his body only as salt is to pork—in preventing imminent putrefaction."

FIRE SCREEN.

The accompanying illustration represents a charming piece of work designed and executed under the auspices of the Royal School of Art Needlework, in London. The

FIRE SCREEN—ROYAL SCHOOL OF ART NEEDLEWORK.

design was doubtless made by one of the artists employed by that institution, after which it was embroidered upon the cloth and mounted as we see it here. A fourth panel, concealed from view in the illustration, but similar in character to the one on the right, completes the harmony of the design, which is in every way admirable.

Terrestrial Magnetism and Electricity.

Professors Ayrton and Perry, of the College of Engineering, Tokio, Japan, communicate to the *Philosophical Magazine* a short note, proposing the hypothesis that the phenomena of earth currents, terrestrial magnetism, and atmospheric electricity are due to the fact that the earth is an electrified condenser, whose capacity or potential is continually changing on account of its rotation and its annual orbital motion, the successive cooling and warming of the air, the formation of clouds and rain, etc., etc. These changes produce electric currents tending always to restore the equilibrium, whence follow the phenomena in question. They suggest that observations of atmospheric electricity may be used to predict atmospheric changes.

William Leroy Broun describes, in *Nature*, a new lecture experiment, to show the action of terrestrial magnetism. A rectangular frame of light wood, carrying twenty coils of insulated wire, was suspended in a horizontal position from the pans of a balance, so that the long sides of the rectangle were at right angles to the beam; and mercury connections were arranged at the middle of the short sides, so that a current could be sent through the wire. This apparatus being placed with the long sides of the rectangle perpendicular to the magnetic meridian, when the battery current passed from east to west on the northern side, and from west to east on the southern side, the north side would be attracted, and the south side repelled by the earth currents, both influences combining to deflect the beam of the balance. On reversing the current the deflection was in the opposite direction.

The Simplon Tunnel.

Our French neighbors, recognizing the vast importance of the proposed Simplon tunnel to their commerce, have, during the last few months, been in negotiation with the Swiss Government, and a treaty similar to the one which was concluded in 1871 between Germany, Switzerland, and Italy concerning the St. Gothard tunnel, will shortly be signed, by which permission will be granted to the French Government to subsidize the Simplon Railway Company to the amount of some 48,000,000 francs. M. Léon Say, the French Minister of Finance, arrived at Vevay on August 16 to make a personal inspection of the site of the tunnel and of the works which have already been carried out, in order that he may possess full *connaissance de cause* in recommending his government to grant the subsidy in question. The works alluded to consist of a line of railway lately completed and opened to traffic, which extends from Lausanne up the Rhone Valley to Brigue, at the foot of the Simplon—the very spot where it is proposed to pierce the tunnel.

On the other side of the mountain the Italian Government is engaged in constructing, at the cost of 28,000,000 francs, a line of railway which will unite Iselle at the southern end of the tunnel with Arona on the Lake Maggiore, the present northern terminus of the Haute Italie railways. The Simplon Railway Company are now, therefore, about to commence the tunnel, which, when terminated, will complete the straight line of railway extending from Paris to Brindisi, *via* Pontarlier, Lausanne, the Simplon, and Milan, thus obviating the immense angle described by the Mont Cenis route. It may be remembered that the proposal to subsidize the Simplon route was already submitted to the French Chambers in 1873, when it was indefinitely postponed without discussion. This want of proper consideration must be attributed to several reasons. In the first place, the resignation of M. Thiers and other political events absorbed men's minds in France at that moment; secondly, the Compagnie de la Ligne d'Italie, in whose favor the concession had originally been granted, had just failed in an exceedingly discreditable manner, and had been wound up by order of the Swiss Government. Lastly, at that time, when the prospect of completing the St. Gothard tunnel was apparently hopeless, the Simplon route not only seemed to offer no very special advantages to French commerce, but even appeared in the light of a competitor with the Corniche and Mont Cenis Railways, nor were the Paris-Lyon-Mediterranée Railway Company in favor of the undertaking. Now, however, the aspect of affairs has entirely changed. Since 1874 a new company has been intrusted with the execution of the enterprise, and has given most satisfactory proofs of its activity by the completion of the railway up to the very entrance of the proposed tunnel at Brigue. Colonel Cérésole, formerly president of the Swiss Confederation, is the leading spirit and managing director of this company, and is encouraged in his work by the earnest support of such men as Gambetta, Grévy, Léon Say, etc.

Although the tunnel will be rather longer than that of the Mont Cenis or of the St. Gothard, it will be constructed and worked under very much more favorable conditions than either of them. The entrances to the St. Gothard and Mont Cenis tunnels are both situated at a considerable altitude—the former being at 1,152 meters, and the latter at 1,560 meters above the level of the sea. Consequently, costly zigzag and corkscrew lines of access have been resorted to in order to reach the entrance of the tunnels, and owing to the very steep gradients, the power of traction required is something enormous. The Simplon tunnel, on the other hand, enters the mountain at its very base. The railway extending from Lausanne up the lower part of the Rhone Valley, is perfectly straight and without any curves, while the gradient nowhere exceeds 10 millimeters—1 in 100. At its exit on the southern side of the mountain, in the Diviera

Valley, the gradient is somewhat stronger—13 in 100. In fact, when the tunnel is completed, the highest point of the line between Paris and Milan will not be in the Simplon, but between Dijon and Lausanne. Owing to the low level of the tunnel, the line will not suffer from the frequent interruptions which the snow causes in winter on the Mont Cenis and St. Gothard routes.

Competent geologists declare that the granite and rock of the Simplon are less hard and compact, and that the infiltrations are less serious than those of the St. Gothard and the Mont Cenis. The Rhone at the Swiss, and the Diviera at the Italian extremity of the tunnel, will provide the hydraulic power necessary for the boring, while, thanks to the temperate climate of the Valais, the works will not be exposed to the risk of being deprived of their motive power during severe winters, as were those of the Mont Cenis and the St. Gothard.

The tunnel will be 18½ kilometers in length, as compared with the 15 kilometers of the St. Gothard and the 12 kilometers of the Mont Cenis tunnels; and, as it is estimated that a daily advance will be made of 9 to 10 meters in the boring, we may look for its completion in seven or even six years' time. Eighty million francs are to be devoted to the undertaking under the following items: 74,000,000 francs for the tunnel itself, estimated at the rate of 4,000,000 francs per kilometer. This estimate appears somewhat high when compared with that of the St. Gothard, which is being pierced at the rate of 2,500,000 francs per kilometer. One million francs are required for the completion of the roadway in the tunnel, and 5,000,000 francs for the construction of a great international station at Brigue, similar to that at Modane, on the Mont Cenis Railway.

Only a very small portion of this sum, namely 13,500,000 francs, consists of stock subscriptions, the balance of 66,500,000 francs being granted to the company in the form of the following subsidies: 4,500,000 francs from the Swiss Federal Government; 5,000,000 from the government of the Canton de Vaud; 1,000,000 from the government of the Canton du Valais; 3,000,000 from the governments of the Cantons de Berne, Fribourg, and Geneva; a grant of 5,000,000 from the Swiss Occidental Railway Company, which will derive great advantages from the undertaking; and, lastly, 48,000,000 francs, the subsidy about to be granted by France.—*London Times.*

Argan Oil.

Except the description given by Sir Joseph Hooker in his recent Book of Travels in North Africa (see SCIENTIFIC AMERICAN, April 12, 1879), and a brief notice of the exportation into Europe of argan oil by the Danish Counsellor of State, Georges Höst, who traveled in the kingdoms of Marocco and Fez during the years 1766–1768, the only published account of the uses of the argan is given in a very little known Danish work, published by P. K. A. Schousboe, entitled "Iagttagelser over Vœxtriget i Marokko." Forste Stycke. Kiobnhavn, 1800, 4, 7 tab., of which a German edition appeared in 1801, in 8vo, by J. A. Markussen. It gives an account of some Marocco plants; and, after an introductory sketch of the physical geography of Marocco, it contains descriptions of the plants of the country in Latin and German, with occasional observations in German. The account of the argan under Retz's name of *Elæodendron argan* is long: first comes a technical description, followed by a history of its synonymy, and then the following notes (translated for the *Gardener's Chronicle*, by Mr. Bentham):

"It is surprising that this tree should hitherto have been so little known, as it is found in a country near Europe, and visited by many travelers, who speak in their diaries and descriptions of oil of argan and of argan trees, these last as constituting a considerable proportion of the forests of the country. It is, however, not to be met with in the northern provinces, but only toward the south. All those persons from whom I have sought more accurate information on the subject are unanimous in stating that it only grows between the rivers Tansif and Sus—that is, between the 29° and 32° N. lat.—and there constitutes forests of considerable extent. It flowers in the middle of June, and the fruit remains on the tree the greater part of the year. The young fruit sets in the end of July or beginning of August, and grows slowly till the rainy season commences toward the end of September. It now enlarges rapidly and attains its full size during that season, so as that by the middle or end of March it is ripe enough to be gathered for economical uses. Both the fruit and the wood are serviceable, but especially the former; for from the kernel an oil is extracted which is much employed for domestic purposes by the Moors, and is an important production of the country, as it saves much olive oil, which can thus be thrown into commerce and made to bring money into the country. It is calculated that in the whole argan region 1,000 cwt. of oil is annually consumed, thus setting free an equal quantity of olive oil for exportation to Europe. Our countryman, Höst, in his 'Efterretninger om Marokos,' p. 285, says that the argan oil is exported to Europe, where it is used in manufactures. Such may have been the case in former times when it might be cheaper; but now there would be no advantage in doing so, as it costs almost as much as olive oil. At present no argan oil whatever is exported.

"As the practice in preparing this oil is somewhat different from that of common olive oil, it may be useful to enter into some details on the subject. I have myself been present during the whole operation, and consequently speak from experience:

"In the end of March the countryman goes into the wood, where the fruits are shaken down from the trees and stripped of their husks on the spot. The green, fleshy pericarp, which is good for nothing else, is greedily eaten by ruminating animals, such as camels, goats, sheep, and cows, but especially by the first two. Therefore, when the Arab goes into the wood to collect argan nuts, he gladly takes with him his herds of the above animals, that they may eat their fill of the green husks whilst he and his family are collecting and shelling the nuts. The horse, the ass, and the mule, on the contrary, do not like this food. When a sufficient quantity of nuts are collected they are brought home, the hard wooden shell is cracked between stones, and the inner white kernels are carefully extracted. These are roasted or burnt like coffee on earthen, stone, or iron plates; in order that they may not be too much done they are constantly stirred with a stick. When properly roasted they should be all over of a brown color, but not charred on the outside. The smoke which is disengaged during the process has a very agreeable odor. As soon as the kernels have cooled, they are ground in a handmill into a thick meal, not unlike that of pounded almonds, only that it is of a brown color, and the meal is put into a vessel in which the oil is separated, which is done by sprinkling the mass now and then with hot water, and keeping it constantly stirred and kneaded with the hand. This process is carried on until the mass becomes so hard that it can no longer be kneaded; the harder and firmer are the residuary coarse parts, the more completely is the oil extracted. At the last, cold water is sprinkled upon it, in order, as they say, to expel the last particles of the oil. During the operation the oil runs out at the sides, and is from time to time poured into a clean vessel. The main point to be attended to in order to extract the greatest quantity and the best quality of oil, is that it should be well kneaded, and that the proper proportion of hot water for the extraction of the oil should be used; it is always safer to be sparing of it than to be too profuse. The residuary mass, often as hard as a stone, is of a black-brown color, and has a disagreeable, bitter flavor. The oil itself, when it has settled, is clear, of a light brown color, and has a rancid smell and flavor. When it is used without other preparations in cooking, it has a stimulating and pungent taste which is long felt on the gums. The vapor which arises when anything is fried in it affects the lungs and occasions coughing. The common people use it generally without preparation, but in better houses it is the custom, in order to take off that pungency, to mix it previously with water, or to put a bit of bread into it and let it simmer before the fire. "The wood, which is hard, tough, fine-grained, and of a yellow color, is used in house carpentry and for other purposes."

American Jute.—(*Arbutilon Avicennæ.*)

In a communication to the *Ohio Farmer*, the Secretary of the New Jersey Bureau of Statistics of Labor and Industry confirms the high opinion that has been expressed with regard to the utility of the common arbutilon as a fiber plant. Hitherto this plant has been a common weed—too often a common nuisance—throughout the Middle States. For half a century or so it has had a hard fight with our farmers, whose efforts to eradicate it have been unavailing.

Having thus proved its right to grow, by inherent vitality and stubbornness, the arbutilon is now promoted from the order of weeds to the ranks of the useful plants, thus demonstrating anew Emerson's dictum that a weed is only a plant whose utility has not been found out. The Secretary, Mr. Sam'l C. Brown, says:

We need anticipate no difficulty in growing this jute-producing plant upon any good, well fertilized upland, or well drained bottom lands, but we always state that our success in producing the fiber, owing to the cheap labor of India, is wholly dependent upon obtaining it through mechanical appliances. This problem I regard as well nigh solved already. If not by contrivances now in hand, through modifications or substitution of others, success will be achieved sooner or later. The inventive genius of our country is not exhausted, but more alert and aggressive than ever.

The quality of this domestic jute, for a diversity of purposes, is established beyond question. Hitherto gunny cloths, cordage, and other coarse products have absorbed most of the jute manufactured in India, England, and in this country, but Mr. Lafranc, who is an expert in fibers, and giving special attention to the development of jute and ramie in New Jersey, thinks we will be able to turn jute to other and more profitable uses, in combination with wool, cotton, silk, etc. This will be effected by cottonizing the long staple, thus making a vegetable wool which in fineness and strength will be in close proximity to the coarser grades of animal wool. Samples of jute, thus manipulated into a higher priced commodity, have been submitted to carpet manufacturers and other consumers of coarse wool, and they have elicited unqualified approval for the purposes indicated.

The range of uses to which jute in its various forms can be utilized under a system of cheap production, is without limit, so that instead of consuming for domestic purposes, as we now do, about five million dollars per annum of raw and manufactured jute, the quantity could be increased many fold, and our agricultural and manufacturing interests be vastly augmented thereby. Any one who has seen spontaneous patches of the arbutilon growing under ordinarily favorable conditions, can see that the product of a cultivated field per acre would necessarily be heavy, for its growth is often eight feet, and we have seen it twelve feet high. Our calculation, based upon observation of wild and cultivated growths, is that with appropriate fertilizers and rich soil, from four to seven tons of dry stalks can be grown per acre. Mr. Lafranc offers to pay, this fall, eight dollars per ton for jute stalks, and ten dollars for ramie, delivered in Camden in a dry state. All these are proximate figures, and are furnished to meet a natural inquiry respecting the profit of growth to the farmers. We always take occasion to advise the farmers to collect all the seed within their reach for future use. It is generally believed that the best results will be obtained in jute culture from sowing the seed broadcast, and in soil as free from weeds and grass as possible.

A New Theory of Sea Sickness.

The singular benefit derived by the use of amyl nitrite in sea sickness has suggested a new theory of the cause of that distressing malady, namely, that it is due to cerebral anæmia. The proposer, Henry Naylor, L.R.C.P., L.R.C.S., Edinburgh, says:

"The rapid swinging of the vessel and the body with it irritates the eyes and vision, and this by reflex action produces a spasm of the cerebral capillaries; this explains the feeling of faintness and giddiness that comes on suddenly, just as the vessel gives a big swing. The sudden emptying of the cerebral vessels causes the stomach to sympathize, resulting in efforts of vomiting, whether the stomach be full or empty. These symptoms are most distressing when the subject is in a standing or sitting position, with the eyes open. If he lies down the change of position relieves the anæmia, the faintness and giddiness pass off, and the sickness ceases. But occasionally even the recumbent position does not give relief if the eyes are kept open. When they are shut the symptoms are not felt in the least. I have known this to be the case with several ladies who were never comfortable while at sea unless they were lying down with their eyes closed. They were able to eat meals and retain them if they lay down and closed their eyes immediately afterwards. In fact, I have been obliged to keep some constantly in bed to prevent their dying of starvation. A fact that helps to show the feasibility of the anæmic theory is that brandy and other stimulants give considerable relief for a time, which would not be the case if cerebral congestion had to do with sea sickness. The explanation of how sea sickness continues so persistently in some, is that the sickness weakens the heart's action, and this keeps up the cerebral anæmia, and that in turn again produces the sickness; so that prolonged sea sickness is due to a circuit of causes, the one producing the other—the visional irritation, cerebral anæmia, sickness, weak heart's action."

Mr. Naylor adds that amyl nitrite usually does good in sea sickness, if used at once, because, being an anti-spasmodic, it relieves the spasm of the cerebral vessels, and thus the brain is refilled with blood. But if it fails, then the persistent sickness, by its effect on the contractions of the heart, prevents the brain from getting a sufficient supply of blood, and thus the brain becomes anæmic, not from a spasm of the capillaries, but from an insufficient power of the heart. It is at this stage that alcoholic stimulants in small doses, frequently repeated, give great relief.

Clearing Harbors of Torpedoes, Etc.

A trial has lately been made on board the Bloodhound, gunboat, at Portsmouth, Eng., of a new means which has been suggested by Captain Arthur, while in command of the Vernon, for clearing harbors of sunken mines and fixed torpedoes. At present the method adopted is to destroy the engines by countermining or by the hazardous process of "creeping." This is effected by boats being sent out to grapple for the cable connections, and then serving them by small charges of gun cotton. This mode, however, is very slow. The new method of opening a free channel for the passage of ships, as tried in the Bloodhound, consists in running out a couple of booms, 30 feet in length, from the bows of the ship. Across the submerged ends is fixed a horizontal beam, 38 feet in length, having a zigzag arrangement of iron rods in the form of a W; the idea being that the open space of each V of the series, as it is pushed through the water, will inclose the torpedo fastenings or connections, and lead them to the point at the bottom, which is fitted with a scissor contrivance, the blades of which are worked by levers in connection with the capstan on board. The beam searcher has a sweep of 50 feet, and the mechanism is capable of cutting through the strongest electric cable. A net, which is supported from the whiskers of the bowsprit, receives the liberated torpedo, and prevents it exploding against the operating craft. The trial proved a great success.

Comparative Strength of Explosives.

The report of the United States Board of Army Engineers, just published, presents the following interesting table as the result of two years' thorough trial of the relative efficiency of the various modern explosives, taking ordinary dynamite as the standard:

Dynamite, No. 1	100
Gun cotton	87
Dualin	111
Rendrock	94
Dynamite, No. 2	83
Vulcan powder	82
Mica powder	83
Nitro-glycerine	81
Hercules powder, No. 1	106
Hercules powder, No. 2	83

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.

The best results are obtained by the Imp. Eureka Turbine Wheel and Barber's Pat. Pulverizing Mills. Send for descriptive pamphlets to Barber & Son, Allentown, Pa.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

The Secret Key to Health.—The Science of Life, or Self-Preservation, 300 pages. Price, only $1. Contains fifty valuable prescriptions, either one of which is worth more than ten times the price of the book. Illustrated sample sent on receipt of 6 cents for postage. Address Dr. W. H. Parker, 4 Bulfinch St., Boston, Mass.

The Baker Blower runs the largest sand blast in the world. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

Magnets, Insulated Wire, etc. Catalogue free. Goodnow & Wightman, 176 Washington St., Boston, Mass.

Forsaith & Co., Manchester, N. H., & 218 Center St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

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

H. Prentiss & Co., 14 Dey St., New York, Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

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

Linen Hose.—Sizes: 1¼ in., 20c.; 2 in., 25c; 2½ in., 28c. per foot, subject to large discount. For price lists of all sizes, also rubber lined linen hose, address Eureka Fire Hose Company, No. 13 Barclay St., New York.

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

Eclipse Portable Engine. See illustrated adv., p. 189.

Bradley's cushioned helve hammers. See illus. ad. p. 142.

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

Eagle Anvils, 9 cents per pound. Fully warranted.

Pat. Steam Hoisting Mach'y. See illus. adv., p. 190.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

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

New 8½ foot Boring and Turning Mill for sale cheap. A first class tool. Hilles & Jones, Wilmington, Del.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

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

Machine Diamonds. J. Dickinson, 64 Nassau St., N. Y.

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

Sawyer's Own Book, Illustrated. Over 100 pages of valuable information. How to straighten saws, etc. Sent free by mail to any part of the world. Send your full address to Emerson, Smith & Co., Beaver Falls, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 30.

$250 Horizontal Engine, 20 horse power. See illustrated advertisement, page 189.

Combined Universal Concentric or Eccentric and Independent Jaw Chucks. Pratt & Whitney Co., H'tf'd, Ct.

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

Machines for cutting and threading wrought iron pipe a specialty. D. Saunders' Sons, Yonkers, N. Y.

Steam Engines, Automatic and Slide Valve; also Boilers. Woodbury, Booth & Pryor, Rochester, N. Y. See illustrated advertisement, page 29.

Shafting, Pulleys, and Hangers. Nadig & Bro., Allentown, Pa.

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

For Sale, Low.—A 125 Passenger Light Draught Side Wheel Steamer and several Launches. S. E. Harthan, Manufact'r of Launches and Engines, Worcester, Mass.

Automatic Machines for grinding quick and accurate, Planer, Paper, Leather, and other long knives. The best Solid Emery Wheels and Portable Chuck Jaws. Made by American Twist Drill Co., Woonsocket, R. I., U.S.A.

For Sale.—Patent Rights of Schneider's Combination Step and Extension Ladder. A very salable article. For terms, etc., address M. Schneider, 35 S. Main St., Dayton, O.

Cylinders, all sizes, bored out in present positions. L. B. Flanders Machine Works, Philadelphia, Pa.

Band Saws a specialty. F. H. Clement, Rochester, N. Y.

A well equipped Machine Shop desire to manufacture special machinery. Address T. H. Muller, care of P. O. Box 53, New York.

Wanted.—A second hand fifteen horse power Ames or Mann portable steam engine. Address stating condition and price, L. G. Tillotson & Co., 5 & 7 Dey St., New York.

Cooper's Folding Shaving Horse. Takes only 4 x 12 in. floor space. Address S. E. Cress, Hillsboro, Ill.

NEW BOOKS AND PUBLICATIONS.

DISTRIBUTION OF HEAT IN THE SPECTRA OF VARIOUS SOURCES OF RADIATION. By W. W. Jacques, Ph.D. Cambridge: John Wilson & Son.

Contains a review of the more important experiments that have been made in connection with the distribution of heat in the sun's spectrum, with an account of Dr. Jacques' own experiments.

WONDERS OF THE FLORA. By H. Acosta Kresken. Dayton, Ohio: P. A. Kemper. 12mo, cloth, price $1.50.

As its title does not indicate, this is a singularly good little treatise on the art of preserving flowers with their natural colors; to which is added a number of chapters on ornamental grasses and mosses and their uses, directions for collecting and preserving butterflies and other insects, the art of making wax flowers and fruits, and kindred subjects. Mr. Kresken has worked up his subject with no little patience and enthusiasm, and gives his readers the benefit of many years of experience in this department of household decoration. His exhibitions of preserved flowers at the Cincinnati Exhibition and elsewhere have been much admired, and have won him many medals. The book is prettily printed and bound.

AROUND THE WORLD WITH GENERAL GRANT. By John Russell Young. New York: American News Company. Parts 3, 4, and 5. Price 50 cents each.

These three numbers of Mr. Young's splendid record of the travels of General Grant, cover the experience of the party in Paris, on the Mediterranean, in the chief Italian cities, at Malta, Cairo, and up the Nile. The promise of the early numbers is well sustained both in the narrative and in the numerous and exceptionally fine illustrations.

HYGIENE AND PUBLIC HEALTH. Edited by Albert H. Buck, M.D. 2 vols. 8vo, pp. 791 and 675. New York: William Wood & Co.

The most important cyclopedia of individual and public sanitation ever published. The several papers, each a treatise in itself, have been written by American physicians and scientific investigators of established reputation, with special reference to the climates, conditions of soil, habitations, modes of life and laws of the United States. The introductory chapter, by Dr. John S. Billings, U. S. A., sets forth in some seventy pages the scope and importance of the subject, the causes of disease, and the jurisprudence of hygiene. Then follow: Infant Hygiene, by Dr. A. Jacobi; Food and Drink, by Dr. James Tyson; Drinking Water and Public Water Supplies, by Professor William Ripley Nichols; Physical Exercise, by Dr. A. Brayton Ball; The Care of the Person, by Dr. Arthur Van Harlingen; Soil and Water, by Dr. Wm. H. Ford; The Atmosphere, by Dr. D. F. Lincoln; General Principles of Hospital Construction, by Dr. Francis H. Brown; Hygiene of Occupation, by Dr. Roger S. Tracy; Hygiene of Camps, by Surgeon Charles Smart, U. S. A.; Hygiene of the Naval and Merchant Marine, by Dr. Thos. J. Turner, Medical Director, U. S. Navy; Hygiene of Coal Mines, by Henry C. Sheafer, of the *Miner's Journal;* The Hygiene of Metal Mines, by R. W. Raymond, Ph.D.; Infant Mortality and Vital Statistics, by Dr. Thos. B. Curtis; Public Nuisances, by Dr. R. S. Tracy; Adulteration of Food, by Stephen P. Sharples, S. B.; Sea Board Quarantine, by Dr. S. Oakley Vanderpoel; Inland Quarantine, by Dr. S. S. Herrick; Small Pox and other Contagious Diseases, by Dr. Allan McLane Hamilton and Dr. Bache McE. Emmett; The Hygiene of Syphilis, by Dr. F. R. Sturgis; Disinfectants, by Elwyn Waller, Ph.D.; Village Sanitary Associations, by Dr. R. S. Tracy; School Hygiene, by Dr. D. F. Lincoln. The writers will be recognized as among the best known physicians, medical and surgical professors, sanitary inspectors, and health officers of the country. For the medical profession and for public health officers and inspectors the work must prove of the highest value. If it could have a proper popular circulation, the benefit would be inestimable. It is too much to hope, however, that the public will take anything like a sufficient interest in matters of such vital importance as to secure to the work anything like the general reading it should have. It should have a place certainly in every public library.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

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

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

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

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

(1) F. B. G. writes: 1. I send per mail a sample of rock for examination. It is unlike any of the other rocks and ledges about here; we use it for cutting glass. It makes a good polishing powder. A. It is quartz rock. 2. Is there anything used in refining kerosene oil that would cause it to be unsafe to take as a medicine? A. Usually, no. We cannot recommend such a "medicine," however.

(2) "Engineer" asks: What is the Great Eastern steamship doing at present? Have you given any news about this ship in any previous number of your paper, as I believe it was reported lately in the London *Times* she was being newly fitted up for some new trade? A. We last heard that she was being fitted up for the cattle trade between Texas and Great Britain.

(3) T. H. J. asks by what process the two lenses (forming an achromatic lens) can be separated, the balsam cement (uniting the two) having become hardened by age. A. Heat them in hot water.

(4) R. B. N. asks: What is torsion strength in horse power of 2 inch wrought iron turned shafting, ten, forty, and fifty feet long, driving pulley being at end of shaft; and what breaking strain at ten feet? A. It depends upon the speed of the shaft. You must have the bearings close enough together to prevent a serious spring of the shaft from the strain of the belts.

(5) W. C. asks: 1. How many ounces of pure gold are obtained from one ton of high class California quartz? A. There is a wide difference in the yields of different mines—from 30 cents per yard (hydraulic gravel) to $1,000 per ton (quartz lode); from $6 to $70 would perhaps comprehend the average variation of those quartz mines at present profitably worked. 2. How much is one ounce of gold worth? A. Pure gold is worth $20.67 per ounce.

(6) J. C. C. writes: 1. I have a boat 18 feet long by 4 feet broad; she also has very fine lines. I have a link motion engine 2x2. Is the engine large enough for the boat? A. No. 2. Would you advise me to use one of Herreshoff's coil boilers, or a common one? A. A common one. 3. How big a wheel should I use, and what speed would she make? A. 15 or 16 inches diameter. Probably about 4 miles per hour, if you have plenty of boiler.

(7) E. B. asks: How do the makers of carved toy work in Switzerland and Germany learn their skill, acquire their ability in imitating forms of men and animals?—for, I take it, this ability of theirs is not learned in any school. A. The skill of the Swiss and German wood carvers has been developed very largely by the instruction in this art furnished by special schools, established for the purpose in all the wood carving districts.

(8) W. T. A. writes: When a steam engine is working does the steam exert the same force on the cylinder head as on the piston? A. Yes.

(9) E. C. M. suggests the following method of binding the numbers of the SCIENTIFIC AMERICAN into compact volumes: Procure two small planks, slightly longer than the paper and, say, 1½ inch wide and ¾ inch thick; pine will do. Having nicely arranged the papers, place the volume between these planks, and tie a strong double cord loosely around them. This cord is then drawn taut by inserting two uprights, say 2½ inches high, and is still further tightened by twisting by means of the short stick, A, as in the old fashioned buck saw. In this way the papers are firmly compressed. Then with a 1-12 inch twist drill (using, preferably, a spiral drill tool) pierce from 13 to 14 holes along the edge of the volume, taking care that the former is supported from below at the point of drilling. Finally pass a strong waxed cord through the holes, making a slip knot at B, and continuing in a sort of lock stitch way as indicated by the diagram, always drawing the cord as tight as possible. The head of a stout pin will do to pass the cords at the points, C. Fasten the end of the cord, and all that then remains to be done is to remove the planks.

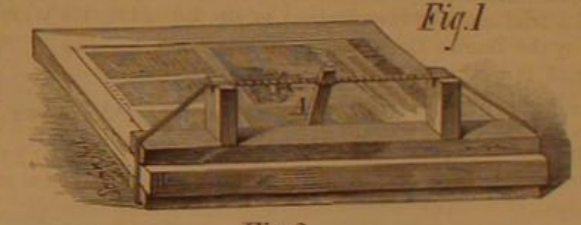


Fig. 1

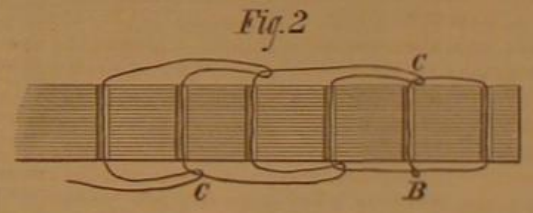


Fig. 2

(10) J. H. W. asks: Which has the most power, a cylinder with 20 inch bore and 20 inch stroke, or two cylinders 10 inch bore and 20 inch stroke, using the same steam pressure in both cases? A. If they make the same number of revolutions, the 20 inch cylinder has double the power of two 10 inch.

(11) C. H. asks for a receipt for keeping the bright surface on polished steel instruments, such as pocket knives, razors, drawing and surgical instruments; and how to remove the tarnish. A. In finishing a film of oil remains adhering to the steel, which, under ordinary circumstances, preserves the luster. Clean them frequently, and especially after handling, with well dried chamois leather.

(12) W. M. asks how to remove wool from the skin, without clipping. I have a large quantity and find it very tedious to clip, and I think there is a process to remove it without soiling the wool. A. Short wool is removed from skins by a process called "liming," in which the skins are soaked in milk of lime until the tissues are sufficiently softened to admit of removing the wool readily by hand pulling. Due care must be observed to avoid injuring the wool.

(13) F. C. writes: On Thursday last we had a collision on the Camden and Atlantic Narrow Gauge Railroad, in which five lives were lost on the passenger train, the other colliding train being freight. Now, accounts state that the engineer of the passenger train, seeing that it was impossible to avoid a collision, opened the throttle valve of his engine to give all the impetus possible to his train, with the object of trying to knock the freight train off the track, when by so doing it would prevent the passenger cars from telescoping and save the lives of many passengers. Was this mode of proceeding correct? A. It is stated as the result of experience, by old railroad engineers, that in all cases of apprehended collision, if the speed of the train cannot be effectually checked, and a collision be unavoidable, the safest course is to get all the speed possible, as the slowest train invariably receives the most damage.

(14) J. A. S. asks: 1. What would be the best and cheapest piping for conveying strong salt water, say 5 or 6 inch stream, for a distance of 5 or 6 miles? A. Wood tubing, also enameled iron conduits, are in practical use for such purposes, and have, we believe, proved most economical. 2. Is there a work published giving the different systems of water works, if so, where can it be had, and what would be the cost? A. There are a number of good works on this subject. Address the book dealers who advertise in these columns for catalogues.

(15) D. S. asks for a method of removing mildew from sailcloth. A. Hypochlorite of alumina is said to be one of the best remedies. Moisten with water, rub well into the cloth, moisten again with dilute sulphuric acid (1 to 20), and, after half an hour, rinse thoroughly in soft water and then in water containing about an ounce to the gallon of sulphite or hyposulphite of soda. A stiff brush may be advantageously employed in applying the hypochlorite.

(16) J. H. N. asks: What preparation is used in dyeing duck deadgrass color? A. Boil the goods in a bath of 2 lb. ferrocyanide (yellow prussiate) of potassa, wring out half dry, and then boil in a solution of ½ lb. sulphate of copper in 10 gallons water. Use stronger copper for a stronger color.

(17) A. H. M. asks: 1. What are the proportions of the popular shoe dressing for ladies and children's shoes? It is composed of gum shellac, borax, extract logwood, bichromate of potash, and ammonia, but I cannot get the proportions to make it. A. See p. 171 (22), current volume of SCIENTIFIC AMERICAN. 2. I want to make one of those phosphorescent or illuminated faces for clocks. What shall I use and how shall I use it, and is it permanent? A. The substance employed for this purpose is a sulphide of calcium mixed with a a resinous varnish. 3. I dissolved some India rubber in turpentine and benzine and applied it to cheap muslin and calico; but it will not fill the cloth so as to make it waterproof. What shall I mix with it to make it fill the cloth to be elastic and flexible? What I applied was as thick as honey. A. Moisten the cloth thoroughly, before applying the varnish, with benzol. When the coating has partially dried pass the cloth between heavily weighted soapstone rolls.

(18) D. M. C. asks how to make a good modeling wax, such as mould makers use. A. Melt 30 ounces of best white wax, and while it is cooling mix with it 1 ounce flake white. 2. I have been making a brass mould for casting white metal rings; the castings are about 2 inches in diameter, and they do not fill the mould. A. Provide plenty of small air vents, smoke your mould occasionally, and pour your metal into the mould through a deep gate or channel. If you do not succeed well with the metallic mould, try plaster of Paris, following directions given in SUPPLEMENT, No. 17.

(19) W. C. writes: In your issue of July 12, Mr. Cobb speaks of the good results he obtains from the use of refined petroleum in his boilers. Will you please inform me in your Answers to Correspondents, what he means by refined petroleum, or to what grade of oils in our markets this would apply? The water we are compelled to use here is about the worst in the world, being mostly from wells sunk in the sand. It seems to be charged with dissolved shells, etc., in addition to the usual salts of sea water, and forms a most obstinate scale very rapidly. I have tried a number of compounds, which were all highly recommended, but none of them were successful, even to the extent of modifying the evil. A. Petroleum which has been freed from earthy impurities and subjected to partial distillation in order to remove the lighter or more volatile hydrocarbons—such as petroleum ether, gasoline, etc., is usually denominated refined petroleum. Under the circumstances a feed water heater properly arranged would probably remove much of the incrustation-forming matters.

(20) F. L. asks (1) for a receipt to color iron castings black or brown. A. Mix chloride of antimony with warm olive oil to form a cream, add a few drops of nitric acid, and apply to the warm clean iron. Or apply the following preparation. Sulphate of copper, 2 oz.; chloride of iron tincture, 1 oz.; nitric acid and spirits of nitre, each ½ oz.; spirits of wine, 1 oz.; water, 40 oz. A strong warm aqueous solution of pyrogallic acid stains iron black. 2 To bronze castings. To make castings with green and bronze stripes. I would like a cheap made up preparation of chemicals, and at the same time one that would look well. A. Shellac, 4 oz.; benzoin, ½ oz.; methylic spirit, 1 pint; dissolve and strain through a fine cloth. To this add a sufficient quantity of bronze green, finely ground. Lampblack, red or yellow ocher may be added to temper the shade. Thin with methylic spirit, and apply with a brush. This work is usually given a thin coating of the clear varnish and touched up with gold powder. 3. A receipt for tinning gray iron castings, and the method of doing the work. A. Clean the castings by pickling in dilute sulphuric acid (1 to 30 of water) and scouring with sand if necessary. Then boil them in a concentrated aqueous solution of stannate of soda, with a quantity of granulated tin. 4. How to copper iron castings. A. Clean the iron as above and tumble it for a few minutes in sawdust moistened with a solution of one lb. sulphate of copper in two gallons of water made slightly acid with oil of vitriol. Wash immediately in hot water.

(21) F. H. S. asks: 1. What is the best form of a simple battery, and how many cells would be required for nickel and silver plating? A. You can use

several cells of an ordinary Smee battery, with carbon negative plate. The zinc surface exposed in the battery should about equal the surface of the work in the plating bath. A tension of two such cells will be found sufficient for ordinary work. 2. How are the solutions for gold and silver plating made, and what are the proportions for 1 gallon of each of the solutions? A. The whitening bath consists of a solution of 1 lb. potassium cyanide and ¼ oz. of silver cyanide or chloride to the gallon of water (soft); the plating bath of 1 lb. potassium cyanide and 1 oz. silver cyanide or chloride per gallon of water. For gold plating see p. 2340, No. 160, SCIENTIFIC AMERICAN SUPPLEMENT. 3. How is the quantity of silver deposited determined? What is used in the silver solution to plate bright, and how used? A. Weigh the work before and after plating. This is seldom resorted to, however, the time of exposure in the bath being a sufficient index for practical purposes. Carbon disulphide is sometimes added to the bath with the intent of securing a bright deposit, but as a rule, electroplaters prefer to dispense with any such addition to their baths. 4. How are the plated surfaces polished? A. Usually by burnishing with tools of steel or bloodstone, or by buffing with rouge and whiting.

(22) A. A. & S. ask: How much more water is there in every cubic inch in a pipe at 50 lb. pressure, than when there is no pressure? A. The difference is inappreciable. Water is practically incompressible.

(23) H. B. & S. ask: If the inside of a house has been painted long enough to have been dry and the paint yet sticks, what will prevent the paint from sticking? A. Try a small quantity of linseed oil with plenty of drier, and thinned down considerably with turpentine. You should try the experiment on a small scale at first.

(24) C. T. asks: Which would support the greater weight, a pillar of solid iron, 4 inches in diameter, or one of same diameter of hollow iron, and about what would be the difference in strength? A. One of solid iron. The difference would depend upon the thickness of the hollow pillar.

(25) T. T. P. writes: Our village is watered by a spring about six hundred yards away, at an elevation of some 15 or 20 degrees. The water is conveyed to the town through an inch lead pipe, having only one outlet. I put a stop cock hydrant in the pipe, about one hundred and fifty yards from its outlet. I proceeded as follows: After inserting my faucet or stop cock perpendicularly, I made a short bend upward in the pipe just below, the bend being elevated about ten inches above the cock. The water only made a gurgling noise and passed on by the stop cock without flowing out. What is the difficulty, and how can I make it work? A. You put in the stop cock at right angles to the current in the pipe; the current carries the water past the opening without being diverted from its course. If you insert an enlargement in the main pipe, and divert the water to the stop cock with an easy angle, you will probably succeed.

(26) "Novice" writes: I wish to move a shaft which is now geared to another as follows: The distance between each shaft centers is 8⅝ inches, and on one shaft there is a 4 inch diameter gear, and on the other a 13¾ inch gear. I wish to move the shaft with the 13¾ inch gear 3¾ inches further away from the shaft with the 4 inch gear, and retain the present speed of both; what size gear shall I put on each shaft? A. Wheel, 19·21 inch diameter; pinion, 5·53 inch diameter.

(27) W. C. T. asks: 1. Can I place one end of a 2 inch iron pipe in the fire and force air through 100 feet with a fan and have it come out hot at the end from the fire? A. Yes. 2. If the air is forced through very rapid will the speed cool it before it gets through? A. It will probably part with some of the heat, though if sent through the pipe at a high velocity, the loss will be very slight.

(28) P. M. writes: 1. In testing a steam boiler with cold water pressure, if the inspectors apply 120 lb. pressure, how much steam can the boiler carry with safety? A. By inspectors' rules, 80 lb. 2. Which can you get the greatest pressure with, cold water or steam? A. With cold water, having proper appliances. 3. Why is water used in preference to steam? A. If the boiler gives way under the test, the water is not so dangerous or destructive as steam. 4. In your article on the horse power of the steam engine, where do you get the 33,000 that you divide with? A. 33,000 lb. lifted one foot high per minute, is the unit of horse power. It represents the power of one horse.

(29) J. G. B. writes: There is an engine in this place, 8x12 cylinder, which makes 150 revolutions per minute, uses 70 lb. steam on gauge; sold by maker for 15 horse power. By rule in SCIENTIFIC, it is 50 horse power. What is the matter? One fifth off for friction, and it would be 40 horse power. A. Your engine was sold you as a 15 horse power nominal. It is a poor engine that cannot in use give out double its nominal power, and frequently it is 3 to 5 times the nominal power. 2. Will you work out your rule in all its details, so that it can be comprehended by all, with 2 sums, say one engine, 8x12, 150 revolutions, 70 lb. steam, and one 10x20, same revolutions and steam? A. You say 70 lb. steam: this is the pressure in the boiler, but what is it in the cylinder? Boiler pressure does you no good, except you get it in the cylinder. Your 8 inch cylinder, by 12 inch stroke, with 70 lb. steam in cylinder, 150 revolutions is: Area of 8 inches = 50 inches, and 150 revolutions = 300 feet per minute, then $\frac{50\times70\times300}{33{,}000}$ = 13·8 horse power; deduct 20 per cent for friction and losses, 31·8 − 6·3 = 25·5 horse power. Then for 10 inch cylinder, 20 inch stroke, 70 lb. steam, and 150 revolutions = 550 feet per minute, $\frac{78\cdot5\times70\times500}{33{,}000}$ = 83 horse power, less 20 per cent = 83 − 16·6 = 66·4 horse power.

(30) J. B. H. asks (1) how to Babbitt a brass box of an engine that is worn well down and thumping. A. Drill shallow holes in the box, tin the surface, and then cast in the Babbitt metal. 2. What will stop a boiler from foaming? A. We cannot inform you without knowing the cause. Sometimes throwing a little oil in by the feed pump will check it temporarily.

3. How to find out the pressure of steam in the cylinder. A. By using an indicator. 4. To find out how much water the pump of an engine is throwing. A. If the pump is throwing full, estimate its contents; otherwise deliver the water into a tank a certain number of strokes, and measure the water in the tank. 5. How to find out the horse power of an engine. A. See reply to J. G. B., on this page.

(31) G. B. M. writes: I wish to transmit five horse power the distance of one mile. Can it be done with a line of shafting; and if so what size iron? A. The use of shafting for your purpose would be very expensive and unsatisfactory; the torsional spring or elasticity would be so great that the speed given off would be very irregular. Wire rope transmission would be cheaper and far better.

(32) W. H. M. S. writes: Please give me a rule to determine the horse power of an engine. Suppose a locomotive engine with a driving wheel 5 feet diameter, length of stroke 4 feet, cylinder 16 inches diameter, and a pressure in the boiler of 125 lb. to the square inch: what is the horse power? A. See reply to J. G. B., on this page.

(33) J. F. asks for the best paint or other cheap, available means of protecting a wrought iron post from rust in damp ground. A. Use a good asphaltum varnish thickened with anhydrous iron oxide or burnt ocher.

(34) F. S. W. asks: How can I make lard hard, yet run into an oil when a gentle heat is applied to it? I have tried wax, but it leaves small hard lumps when cold. A. Try paraffine wax.

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

C. W. C.—Argentiferous copper glance. This ore will probably prove well worth working.—F. K.—They are crystals of chrome alum. The carbon had probably been employed in a bichromate of potash battery.—T. A. H.—It is a hydrocarbon closely resembling hatchettite, probably of natural origin. A larger sample would be desirable to properly classify it.—W. C.—Neither of your samples contains silver. No. 1 is a shale, and No. 2 a ferruginous sandstone.—J. W. W.—1. A variety of amphibole. 2. Quartz and argentiferous galena, of some value.—W. R. T.—It is *simpla lunator*.

COMMUNICATIONS RECEIVED.

On Aids to Motive Power of Vessels. By E. R.
On Astronomical Phenomenon. By J. H.
How to Forecast the Weather. By G. R. C.
On the Ground Element. By E. Z.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

August 26, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Amalgamator, electric, J. O. Stewart 218,918
Axle box, car, A. Onslow 219,009
Axle box, car, S. S. Sencenbaugh 218,834
Axle box lid, car, A. P. Case 218,928
Axle box, vehicle, B. Crowther 218,939
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Clock, J. M. Josias 218,980
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End gate, wagon, Merz & Williams 218,996
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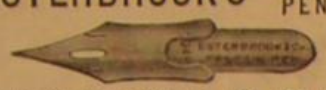

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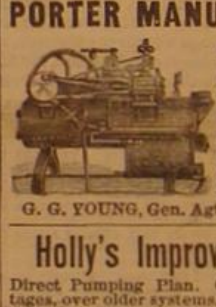

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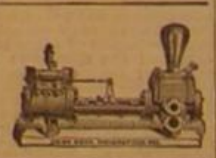

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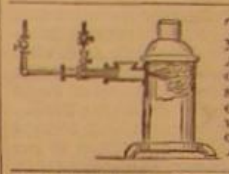

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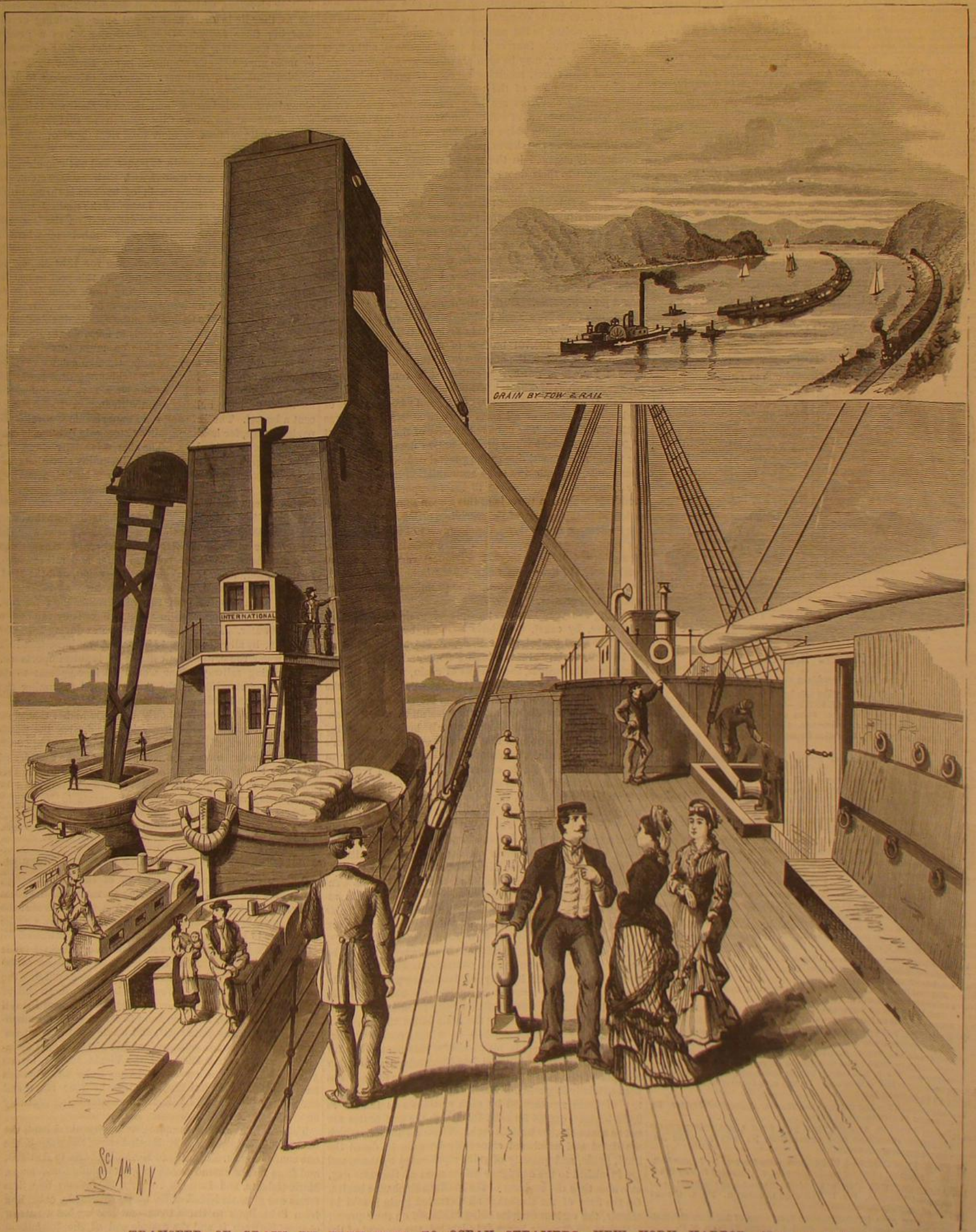

TRANSFER OF GRAIN BY ELEVATORS TO OCEAN STEAMERS NEW YORK HARBOR.—[See page 208.]

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No. 196,

For the Week ending October 4, 1879.

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THE GRAIN TRADE OF NEW YORK.

One cannot cross either of our river ferries, still less circumnavigate the city or take a few hours' sail up the Hudson, without being amazed at the movement of breadstuffs visible on all sides. On the Hudson River Railroad, and all the other iron thoroughfares converging upon this city, long trains of grain cars are almost constantly in sight, while on the river vast rafts of grain laden canal boats more than rival the railway trains in carrying capacity. It is no uncommon thing for one of the large towing steamers to bring down the river fifty, sixty, or more canal boats, each carrying from eight to fourteen thousand bushels of wheat, corn, or other grain. In single file, one of these vast tows would make a continuous line of canal boats more than a mile in length; while an equivalent tonnage in cars would require twenty-five or thirty 40-car trains, or from six to seven miles of cars, according to the nature of the grain.

Not unfrequently four or five ocean steamers, and a fleet of other shipping, may be seen about the great railroad elevators at 65th street, receiving cargoes of grain and cattle. At each of the piers of the numerous European steamship lines, floating elevators are busy transferring grain from canal boats; others are at work in midstream alongside ocean steamers and sailing ships at anchor; and at the extensive warehouses along the shores, permanent or floating elevators are similarly engaged in the rapid handling of the staff of life, brought to their doors either in canal boats and barges, or in cars floated, on boats made for the purpose, from the piers of the Erie and other railways.

The magnitude of this grain trade of New York may be judged from a few statistics. During the week ending September 6, the receipts at this port were: Flour, 112,124 barrels; wheat, 2,271,492 bushels; corn, 1,327,014 bushels; oats, 279,355 bushels; rye, 139,886 bushels; barley, 1,100 bushels—about as much as was received at all the other seaboard ports together. During the same week the exports of breadstuffs from New York included 113,224 barrels of flour, 2,519,409 bushels of wheat, 914,623 bushels of corn, 2,996 bushels of oats, 103,701 bushels of rye. At the last date named, September 6, the amount of grain in our city granaries and afloat in our harbor embraced in round numbers, 3,750,100 bushels of wheat, 3,100,000 bushels of corn, 810,000 bushels of oats, 160,000 bushels of rye, and 26,000 bushels of barley. The grain of all sorts in store at New York was 6,332,035 bushels. The storage capacity of the port is about 12,000,000 bushels, but the present active demand for grain for foreign shipment, due to the general deficiency of European crops, prevents any large accumulation here. Indeed, the bulk of shipping devoted to the transportation of grain from this to foreign ports is at this season something unprecedented in the history of the world. During the week ending September 10 (six days), the clearances of flour and grain for Europe alone embraced eighty-five vessels (45 barks, 30 steamships, 4 ships, 5 brigs, 1 schooner), carrying a grand total of 78,112 barrels of flour, 1,942,248 bushels of wheat, and 1,249,092 bushels of corn. The promise for the current week is still greater.

During the year 1878 the receipts of grain alone at this port were, by canal, 63,663,049 bushels; by vessels coastwise, 1,090,236 bushels; by rail, 63,960,486 bushels—a total of 128,613,771 bushels. Changing flour and meal to their equivalents in bushels, the receipts of grain, flour, and meal were, during the year, 152,862,170 bushels. During the same period the export of cereals from New York amounted to 107,819,044 bushels, the exports from all the other Atlantic ports together (including Montreal) being 104,678,187 bushels—evidence enough that our city still holds the lion's share of this trade. To describe in detail the manner in which the grain trade is conducted here would require a volume. A rough outline of it will have to answer.

As already indicated, the vast stream of life-sustaining wealth flows to us through channels of two distinct sorts—by water and by rail. The inflow coastwise is too small, relatively speaking, to demand especial notice. The Erie canal, with the Hudson river on one side and the railways on the other—chiefly the New York Central and Hudson River Railroad, the Erie road and the Pennsylvania Central—divide the traffic about equally. And the grain received by each route has, speaking generally, its particular treatment. That which comes by rail is graded according to rules agreed upon by the New York Produce Exchange, and is sold by grade, the identity of the grain being lost. The grain received by water, on the contrary, is chiefly handled without grading, the identity of lots being preserved. In the latter case the consignee receives the identical grain shipped to him, say from Buffalo or any point farther West; in the former, he receives not the grain billed to him, but a certificate for so many bushels of wheat, corn, or other grain of a specified grade, his particular shipment being, for economy in warehousing and handling, mixed with other receipts of the corresponding kind and grade after it has been officially inspected, graded, and weighed. The quantity of grain represented by each certificate is limited to 8,000 bushels, except for oats, for which the certificates are not to exceed 10,000 bushels each. These certificates, which are dated and numbered consecutively, state in detail the kind, grade, and quantity of grain represented by them, and are furnished to the consignee before noon of the same day, at which time the business of the Produce Exchange begins. On the floor of the Exchange all ungraded grain is sold by sample, the various samples being exhibited on their proper tables, in small paper boxes duly labeled, the amount of the lot, and the place where it is stored or afloat, being fully set down. The graded grain is represented by type samples, so that dealers can see exactly what their certificates call for. A buyer purchases for exportation from various sellers, say, 100,000 bushels of No. 1 white winter wheat, or any other of the dozen different grades of winter wheat. He handles no grain, but receives instead certificates representing that amount of grain of the specified kind. On the presentation of such certificates to the railway company or companies issuing them, freight and accrued charges being paid, the companies deliver the grain out of their general stock of that grade, at such point in the harbor as may be designated.

A vast amount of loading is done at the elevators at 65th street and North River. A larger amount is transferred by floating elevators, which draw up alongside the great steamers as they lie in their accustomed slips, receiving or discharging their freight. Our illustration gives a general view of an elevator of this sort, of which a fleet of twenty or more are constantly employed in our harbor. There are besides numerous stationary elevators belonging to large grain dealing firms, at the lower end of New York island and along the Brooklyn shore; and the Erie Railroad Company are building at the Jersey City terminus of that road an elevator which promises to more than rival those of the New York Central.

The speed at which grain is transferred at these elevators is amazing to one not familiar with their management. A shaft inclosing an endless chain of buckets is thrust into a laden car or canal boat, and instantly the grain begins to travel up the long incline to be delivered on the opposite side at a rate often exceeding fifty bushels of wheat a minute, or a larger quantity of lighter grain.

The report of the Produce Exchange for 1878 shows the authorized charges for handling grain at this port to be, per bushel: weighing, ½ cent; elevating from canal boats, ½ cent; for delivering on board single deck ocean vessels, including trimming, $7 a thousand bushels; ditto, double-decked ocean vessels, $8; on ocean vessels in bags, $6.25; on coastwise vessels, $2.50. The expenses on grain to shippers by rail from the interior are: for inspection, 25 cents a car; elevation, ½ cent a bushel; half weighing, ¼ cent a bushel; storage, ¼ cent a bushel. At the New York Central elevator the charge for bulking grain with storage (10 days) is ¼ cent a bushel. The Erie and the Pennsylvania Central Companies charge, for holding grain on storage in lighters, ¼ cent a bushel for each ten days. The charge for delivering afloat ungraded grain in railroad lighters, including elevation from boats, ranges from 3 cents to 1½ cents a bushel, according to the bulk of the lots handled. The authorized charge for towing laden canal boats about the harbor ranges from $5 to $11, according to distance. The freight tariff from the great grain distributing point of the West, Chicago, varies with the season, the style of carriage, the degree of competition between the railways, or between water and rail carriage. In the winter, when the lakes, the Erie canal, and the Hudson River are closed, the rate rises as high as 25 cents a bushel. On the opening of the water routes the rates fall, dropping at midsummer as low as 8 or 9 cents by rail and 6 cents by water. The average rate by water during 1878 was 7¼ cents; by all rail routes, 12 cents. As an important link in the water route, the Erie canal is of infinite importance. The existing railways alone would be incompetent to do the carrying required at the time required (assuming the foreign demand unimpaired); besides, by having the monopoly, their rates would not only be made higher than now obtains, but possibly so high as either to destroy the possibility of our competing in price with Russian wheat in Liverpool, or to make competition possible only at the sacrifice of all profit to our wheat growers. It is worth noting in this connection that during the present year the average cost of transporting wheat from Northern Minnesota to New York—26 cents a bushel—is less than was the cost of the carriage of wheat by lake and canal from Chicago twelve years ago.

FORMER EXTENSION NORTHWARD OF SOUTH AMERICA.

In his report to the Superintendent of the Coast Survey, describing the past winter's dredging operations of the Coast Survey steamer Blake, Professor A. Agassiz shows that the soundings taken, together with those previously known, make it possible to trace with tolerable accuracy the outline of the land masses which anciently united the West India Islands with the continents. After describing the geography of the 100-fathom line, Prof. Agassiz says that, on examining the 500-fathom line, Jamaica is found to be the northern spit of a gigantic promontory which once extended toward Hayti from the mainland, reaching from Costa Rica to the northern part of the Mosquito coast, and leaving but a comparatively narrow passage between it and the 500-fathom line encircling Hayti, Porto Rico, and the Virgin Islands, in one gigantic island. The passage between Cuba and Jamaica has a depth of 3,000 fathoms, and that between Hayti and Cuba is not less than 873 fathoms, the latter being probably an arm of the Atlantic.

The 500-fathom line connects, as a gigantic island, the banks uniting Anguilla to St. Bartholomew, Saba Bank, the one connecting St. Eustatius to Nevis, Barbuda to Antigua, and from thence extends south so as to include Guadeloupe, Marie-Galante, and Dominica. This 500-fathom line thus forms one gigantic island of the northern islands, extending from Saba Bank to Santa Cruz, and leaving but a narrow channel between it and the eastern end of the 500-fathom line running round Santa Cruz. As Santa Cruz is separated

from St. Thomas by a channel of 40 miles, with a maximum depth of over 2,400 fathoms, this plainly shows its connection with the northern islands of the Caribbean group, rather than with St. Thomas, as is also well shown by the geographical relations of its mollusca. The 500-fathom line again unites, in one gigantic spit extending northerly from the mouth of the Orinoco, all the islands to the south of Martinique, leaving Barbadoes to the east, and a narrow passage between Martinique and the islands of Dominica and St. Lucia. At the time of this connection, therefore, the Caribbean Sea connected with the Atlantic only by a narrow passage of a few miles in width between St. Lucia and Martinique, and one somewhat wider and slightly deeper between Martinique and Dominica, another between Sombrero and the Virgin Islands, and a comparatively narrow passage between Jamaica and Hayti. The Caribbean Sea, therefore, must have been a gulf of the Pacific, or have connected with it through wide passages, of which we find the traces in the tertiary and cretaceous deposits of the Isthmus of Darien, of Panama, and of Nicaragua. Central America and northern South America at that time must have been a series of large islands with passages between them from the Pacific into the Caribbean.

These results furnish an intelligible and at the same time trustworthy explanation of the peculiar geographical distribution of the fauna and flora of the West Indies. Instead of showing, as might naturally be assumed from their proximity to Florida, an affinity in their fauna and flora with that of the United States, the island of Cuba, the Bahamas, Hayti, and Porto Rico show unmistakable association with that of Mexico, Honduras, and Central America, while the Caribbean Islands show in part the same relationship, though the affinity to the Venezuelan and Brazilian flora is much more marked. The former geographical connections thus indicated are made certain by the Blake soundings.

THE FUTURE OF ORGANIC CHEMISTRY.

Berthelot has estimated the possible number of compounds of acids with alcohols at 1,400,000,000,000,000. With such a future before them ambitious young chemists need not despair of finding new compounds for centuries to come. The number of new bodies prepared annually will probably not exceed 1,000, but each year will see these numbers grow. Of all these new products less than 5 per cent have any so-called practical—*i. e.*, commercial—value. A majority, in fact, are never seen again outside of the laboratory where they are discovered, are never heard of after the first description has gone the rounds of the chemical journals, and been finally registered in the big year book, or Jahresbericht, into which are annually posted abstracts of all the minor entries that have been made in the various daybooks and blotters throughout the world. Yet each little discovery, insignificant though it may appear, every new body, useless as it may seem, is valuable. They are the bricks and stones from which a grand and imposing edifice is to be built, and while they may be allowed to lie for years in the rubbish heap, they will one day be sought out to fill their destined place in the structure. It is one man's place to provide the material, another to arrange them in position. As yet the outlines of the building are scarcely discernible; here a tower and there a pinnacle, then an ugly gap. In one place an imperfect foundation is settling and threatening ruin to the stories above; portions of it will need rebuilding; new corner stones are needed here and there; the glittering pinnacles have been misplaced, an overhanging turret threatens the passer-by. Future architects will change the plans, attempt new designs, but complete success is possible only after all the material is on the ground. Let no investigator feel that his little contribution is of no value; it may yet occupy a far more important position than those which for the present serve as capstones and cornice.

Aside from the theoretical value which attaches to these soon-to-be-forgotten compounds, it is worth while to prepare them and to study their properties carefully; it is impossible to prophesy what technical value they may possess or to what they may lead.

The question is often asked, Shall we ever be able to make the valuable alkaloids, particularly quinine? It is too soon to answer this question. A few years ago the synthese of coniine was announced, but it proved to be an isomeric body, a paraconiine. The next trial may give the real article, and then other alkaloids may follow. The recent success of an American in Paris, who prepared the glucosides synthetically, marks an important epoch in synthetical chemistry. The synthesis of cane sugar will probably follow, and who can say where this will lead to? Since the day when Woehler first made artificial urea, many useful forms of synthesis have been devised. Of these the most important commercially was the manufacture of artificial alizarine. Agriculture as well as technical industry was affected by it. Kolbe's synthesis of salicylic acid has proved a boon to suffering humanity. Tiemann's synthesis of vanilline, although much talked of, was necessarily of less importance from the relative small consumption of this flavor. Bäyer's recent synthesis of indigo is of no importance to the dyer at present, because his method is too circuitous and expensive, but it is no less the great achievement of a master mind. Another may modify his method and make it profitable.

The first step in the successful imitation of a natural product is to ascertain with certainty its constitution, into what products it is most easily separated, and how these again break up into simpler ones already known. Kolbe knew that salicylic acid could be readily converted into carbolic acid, carbonic acid being liberated. He reasoned, then, that if he could make carbonic acid act upon and combine with carbolic acid, salicylic acid would probably result. By the intervention of metallic sodium the reaction was accomplished, but sodium is too expensive a metal for such a purpose, hence he sought and found a cheaper one in caustic soda; what the latter lacked in energy was compensated for by simply raising the temperature.

The conversion of cane sugar into grape sugar (glucose) is a very simple affair, and has long been understood. The operation seems to consist in the abstraction of the elements of water. Could we not add the elements of water to grape sugar and convert it into cane sugar? As yet it has not been accomplished. The grape sugar has no desire to enter into a partnership with water on such terms as to form cane sugar. Carbon is a queer element, and we cannot always comprehend its idiosyncrasies. Anybody can convert a diamond into charcoal; no man has yet converted charcoal into diamonds. Yet why, we do not know.

Bäyer's synthesis of indigo blue furnishes a most instructive example of reversed operations. It had long been known that when indigo is oxidized with nitric acid *isatine* is formed. So Bäyer reasoned from this that he must be able to reduce isatine to indigo blue, and in this he succeeded by the aid of phosphorus and chloride of phosphorus. The next step was to prepare the isatine. *Oxindole* can be made from isatine, therefore Bäyer thought he could make isatine from oxindole, and after a few unsuccessful efforts he finally succeeded in making isatine. This completed his research, for he had already made oxindole from phenylacetic acid, which in turn is made from some of the coal tar products. The synthesis is complete, although tedious.

In addition to the wide field of pure synthetical chemistry, where coal tar is converted into true imitations of nature's own products, a field as yet but little cultivated, there is another scarcely yet explored—the conversion of one natural product into another and more valuable one, through purely chemical means. The conversion of starch into sugar, and that again into alcohol, is one which nature suggested and in which she assists. Sawdust is converted into oxalic acid and old rags into sweet sirups; but there are still other problems awaiting solution. Stearic acid is much more valuable than oleic. Who will convert the latter into the former? Oil of turpentine is isomeric with oils of bergamot, lemon, and lavender. Who will transpose the first into the others?

It cannot be denied that men have spent years—nay, a lifetime—on fruitless experiments; but the time is near at hand when *intelligent* work is sure to bring some reward, and although few secure great fame or wealth, still fewer go unrewarded. He who makes no experiments is sure to make no discoveries.

THE USE OF THE JEW'S EAR FUNGUS IN CHINA.

According to a paper recently read before the Philosophical Society of Wellington, New Zealand, it appears that a large trade is carried on between that colony and China in the fungus known as "Jew's ear." This trade is practically restricted to a single species, *Hirneola polytricha*, Mont., which is very abundant on decaying timber in all the forest districts. Small quantities only of this fungus were exported before the year 1872; in that year, however, the amount declared at the various ports in the colony was 57 tons 14 cwt., of the estimated value of $9,635; in 1877 it had increased to 220 tons 5 cwt., valued at $16,590, the total amount exported during the seven years ending 1878, being 838 tons, of the value of $189,060. The declared value of this fungus is about $220 per ton, or more than four and a half times the nominal price of one penny per pound paid by the merchant to the collector. As no process is required to prepare the fungus for market, the only outlay connected with it is the cost of collection and spreading in the open air or in sheds for a few days to allow of the evaporation of the moisture, and even this is rarely necessary in the summer, so that in round numbers the sum of about $40,000 represents the actual remuneration of the collectors, while the merchants' profit is represented by the disproportionate figure of $145,000. China is the sole market for this fungus. The use to which the Chinese apply it is as a medicine for purifying the blood, administered in the form of a decoction. It is also used on fast days, with a mixture of vermicelli and bean curd, instead of animal food. It seems to be likewise largely used in soups as ordinary food, and is sold at retail at about 25 cents per pound. An allied species, the common Jew's ear (*Hirneola Auricula-Judæ*), which also occurs in the colony, is decidedly rare as compared with the preceding one. Another species of *Hirneola* is collected in Tahiti, for export to China, and a larger species, found in northern China, is said to be extensively collected for home use. The paper above noted points out "the singular phenomenon of a product utterly useless in the country where it is found, being utilized by one of the least progressive people on the face of the earth, thus reversing the ordinary condition in which the civilized race utilizes the products of others less favored." The fungi mentioned in this paper belong to a section of the order in which the whole plant is of a gelatinous nature, becoming horny when dry, but swelling out again to its original form on the application of moisture. One of the species, *Hirneola Auricula-Judæ*, is widely distributed throughout Europe and the United States, and, a century ago, had much reputation in England as a strong purgative and topical astringent, and even now has some repute abroad, inasmuch as it appeared among the medicinal substances sent to the last International Exhibition at London from one of the French colonies. The faculty possessed by the fungus of absorbing and holding water like a sponge has resulted in its use as a medium for applying eye water to weak or diseased eyes, and similar purposes. Medical writers many years ago declared its internal use to be dangerous, and it was therefore rejected by the Edinburgh and London Colleges, and expunged from the pharmacopœias. The curious name that the plant bears is due to the ear-like form which it often assumes.

THE COST OF RAILWAY CARS.

Under examination by the State Committee on Railway Affairs, a leading member of one of our largest car building companies, Mr. Gilbert, testified that the average price of box cars is from $400 to $450. In 1872 they were as high as $1,200. A milk car costs about $100 more than an ordinary box freight car, that is, when the box is not changed. A baggage car truck and a passenger car truck are about the same. The price of a baggage car varies from $2,000 to $2,500. The cheapest style of Wagner's drawing room cars may be made for $8,000; the usual price is $12,000. This includes all the furnishing. The cheaper drawing room cars, four wheels, are made for $10,000. The ordinary mail car costs from $2,000 to $3,000; distributing cars more. Cars for the New York Elevated Road cost from $2,500 to $3,000. The last ordinary passenger cars built cost $4,200; the last built for the Hudson River road cost $5,400, including a heater and some extra fixtures. Small cars for carrying ore cost $200. Mr. Gilbert had never made coal cars or tank cars for oil.

Oliver Sarony.

Oliver Sarony, one of the pioneers in photography, and withal a successful and distinguished artist, recently died in Scarborough, England, in his sixtieth year. Mr. Sarony was born in Quebec, in 1820, and at an early age was thrown upon his own resources by the death of his father. With his brother Napoleon, so widely and favorably known as a photographer in this city, Mr. Sarony came to New York soon after his father's death. Becoming interested in the work of a daguerreotypist the two boys learned the art. In 1843 Oliver went to England, where he practiced photography with success and profit. In 1857 he settled in Scarborough, establishing branch offices in other large towns.

Professionally, Mr. Sarony's especial delight was to induce a customer to order an oil painted enlarged picture when his original purpose was to sit for a dozen cards. We have seen him engaged in such an enterprise, remarks the London *Photographic News*, and watched his almost child-like delight in the success of his efforts. Selecting the most pleasing of two or three negatives which had been taken, it was handed into a distinct department fitted up for rapidly producing transparencies. A transparency obtained, it was placed in a magic lantern kept ready, and a life-size image was thrown on the screen. Mr. Sarony had, in the meantime, invited the sitter and his wife into a gallery of life-size portraits well painted in oil, and handsomely framed. These, of course, elicited admiration, and eventually Mr. Sarony led his visitors into the room, where a fine portrait of the gentleman was presented life-size on the screen. The effect, as all photographers know, is very striking, and fully admits of a little eloquent talk on its fitness for painting. Mr. Sarony talked well and gracefully, with a frank candor that won belief; and on the occasion in question he took an order for an "oil" at sixty guineas.

The American Institute Fair.

The fair of the American Institute in this city opened on September 17. As usual very few of the exhibits were completely ready. The number of exhibitors this year is large, many applicants having to be turned away for lack of space, and there is promised an unusually full and interesting exhibition. A notable feature is an elaborate display of American china ware, under the direction of the National Pottery Association. The large exhibition of Agricultural machinery includes several novelties. Wood-working machinery is also well represented. The elevated railways have naturally called out many inventions for reducing noise and preventing accidents. The safety steam motor for surface roads, lately adopted by the Third Avenue Railroad, is exhibited, with the method of producing and applying steam power; also the compressed air motor of the Winters Improvement Company. A display of fruits, flowers, and vegetables is promised during October.

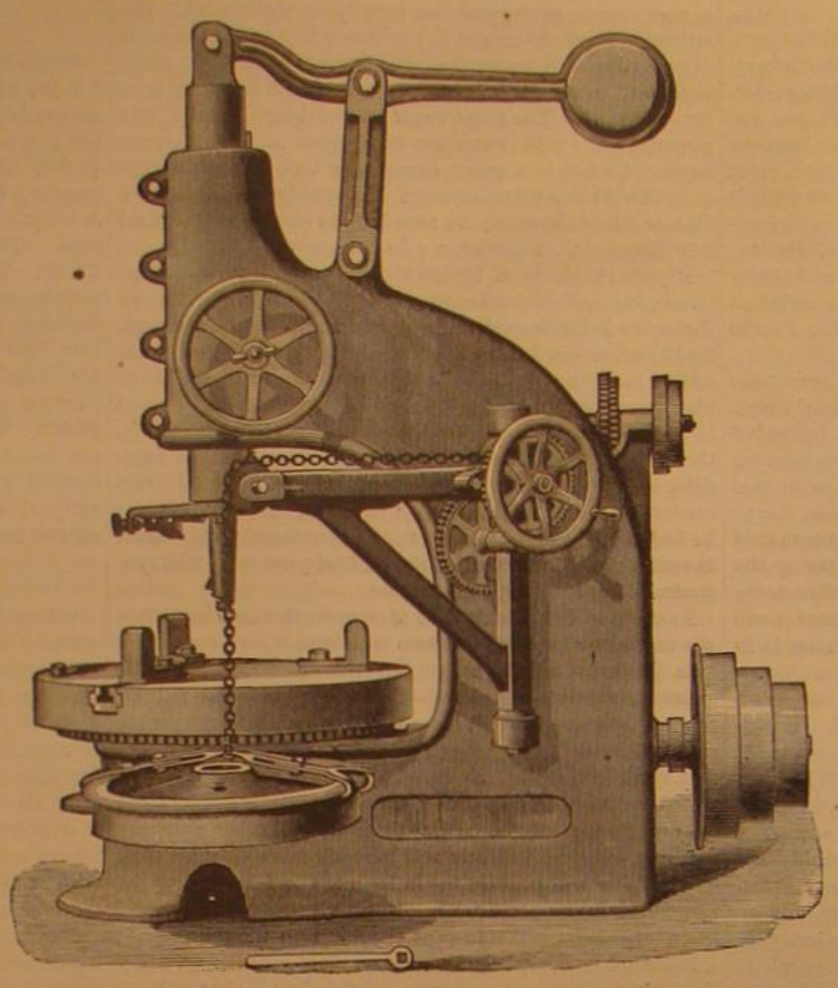
The Suez Canal.

One thousand five hundred and fifty vessels passed through the Suez Canal in 1878. Of these 1,227 were British, 89 French, 71 Dutch, 44 Italian, 38 Austrian, 22 German, 21 Spanish, 8 Egyptian, 8 Japanese, 6 Danish, 5 Swedish and Norwegian, 4 Portuguese, 3 Turkish, 2 Belgian, 1 American, and 1 Zanzibar. The total tonnage was 2,178,316 tons, of which 1,726,946 tons were British.

KEEP THE MOUTH SHUT.—The influence of nasal respiration on the ear is illustrated by Mr. George Catlin, in his history of "The North American Indians." Among two million Indians he found not one who was deaf or breathed through the mouth, except three or four deaf-mutes; and in the memory of the chiefs of 150 tribes, not one case of deafness could be remembered to have occurred. This is explained by the mother always closing the mouth of the child whenever it attempted to breathe through it.

VERTICAL CAR WHEEL BORER.

The vertical car wheel borer, shown in the accompanying engraving, is made by the Putnam Machine Company, of Fitchburg, Mass. It is of heavy construction, combining with good proportions the proper strength for the work it has to perform, and its capacity includes all sizes of wheels from fifteen to forty-eight inches in diameter. The work is held by a four-jawed chuck, the jaws of which, while having independent adjustments to an accurately graduated scale on the slide, are set up or tightened on the work by means of a wrench giving a simultaneous or universal movement. The bearings upon which the chuck revolves are of the form of a double parabola with the concave faces turned in as the journal, while the seat or lower bearing is lined with Babbitt metal, producing an excellent bearing and distributing the pressure over a large area, thus, when properly lubricated, preventing contact and wear of the metal and reducing the running friction to a very small amount. These journal bearings are surrounded by and attached to a rigid circular case, which admits of adjustment for boring either straight or tapering, without changing the vertical line of the boring spindle. The chuck spindle is hollow and allows chips to fall into the interior of the frame, from whence they may easily be removed. The boring spindle is of large proportions, is counterbalanced, and is raised or lowered by a rack and pinion in the back, giving a very quick motion. The feed has four changes, two by belt and two by gears, and the latter admits of being changed instantaneously, independently of the former, for roughing out and finishing operations, by means of a stop rod, while the machine is in motion. The cutter mandrel is of steel, three and one half inches in diameter, and has a taper bearing in the spindle, twelve inches long. An independent head for squaring the hubs of truck wheels is quickly adjusted to, or removed from the spindle as required. A powerfully geared swing crane is attached to the side of the machine, and provided with chain and grappling irons for lifting and swinging wheels on and off the chuck. The driving cone is large and has three changes of speed, and by the arrangement of the countershaft pulleys, admits of two speeds for each cone shift without change of belt.

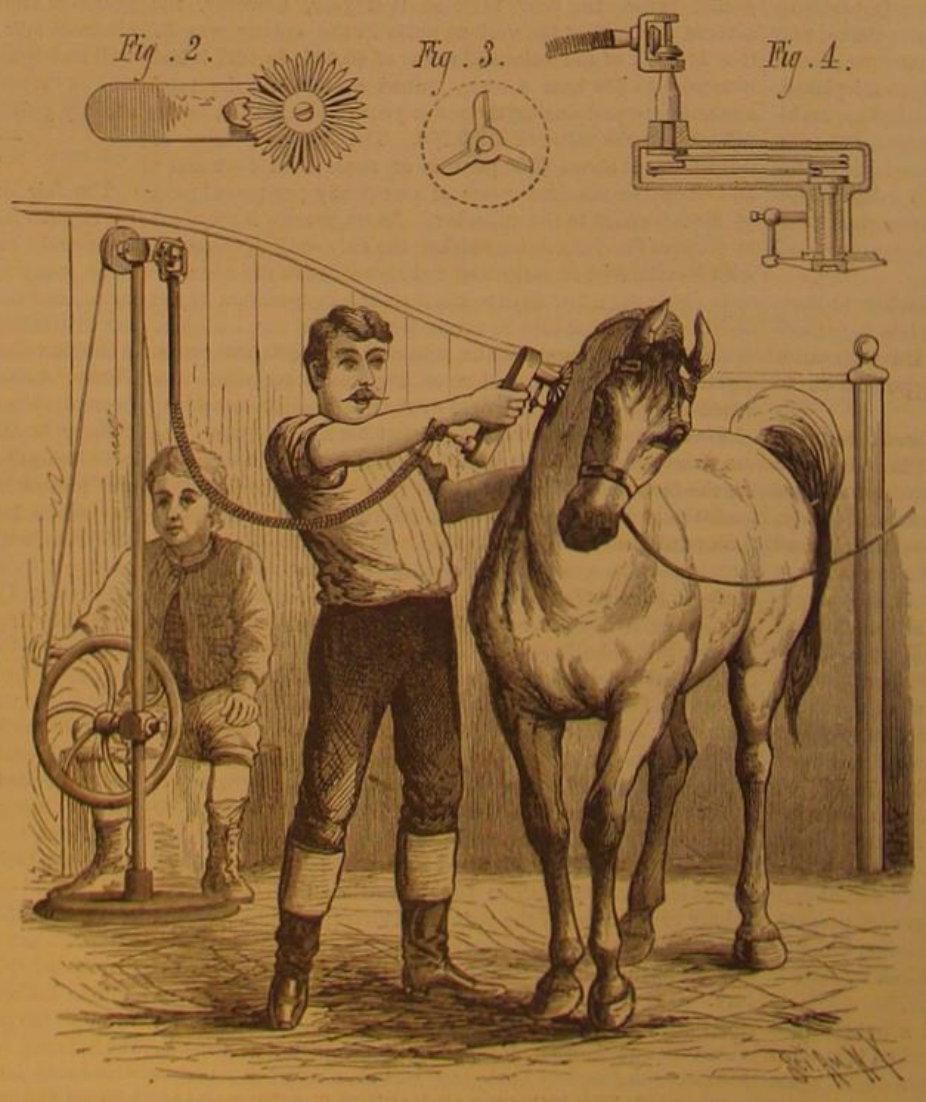


VERTICAL CAR WHEEL BORER.

NEW HORSE CLIPPING MACHINE.

The engraving represents in several views an improved horse clipping machine, recently patented by Mr. Peter Casey, of Providence, R. I. This machine works without noise, and may therefore be used about the head and ears of a horse without frightening him. The driving portion of the machine is connected with the clipper by a shaft having at one end a universal joint, and at the other a flexible portion, which permits of turning the clipper in any required direction. The flexible end of the shaft carries a bevel wheel, which meshes into another bevel wheel on the driving shaft of the clipper.

The construction of the clipper will be understood by reference to Figs. 2, 3, and 4. Fig. 2 shows the side that comes into contact with the skin of the horse; Fig. 3 shows the form of the knife; and Fig. 4 is a longitudinal section of the clipper, showing the connections between the driving shaft of the clipper and the knife spindle. These connections consist of two cranks, placed at right angles to each other, on each shaft, and connected by two links or connecting rods. Underneath the revolving knife there is a guard having radial arms, between which the hair is held and against which it is cut.



CASEY'S HORSE CLIPPING MACHINE.

How India-Rubber is Obtained.

A correspondent of the Boston *Commercial Bulletin*, writing from the Amazon river, Brazil, gives the following account of the method of gathering rubber, as lately observed by him. The process, in many respects, resembles the method of obtaining sugar from the maple trees in Vermont:

"At last we arrived at the encampment, which seemed to be on an island in a vast archipelago. Though the Indians divided the water into river, creek, and lagoon, the latter formed by the overflow in the rainy season, I could not perceive the distinction. In some instances the lagoons appeared to have a current, while the rivers had none, but I accepted their names.

"There were abundant groves of rubber trees in all directions, and men, women, and children were engaged in collecting the rubber, with more method in their labors than I should have expected among such a rude and savage people. Each one had a certain number of trees allotted to him, which he bored with an auger. He then inserted in the hole a piece of hollow cane. To the bark of the tree he fastened with mud a shell of the terrapin, or of a large clam, found in some of these rivers. These serve to catch the liquid. When it drips from the cane it is white as milk, but thicker or with more body.

"A trough dug out of a log is stationed in a central point, and when the trees are all tapped, the man goes his rounds, watching the shells and pouring the contents, when full, into the trough. Toward sunset a fire is made of leaves and twigs, upon which is thrown the fruit of a certain kind of palm, which gives forth a dense smoke.

"A small round-bladed paddle, like those used in the canoe, is dipped into the milk, and turned over once or twice. It is then drawn out, covered with the coating of the liquid gum, and held at once in the smoke of the fire, which hardens and also darkens the coating. It is again plunged into the milk and again smoked, and this process is kept up until the blade of the paddle is covered an inch to an inch and a half in thickness. A knife is passed along one edge of the blade and the mass removed. It appears in shape like a shoemaker's lapstone with a sort of nozzle on one side. In this state it is shipped. From one of these lumps of commercial gum the different coatings may be readily detached."

In this connection we may state that the New York Belting and Packing Company, No. 38 Park Row, New York, have lately placed in their show window a large and splendid living specimen of the rubber tree. The plant is in vigorous condition and attracts much attention.

MISCELLANEOUS INVENTIONS.

An improvement in bottle stoppers, patented by Mr. William Beardsley, of Beacon, Iowa, consists in combining a stopper provided with shoulders, a tubular extension, an orifice, a flanged plug with a bottle neck having a straight bore, and a counterbore for receiving a packing ring and spiral spring.

An improved refrigerator, patented by Mr. Cyrus B. Shaw, of Brooklyn, N. Y., is constructed so as to use less ice than refrigerators made in the usual way, and it can be more easily kept clean and sweet, and may be more easily repaired.

Mr. William Roush, of Yates Center, Kan., has invented an improvement in lanterns which relates to the construction and arrangement of a lamp chimney and frame in a lantern. The object of the invention is to enable the parts to be put together or taken apart easily and quickly, so that the parts can be combined into a lantern adapted for immediate and general use, or the lamp can be taken out and used for ordinary domestic purposes.

Mr. Allen Blewett, of Brookville, Miss., has patented an improved toy pistol, having the barrel and stock or handle made in one piece, the barrel having a slot in its under side, which extends its whole length, to receive the slide, and the stock having a recess in its under side to receive the trigger. In this pistol a rubber spring is used to propel the projectile.

Mr. Joseph H. Stratton, of Beloit, O., has patented an adjustable support for carriage bodies, coffins, and other similar articles while undergoing painting, varnishing. It is arranged so that they can be set in any desired position to accommodate them to the position of the workman. The invention consists of a table or stand provided with devices for holding the body, and pivoted to the end of a lever fulcrumed between two uprights or standards, and with arrangements for securing it in different positions.

An improvement in stiff hat flanges has been patented by Messrs. Lewis L. Smith, Frederick L. Knable, and Henry F. Smith, of Orange, N. J. The flange is made in two parts, with the lines of division at the front and rear, and with the end edges of the one part convex and the end edges of the other part concave, to adapt the flange to be withdrawn from the hat without changing the shape of the hat brim.

Mr. Edmund Kuhn, of New Albany, Ind., has invented an improved grate, which consists of one or more cylindrical revolving grates pivoted horizontally in the lower part of the firebox, and made to shake out the ashes and agitate the fire by turning on their axes.

Mr. John G. Hess, of Guttenburg, N. J., has patented an improvement in spigots or faucets for drawing liquids from barrels. The invention consists in a packing ring of elastic material contained in an annular recess in the spigot around the plug, the aperture of which is concentric with the axis of the plug.

An improved fish trap, patented by Mr. William J. Henderson, of Valdosta, Ga., consists in combining a transparent bottle with a rat trap, so that the fish or animal may be caught without consuming the bait.

Mr. August Buermann, of Newark, N.J. has invented an improvement in spurs, which consists of a stay plate in combination with the heel band of a spur made of two bars and having their rear ends projecting to the rearward, and parallel with each other, to serve as a rowel holder.

PRACTICAL EXPERIMENTS IN MAGNETISM, WITH SPECIAL REFERENCE TO THE DEMAGNETIZATION OF WATCHES.—No. 2.

BY ALFRED M. MAYER.

Experiments which show Something about the Nature of a Magnet.—Take the piece of steel wire, six inches long and one sixteenth of an inch in diameter, mentioned among the articles required in our experiments; score this piece of wire at short distances apart, by filing it around with a sharp file. Now heat the wire to a cherry red, and then plunge it vertically into water. It will now be quite hard, and may be readily made into a magnet by drawing it over the pole of your rat tail file magnet. Paste a small piece of paper around one of the ends of the steel wire before you magnetize it, and then, if you draw the wire over the N. pole of the magnet, from the papered end to the unpapered end, the papered end of the wire will have north polarity, as may be shown by applying the wire to the magnetometer. The magnetic condition of the wire having been found out, we begin by snapping the wire into small pieces, which is readily done, for the scores on the wire determine where it will break. Place each piece on the table as it is separated from the wire, and with its ends pointing in the same direction which they had when it formed part of the wire. Examine each of these pieces in succession. They will be found to be perfect magnets, with N. poles turned all one way, their south poles turned in the other direction. This examination may be made by means of the magnetometer. The fact that each piece is a magnet may also be readily shown by rolling it in iron filings, when it will be found that the filings adhere to the ends of the piece of wire just as they did to the large magnet. See Fig. 11.

23.

Fig. 23 gives a view of the pieces of wire placed end to end just in the position they had when they formed parts of the steel wire. We see that each piece is a perfect magnet, and that the north poles of these pieces all point to the right and their south poles all to the left. But each of these little fragments may be broken into two, and so on; and as far as the subdivision may be carried, it has been found that each minute fragment is a perfect magnet, with one of its ends a south, and the other a north magnetic pole. In imagination we may conceive of this subdivision carried so far that one of the particles thus reached may be invisible to the unaided eye. Indeed, nothing prevents us from logically assuming that even if a molecule of the steel should be reached it would be found to be a perfect magnet.

An Experiment with a Magnet formed of Steel Filings Packed in a Paper Cylinder, is interesting when studied in connection with the experiments just made, and will serve to give us further information as to the nature of a magnet.

Take a piece of letter paper, and having wrapped it several times around a lead pencil, paste the free edge of the paper on to that wrapped around the pencil. After the paste has dried you may draw out the lead pencil, and you will then have a tube made of paper. Cork one end of this tube, or you may close it by doubling over the paper at its end and gluing. Fill this tube with steel filings, and then close the other end of the tube. This tube, filled with steel particles, may be formed into a magnet by drawing it over the pole of your rat-tail file magnet. After you have performed this operation several times, present the tube to the magnetometer, and you will find one of its ends is a north, while the other is a south pole. Having thus satisfied yourself that it is really a magnet, shake the tube so that the positions of the particles of steel filings are changed. On testing the tube at the magnetometer it will be found that much, probably all, of its magnetism has gone from it. If it has not all disappeared it can be made to do so by repeated shaking of the tube. This experiment shows that not only must each particle or even molecule of a steel bar be a perfect magnet, but it also shows that these magnetized particles must be arranged in a definite order, that is, with all their N. poles pointing in one direction and their south poles in the opposite direction, so that the body, as a whole, may obtain and retain its magnetic polarity. Before the year 1600, when William Gilbert, the physician to Queen Elizabeth, made the celebrated experiment of breaking a magnet into many parts and testing the polarity of each piece, it had been thought that all of the north polar magnetism was contained in one end of the magnet, while the other end of the magnet held the south polar magnetism.

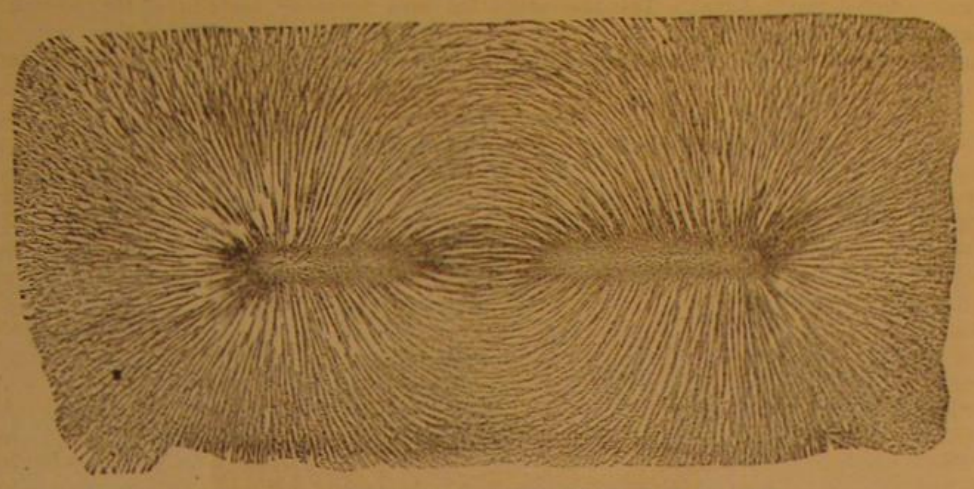


FIG. 24.—MAGNETIC CURVES AS SHOWN BY IRON FILINGS.

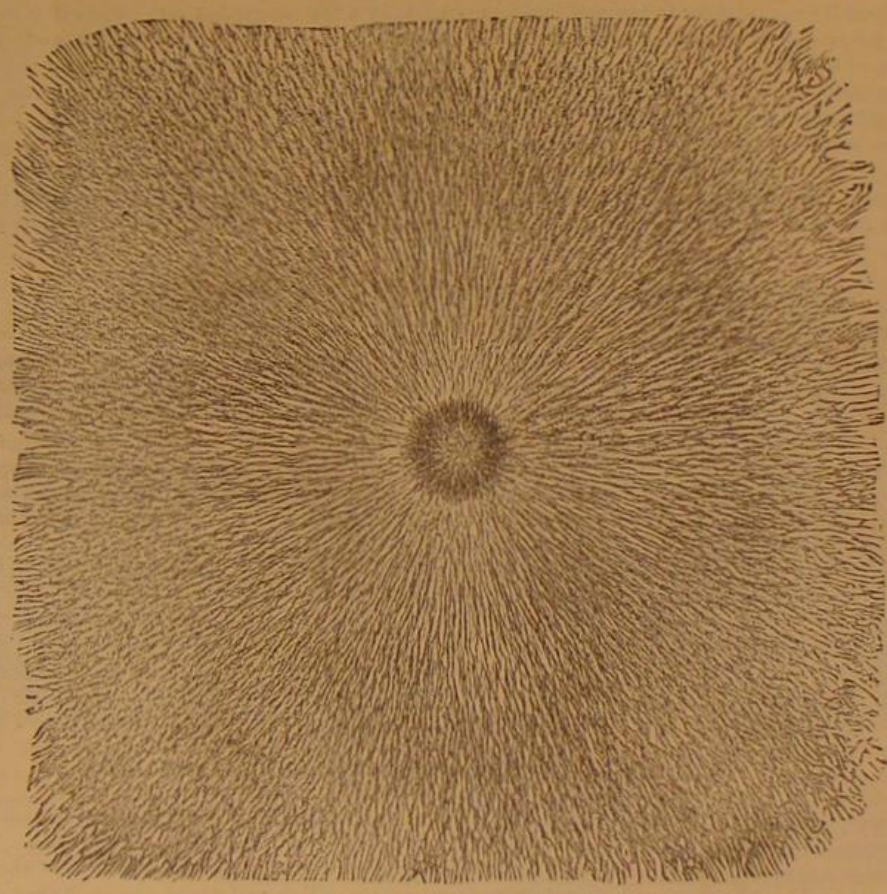


FIG. 25.—ARRANGEMENT OF FILINGS OVER THE END OF A ROUND MAGNET.

Interesting Experiments may be made with magnets acting inductively on a great number of iron grains spread on a surface placed over the magnet. We may thus form an idea of how this magnetic influence extends itself into space.

Take a piece of cardboard about one foot long and six inches broad. Support this at its corners on blocks of wood a little thicker than the diameter of your rat-tail file magnet. Place the latter under the cardboard. Now lift the cardboard off its supports and place it to one side on the table. Through a fine sieve sift soft iron filings evenly, and not too thickly, over the cardboard. Lift it up carefully and place it over the magnet. A slight bristling of the filings is all that you will observe of the action of the magnet; but on vibrating the cardboard, by letting fall vertically on it a piece of copper wire, or by tapping it gently with a lead pencil, you will observe curious motions among the grains of filings. They will finally arrange themselves over the magnet in the curves shown in Fig. 24.

Fig. 25 shows the arrangement taken by the iron filings when they are placed on a card and vibrated over the end of a round magnet, the magnet being held in a vertical position under the cardboard.

Fig. 26 are the lines formed over the end of a magnet. Figs. 27 and 28 respectively show the actions of magnets with their unlike and like poles opposite each other.

Fig. 29 is interesting, showing the arrangement of the lines of filings produced on a surface when under it a magnet, 216 millimeters long and 12 millimeters in diameter, is acting inductively on a cylinder of soft iron, 32 millimeters long and 10 millimeters in diameter. In April, 1871, I published in the *American Journal of Science* a method I had invented for permanently fixing these lines of iron filings (or *magnetic spectra*, as they are often called) on plates of glass. When thus permanently attached these plates were used as negatives from which a series of photographs were printed, exactly as a photographer prints from an ordinary photographic negative. The admirable engravings of magnetic spectra given in this article were made by a photo-engraving process directly from the glass plates made by me in 1871. These glass plates carrying the magnetic spectra I have also used for several years as slides in the lantern, in order to exhibit them before large audiences and college classes.

The following is the method of permanently attaching these magnetic figures to glass. A clean plate of thin glass is coated with a film of hard varnish by flowing over it the spirit varnish used by photographers in coating their negatives. If this is not handy, then a solution of shellac in alcohol will do nearly as well, only the latter requires more heating to cause the iron filings to adhere to it. The varnish is poured on one end of the plate, and then caused to cover the entire plate with an even film, by tilting and draining the plate just as a photographer does when he coats his plate with collodion. After the varnish has dried to a hard film the plate is placed, varnished side up, over the magnet or magnets, with its ends resting on slips of wood, so that the under surface of the plate just touches the magnet. Fine iron filings obtained from Norway iron, which has been repeatedly annealed, are now sifted uniformly over the plate, and then the magnetic curves are developed by letting fall on the plate vertically at different points a piece of copper wire. The vibrations of the plate momentarily detach the filings from its surface, and at these moments the magnet arranges them in obedience to its inductive action on them. The plate is now lifted from the magnet, being careful to hold it always in a horizontal position, and either placed with its ends resting on bricks over a hot stove, or it is heated over a gas stove. The film of varnish is thus melted, and the filings sinking into it are permanently fixed there after the varnish has cooled. If any filings should remain unattached, they are removed from the plate by letting its edge fall squarely on the table.

The lines forming these magnetic spectra were called "lines of magnetic force" by Faraday. He also devised the term "magnetic field." *A magnetic field* may be defined as any space at every point of which exists a finite magnetic force; while *a line of magnetic force* is a line drawn through a magnetic field in the direction of the force at each point through which it passes. Before the time of Faraday natural philosophers were satisfied with the mere statement that magnets acted at a distance, and followed generally the same law as ruled in the action

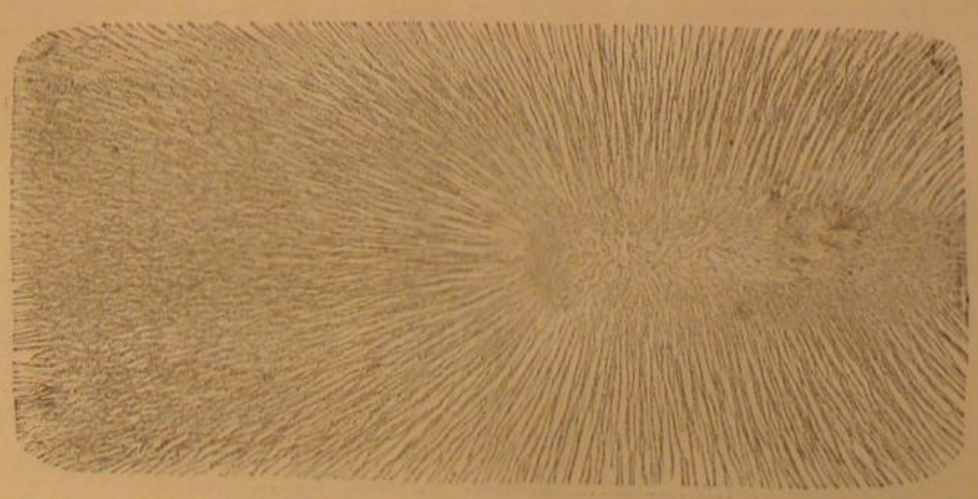


FIG. 26.—LINES FORMED OVER THE END OF BAR MAGNET PLACED PARALLEL WITH ITS PLATE.

of gravitation throughout the celestial spaces, that is to say, that the intensity of the magnetic action decreased inversely as the squares of the distances from the pole of the magnet; but Faraday, in the words of Professor Maxwell, "in his mind's eye saw lines of force traversing all space where the mathematicians saw centers of force attracting at a distance; Faraday saw a medium when they saw nothing but distance; Faraday sought the seat of the phenomena in real actions going on in the medium; they were satisfied that they had found it in a power of action at a distance impressed on the electric fluids." Faraday discovered the general laws which rule the behavior of bodies in the magnetic field. When the magnetic field is uniform—that is, when the lines of magnetic force are parallel—magnetic bodies place themselves in the direction of the lines of force; but when the magnetic field is not uniform, magnetic bodies (like iron, nickel, cobalt, etc.) tend to go from weaker to stronger places of magnetic action, while diamagnetic bodies (like bismuth, borate of lead, etc.) tend to go from stronger to weaker places in the magnetic field.

The conception of the lines of force and the magnetic field, and the statement of the laws ruling the action of bodies in field of a magnet, 'formed," says Sir William Thomson, "one of the most brilliant steps made in philosophical exposition of which any instance exists in the history of science. . . . Mathematicians were content to investigate the general expression of the resultant force experienced by a globe of soft iron in all such cases; but Faraday, without mathematics, divined the result of the mathematical investigation, and, what has proved of infinite value to the mathematicians themselves, he has given them an articulate language in which to express their results. Indeed, the whole language of the magnetic field and lines of force is Faraday's. It must be said for the mathematicians that they greedily accepted it, and have ever since been most zealous in using it to the best advantage. Indeed, much of the scientific work of Thomson, and nearly all of Maxwell's celebrated 'Treatise on Electricity and Magnetism,' may be regarded as translations of Faraday's conceptions into the language of mathematical analysis."

Let us now make a few experiments on these lines of magnetic force. We will thus be led to some remarkable results. Form a small magnet of a piece of sewing needle about one quarter of an inch long. Suspend this with a filament of the floss silk. Having formed a magnetic spectrum, and with the magnet remaining undisturbed under the cardboard or glass, bring the little magnet over one of the lines traced out by the filings. Move the suspended magnet over this line, and you will observe that the length of the needle always lies in the direction of the line, no matter where the needle may be placed over this line. Faraday, from this fact indeed, gave his definition of a line of magnetic force as "that line which is described by a very small magnetic needle, when it is so moved in either direction correspondent to its length, that the needle is constantly a tangent to the line of motion."

"The Earth itself is a Great Magnet." These are the words which may be said to form the text on which the illustrious William Gilbert wrote his work "De Magneto," or "On the Magnet," in 1600; and he certainly gave proofs of the truth of his statement, which, when viewed in the light of the knowledge which he himself discovered, forms an era in the history of the experimental sciences. If the earth be a great magnet, then it also must have its lines of force surrounding it and stretching out into space. At first sight it would seem difficult to prove this, for its proof seems to require the existence of some immensely extended, light, movable and luminous matter surrounding the earth, on which its magnetism can act, and by this action render manifest the direction of its lines of force. Now it so happens that such evidence is not wanting. All of our readers, I imagine, have seen those luminous and movable columns which form the aurora borealis. They appear to start from some level above the northern horizon, and stretching upward appear to converge at some point high up in the heavens. Sometimes this point is higher, sometimes it appears lower, according to the latitude of the observer.

Now we have seen that the magnetic needle always places itself in the direction of, or, more correctly speaking, at a tangent to a line of magnetic force, and it has been often observed that a magnetic needle, when suspended so that it can place itself in any position, either up, down, to the right or to the left, always places itself parallel to those luminous columns. This observation has been repeatedly made in various latitudes, and its general truth is established. The vast luminous rods, which are often 500 miles and over in length, actually trace out in space the earth's lines of magnetic force.

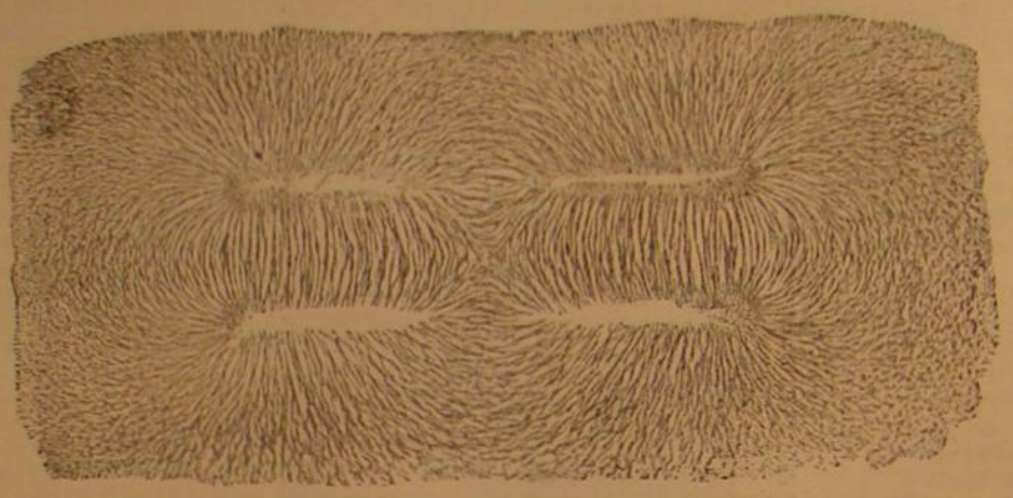


FIG. 27.—MAGNETIC CURVES UNLIKE MAGNETIC POLES OPPOSITE EACH OTHER.

That the earth is a great magnet, you may at any time show to yourself and your friends by a few simple but very charming experiments.

Take the piece of iron, one foot long and three eighths of an inch in diameter (which I mentioned among the things required in our experiments), and heat it to a dull red heat in the fire, and then allow it slowly to cool in the hot ashes. In cooling the rod it should be placed with its length in an east and west direction. After the rod is cold paste a piece of paper around one of its ends. Take it carefully in the hand and avoid letting it fall or giving it a blow. Bring the papered end of the rod up to the needle of the magnetometer, and point it at right angles to the length of its needle and directly toward its center. You will observe that the needle remains stationary as long as the iron rod points *in a horizontal direction* toward its center. This is so because the iron is devoid of magnetism, and hence attracts the north end of the needle with a force equal to that with which it attracts the south end of the needle.

Now observe what takes place when we slowly lift up the end of the rod furthest from the magnetometer. The south pole of the needle at once swings around toward the iron rod. This cannot be owing to the inclined position of the iron, because, even in this inclined position, it is symmetrically placed in reference to the needle, and should not on this account cause the latter to turn. Evidently the iron rod has become magnetic from this change of position. The mere tilting up of its end has made it a magnet. A temporary magnet, it is true, for on slowly lowering the iron into a horizontal position the needle slowly turns into the magnetic meridian, and is then apparently indifferent to the presence of the iron rod.

Now bring the unpapered end of the rod up to the magnetometer and repeat the above experiments. The needle again turns its south end toward the rod when the latter is tilted upward. This shows that the magnetism of the rod depends alone on its position, and that end which is down is always of north magnetic polarity. It has also been found—and you can prove it for yourself—that when the rod is held inclined in the meridian, with its upper end leaning away from the north, so that it is at an angle of about 76° with the horizon, it has the most powerful magnetism that can be given to it by this means.

All of the above curious facts are explained if we consider the earth itself as a great magnet, with its south magnetic pole situate somewhere near the north geographic pole, and with its north magnetic pole placed somewhere near the south geographic pole. If you carry your small suspended magnetic needle over the length of a magnet, you will observe that the north end of the needle will point downward when it is over the south pole of the magnet, and that the south end of the needle will point downward when it is over the north pole of the magnet; while, when over the center of the magnetic bar, the needle takes up a horizontal position. In the same manner acts a freely suspended magnetic needle when carried over the surface of the earth along a meridian. In a far northerly latitude, on the western coast of Boothia, Sir James Ross, in 1831, found that the magnetic needle pointed directly downward, with its north pole toward the center of the earth. He inferred that he then stood on the termination of a line drawn from the earth's center through its magnetic pole to his feet. Subsequently this bold mariner undertook another voyage of discovery in search of a similar point on the southern hemisphere, and in 1841 succeeded in reaching south latitude 76° 12', on Victoria Land, when the south end of the needle pointed downward and made an angle of 88° 40' with the horizon. He concluded from this and other observations that the position where the needle would be vertical was about 160 nautical miles distant. From these and other magnetic observations made in the Antarctic seas, it is supposed that the magnetic pole of the southern hemisphere must be somewhere about south latitude 70° and near the meridian of 125° east of Greenwich. This would bring the position of the magnetic pole somewhere on the territory discovered by our countryman Wilkes. The exact position of this point, however, is not known, for no explorer has ever reached it. Also, it has been well ascertained that along an irregular line, situated on the equatorial belt of the earth, the needle has a horizontal position, just as it has when placed midway between the poles of an artificial bar magnet. This irregular equatorial line is called the earth's magnetic equator.

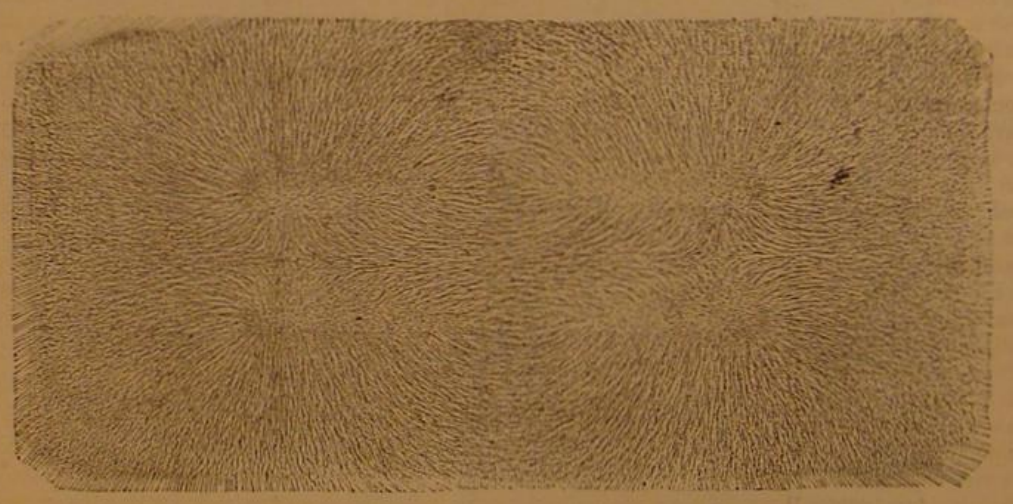


FIG. 28.—MAGNETIC CURVES LIKE POLES OPPOSITE EACH OTHER.

These facts are all explained by conceiving the earth as a huge magnet, and if the earth be a magnet, it also follows that the soft iron rod, when held upright in the southern hemisphere, will have its lower end of south magnetism; while the same end in the northern hemisphere, we have ourselves found, is always of north magnetic polarity. We cannot travel over the earth and test this conclusion for ourselves, but I once found in the Transactions of the Royal Society of London a paper headed "*On the tendency of the Needle to a piece of Iron held perpendicular, in several climates. By a master of a ship, crossing the Equinoctial Line. Anno* 1684." Let the mariner give his own account of his experiments, and we will see that his statements show that when you cross the magnetic equator the lower end of the upright iron rod changes from north to south magnetic polarity: "All the way from England to 10° north latitude, the

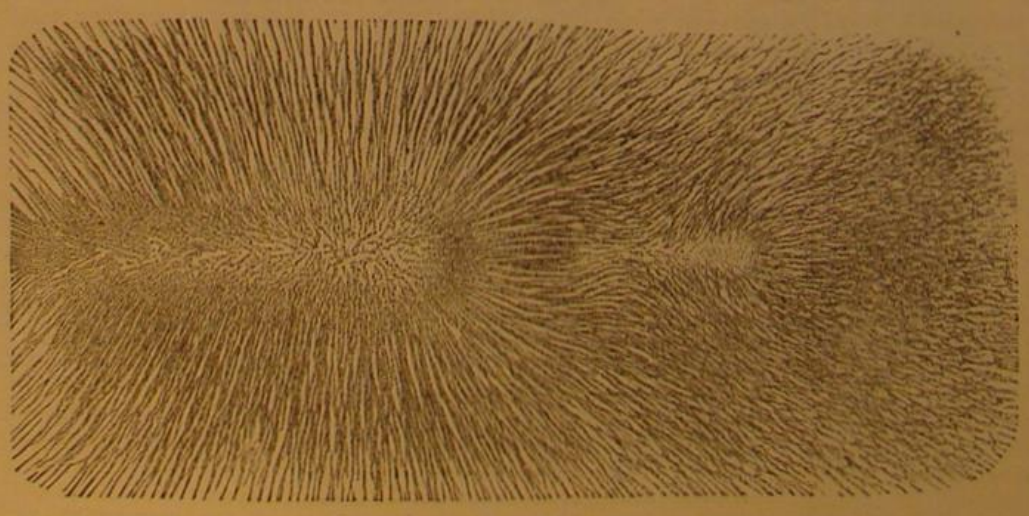


FIG. 29.—CURVES SHOWN BY A MAGNET ACTING INDUCTIVELY ON A CYLINDER OF SOFT IRON.

north end of the needle tended to the upper end of the iron, and the south point to the lower end, very strongly. . . . In latitude 8° 17' south, and meridian distance from the Lizard 17° 35' west, the north point of the needle would not respect the upper end of the iron; but the south point would still somewhat respect the lower end. . . . In latitude 29° 25' south and 13° 10' west, from the meridian of the Lizard, the south point of the needle respected the upper end of the iron, and the north point the lower end strongly."

On the "Magnetic Neutral Line."—There has recently appeared much discussion about the existence of a position of neutrality near a magnet. That a region of that kind, where there appears a break in the continuity of the magnet's attractive and directive force, exists, I have no doubt; but I cannot agree with those who have declared for the existence of a line, or plane, of neutrality in the sense in which Mr. Gary and others have put it. Indeed one hundred and twenty years ago a neutral line was discovered by the celebrated John Robison, Professor of Natural Philosophy in the University of Edinburgh. He is the man of whom James Watt said, "He has the clearest head of any man I know." Having such good indorsement for clearness of head, I cannot do better than let him describe his own experiments:

"Amusing myself in the summer of 1758 with magnetic experiments, two large and strong magnets, A and B (Fig. 30), were placed with their dissimilar poles fronting each other and about three inches apart. A small needle, supported on a point, was placed between them at D, and it arranged itself in the same manner as the great magnets. Happening to set it off to a good distance on the table, as at F, I was surprised to see it immediately turn round on its pivot and arrange itself nearly in the opposite direction. Bringing it back to D restored it to its former position. Carrying it gradually out along D F, perpendicular to N S, I observed it to become sensibly more feeble, vibrating more slowly; and when in a certain point, E, it had no polarity whatever towards A and B, but retained any position that was given it. Carrying it further out, it again acquired polarity to A and B, but in the opposite direction, for it now arranged itself in a position that was parallel to N S, but its north pole was next to N and its south pole to S.

"This singular appearance naturally excited my attention. The line on which the magnets, A and B, were placed had been marked on the table, as also the line, D F, perpendicular to the former. The point, E, was now marked as an important one. The experiments were interrupted by a friend coming in, to whom such things were no entertainment. Next day, wishing to repeat them to some friends, the magnets, A and B, were again laid on the line on which they had been placed the day before, and the needle was placed at E, expecting it to be neutral. But it was found to have a considerable verticity, turning its north pole toward the magnet, B, and it required to be taken further out, toward F, before it became neutral. While standing there something chanced to joggle the magnets, A and B, and they instantly rushed together. At the same instant the little magnet, or needle, turned itself briskly, and arranged itself, as it had done the day before, at F, quivering very briskly, and thus showing great verticity. This naturally surprised the beholders; and we now found that by gradually withdrawing the magnets, A and B, from each other, the needle became weaker, then became neutral, and then turned round on its pivot and took the contrary position. It was very amusing to observe how the simply separating the magnets, A and B, or bringing them together, made the needle assume such a variety of positions and degrees of vivacity in each.

"The needle was now put in various situations, in respect to the two great magnets; namely, off at a side, and not in the perpendicular, D F. In these situations it took an inconceivable variety of positions which could not be reduced to any rule; and in most of them, it required only a motion of one of the great magnets for an inch or two, to make the needle turn briskly round on its pivot, and assume a position nearly opposite to what it had before.

"But all this was very puzzling, and it was not till after several months that the writer of this article, having conceived the notion of the magnetic curves, was in a condition to explain the phenomena. With this assistance, however, they are very clear and very instructive.

"Nothing hinders us from supposing the magnets, A and B, perfectly equal in every respect. Let N H M, N E L, be two magnetic curves belonging to A; that is, such that the needle arranges itself along the tangent of the curve. Then the magnet, B, has two curves, S G K, S E Q, perfectly equal and similar to the other two. Let the curves, N H M and S G K, intersect in C and F. Let the curves, N E L and S E Q, touch each other in E.

"The needle being placed at C would arrange itself in the tangent of the curve, K G S, by the action of B alone, having its north pole turned toward the south pole, S of B. But by the action of A alone it would be a tangent to the curve, N H M, having its north pole turned away from N. Therefore, by the combined actions of both magnets, it will take neither of these positions, but an intermediate one, nearly bisecting the angle formed by the two curves, having its north pole turned toward B.

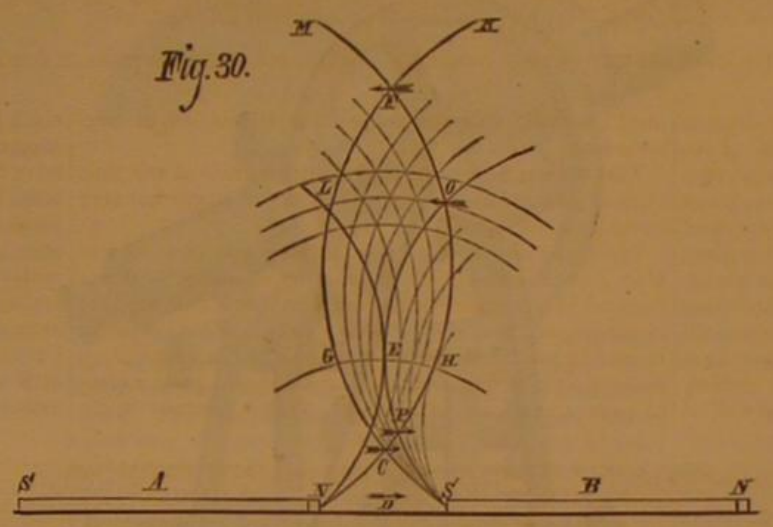
"But remove the needle to F. Then, by the action of the magnet, A, it would be tangent to the curve, F M, having its north pole toward M. By the action of B, it would be a tangent to the curve, K F G, having its north pole in the angle, M F G, or turned toward A. By this joint action, it takes a position nearly bisecting the angle, G F M, with its north pole toward A.

"Let the needle be placed in E. Then, by the action of the magnet, A, it would be a tangent to the curve, N E L, with its north pole pointing to F. But, by the action of B, it will be a tangent to S E Q, with its north pole pointing to D. These actions being supposed equal and opposite, it will have no verticity, or will be neutral, and retain any position that is given to it.

"The curve, S E Q, intersects the curve, N H M, in P and Q. The same reasoning shows that when the needle is placed at P, it will arrange itself with its north pole in the angle, S P H; but, when taken to Q, it will stand with its north pole in the angle, E Q M.

"From these facts and reasonings we must infer that, for every distance of the magnets, A and B, there will be a series of curves, to which the indefinitely short needle will always be a tangent. They will rise from the adjoining poles on both sides, crossing diagonally the lozenges formed by the *primary or simple* curves, as shown in Fig. 30. These may be called *compound or secondary* magnetic curves. Moreover, these secondary curves will be of two kinds, according as they pass through the first or second intersections of the primary curves, and the needle will have opposite positions when placed on them. These two sets of curves will be separated by a curve, G E H, in the circumference of which the needle will be neutral. This curve passes through the points where the primary curves touch each other. We may call this *the line of neutrality* or inactivity.

Fig. 30.



LINES OF MAGNETIC FORCE.

"We now see distinctly the effect of bringing the magnets, A and B, nearer together, or separating them farther from each other. By bringing them nearer to each other, the point, E, which is now a point of neutrality, may be found in the *second* intersection (such as F) of two magnetic curves, and the needle will take a subcontrary position. By drawing them farther from each other, E may be in the *first* intersection of two magnetic curves, and the needle will take a position similar to that of C.

"If the magnets, A and B, are not placed so as to form a straight line with their four poles, but have their axes making an angle with each other, the contacts and intersections of their attending curves may be very different from those now represented; and the positions of the needle will differ accordingly. But it is plain, from what has been said, that if we knew the law of action, and consequently the form of the primary curves, we should always be able to say what will be the position of the needle. Indeed, the consideration of the simple curves, although it was the means of suggesting to the writer of this article the explanation of those more complicated phenomena, is by no means necessary for this purpose. Having the law of magnetic action, we must know each of the eight forces by which the needle is affected, both in respect of direction and intensity, and therefore able to ascertain the single force arising from their composition.

"When the similar poles of A and B are opposed to each other, it is easy to see that the position of the needle must be extremely different from what we have been describing. When placed anywhere in the line, D F, between two magnets whose north poles front each other in N and S, its north pole will always point away from the middle point, D. There will be no neutral point, E. If the needle be placed at P or Q, its north pole will be within the angle, E P H, or F Q I. This position of the magnets gives another set of secondary curves, which also cross the primary curves, passing diagonally through the lozenges formed by their intersection. But it is the other diagonal of each lozenge which is a chord to those secondary curves. They will, therefore, have a form totally different from the former species.

"The consideration of this compounded magnetism is important in the science, both for explaining complex phenomena, and for advancing our knowledge of the great desideratum, the law of magnetic action.

(To be continued.)

THE force of the Light-house Board of the Treasury Department has been reduced by the dismissal of eleven clerks.

Electricity as a Motive Power.

At a recent meeting of the British Association, Professor W. E. Ayrton delivered a lecture on "Electricity as a Motive Power," and interesting illustrations were given, including machinery in motion, driven by power derived from a distance.

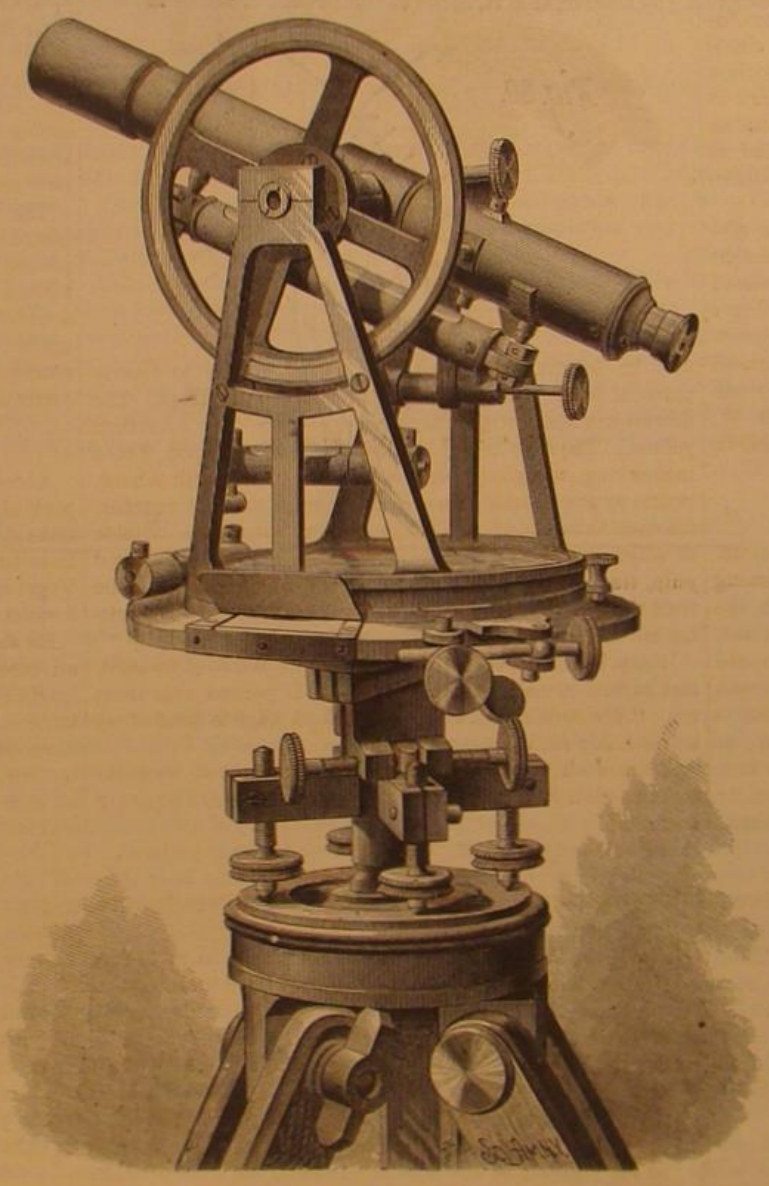
The lecturer stated that in any generation of electricity there was a certain property called the electro-motive force, which meant its tendency to send a current, and which was analogous with the head of water in a reservoir, inasmuch as the product of the quantity of electricity flowing per second, multiplied by this electro-motive force, measured the amount of energy furnished by the generator per second, and which could be reproduced as motive power elsewhere if there were no friction. The loss of energy due to electrical friction in the wires was equal to the square of the current flowing per second multiplied by what was called the resistance of the wire—a number depending on the length, the diameter of the wire, the material of which it was made, and the temperature. The most efficient way to transfer energy electrically was to use a generator producing a high electro-motive force, and a motor producing a return high electro-motive force, and by so doing the waste of power in the transmission ought, he considered, to be able to be diminished with the best existing dynamo-electric machines to about 30 per cent. It would be impossible to increase indefinitely the speed of revolution of the cylinder of an induction machine, since, apart from mere mechanical friction, the iron constituting the core of the revolving part had to be magnetized and demagnetized very rapidly as it revolved. Now, there was a physical limit to the speed with which this could be done, and, in addition, this rapid change of magnetism heated the iron very much. But experiment showed that at the ordinary speed of revolution of dynamo-electro-machines—700 turns per minute—the electro-motive force was proportional to the speed. They were, therefore, very far yet from the limit of speed. Consequently it would be well for the transmission of power to attempt first, a considerable increase of speed in the generator combined with so light a load on the motor, that its speed would be also very high. When this began to fail as larger and larger amounts of power were transmitted, then they might begin increasing the amount of wire on the revolving coils of each; but this, of course, had the objection that the loss of power from a given current would then become somewhat larger. As they had seen that by the use of electricity properly employed, the waste of power in transmission could be reduced for any distance to about thirty per cent of the whole power absorbed at the generator, it followed that the employment of steam engines of vast size at points outside Sheffield would be by far the most economical mode of extracting the energy out of coal. For it was at least four times as expensive to produce power with a small steam engine as with a large one; therefore, including the waste of power in electric transmission, the cost of production of power in small workshops would be little more than one third as dear as if small steam engines were used, and similarly the waste of power in any large mill or factory in its transmission from the large steam engine at its base to all the floors and machines on each floor would be very much diminished. But they would say that in advocating the employment of electricity he was advocating a total change in our mode of producing and transmitting power. Was the probable gain worth the expense of the necessary change? To answer this question they must consider what would be the probable minimum annual gain by the proposed change in Sheffield alone. In making this calculation they must remember that not only could electricity produce motive power, but also heat and light, and electric heating and lighting had this great advantage that no chimneys were required. For example, with the electric current sent to that hall from Messrs. Walker & Hall's works, he could heat a long coil of iron wire white hot, so that when put into a vessel of water, the water in a short time would begin to boil. Various calculations had been made as to the relative cost of lighting by burning coal to produce gas, or by burning coal to work dynamo machines for producing electric currents, and it seemed to be pretty certain that if a large amount of light be required in one place, the electric light was at least twenty times as cheap as coal. Sir William Thomson, the eminent electrician, went so far as to say that it might be made 133 times as cheap. And certainly that there was a great saving in expense in electric lighting was seen from the actual result obtained at the Albert Hall, London, which was an example, and perhaps the only example, in connection with electric lighting, where the science of putting a brilliant light high up had been allowed to ride over the precedent of putting a number of feeble glimmers all over a building. The actual cost, including labor of men, allowance for wear and tear of machinery, etc., was only one-third of that of the former inferior gas lights, and thus a saving of about 30s. an hour had been effected. Lighting streets by electricity had not been so successful economically, for the simple reason that instead of giving a large bright light, at a considerable height, reflected downwards, as in the Albert Hall, London, English conservatism had prevented the authorities from grasping the possibility of using for street illumination anything dif-

fering from an ordinary iron lamp post. But there could be little doubt that if a few large electric lights, high up, were used for street illumination, the same sort of result as has been obtained at the Albert Hall would be arrived at. The cost of using gas in Sheffield for lighting large halls, such as the one they were now in, factories, and the streets, could be halved if electric currents, generated by water engines, worked by hill streams, as well as by very large steam engines, were substituted for gas. It was not necessary for him to tell them how he proposed to employ the electric light to illuminate private rooms, if only he could get people to throw away the notion that to light a room they must have something with a globe on it, like an oil lamp; nor was it necessary for him to remind them that by whitewashing the walls—yes, by whitewashing even the very machines themselves—in some of the Paris factories, the supposed strong shadows cast by the electric light had been less than the strong shadows cast by another bright light, one that we not only put up with, but one that from the force of habit we were tolerably contented with, namely, the sun. At present he was concerned with the pounds, shillings, and pence question, which had more than usual weight in these days of slack trade. Assuming that the cost of gas for lighting the large buildings, factories, and the streets of Sheffield could be halved, also that where it was used for heating purposes the expense could also be halved, by substituting electric currents generated by very large steam engines at certain points, and by turbines driven by falling water out of the town; then they would save per year about £45,000. Supposing, also, that the cost of producing motive power could in the same way also be halved, this represented an annual saving of something like £60,000. In reality, he believed this last economy would be larger, since not only could power be produced so much more economically than by small steam engines or even by a large engine, when a large proportion of its power was, as now, wasted in driving the shafting alone in their factories; but, in addition, much hand work could be economically replaced by machine work. And, lastly, supposing the consumption of coal in Sheffield for heating their metals and for heating their houses could also be halved, then there was another saving of about £300,000 a year; or, altogether, the annual saving that might be produced in this town alone, by substituting electricity for coal, would be something like the large sum of £400,000.

Last year, two French engineers, MM. Chretien and Felix, at Sermaize (Marne), actually plowed fields by electricity, the electric current being produced by two dynamo-electric machines of a form invented by M. Gramme. These machines were usually worked with a steam engine at some convenient place three or four hundred yards away in an adjoining road, and the electro-motors were also two Gramme machines, one on each side of the field, with their coils revolving of course backwards. Through one of these the electric current was sent alternately, so that motion was given to one or other of two large windlasses, one on each of the wagons containing the electro-motors. In this way the plow, which could be used going in either direction, was first pulled across the field, making a furrow, and then back again, making another parallel furrow. If electricity were produced in large quantities at certain centers, then one difficulty that would of course be met with would be that of distributing it properly, since, just as in the case of water or gas, if a large branch pipe in a main be suddenly opened then the supply going on to the other branch pipes in the same main would be diminished, a result causing serious inconvenience in the case of electric lighting. But just as automatic governors had been devised for water and gas, to keep the supply constant, so automatic "electric current regulators" had been devised by M. Hospitalier and by Dr. Siemens, to keep the current constant. One of those invented by Dr. Siemens was on the table before him, and the general principle of its construction was easily understood. As the current passed through the regulator it heated a very thin ribbon of steel, which consequently expanded. The effect of this expansion was to introduce coils of wire into the circuit, the extra resistance of which diminished the strength of the current. Consequently the stronger the current the more was it automatically resisted, and the weaker it became the less was it resisted, and so it remained practically constant at any desired strength for which the regulator was previously adjusted. In conclusion the lecturer said there was a time when "not only in the villages around old Sheffield," so said the historian of Hallamshire, "were the file makers' shops or the smithy to be seen, with the apprentices at work; but even on the hillside in the open country, at the end of the barn, would be the cutler's shed, while in the valley below, by the river, was the grinding stone ready to sharpen the tools that had been manufactured." And why not now? Why should not that mountain air that had given the workmen of Hallamshire in past times their sinew, their independence, blow over their grindstone now? Why should not division of labor be carried to its end, and power brought to them instead of them to the power? Let them hope, then, that in the next century electricity might undo whatever harm steam during the last century might have done, and that the future workman of Sheffield would, instead of breathing the necessarily impure air of crowded factories, find himself again at the hill side, but with electric energy laid on at his commaud.

IMPROVED ENGINEER'S TRANSIT.

The two instruments shown in previous numbers, made by Fauth & Co., were purely astronomical ones. We now illustrate an instrument familiar to most of our readers—an improved engineering transit. This is the standard instrument as furnished by Messrs. Fauth & Co. to the government department that are using this class of apparatus, and it is rapidly gaining favor with railroad engineers and surveyors. The instrument is constructed so as to give great strength with little metal. Instruments of this construction have not sustained serious injury by heavy falls. The telescope standards, which in the old form are merely held on the plate by means of screws, are in this instrument cast on a common base and radiate out from the center, giving the superstructure a firmness which cannot be secured by any other method. A glance at the engraving will give a clear idea of the construction and arrangement of the various parts, and we will only add that the graduations are on silver; the telescope is powerful, and has an achromatic objective. The compass needle is 5 inches long, and the whole is made with a view to economy in first cost as well as to the quality of the instrument.



FAUTH & CO.'S ENGINEERING TRANSIT.

For further particulars address Messrs. Fauth & Co., Washington, D. C.

MECHANICAL INVENTIONS.

Mr. Peter Cooper, of New York city, has recently patented an improvement in propulsion of railway cars, which consists in a combination of well known mechanical powers, by which trains of cars can be propelled at any desired speed by means of an endless chain or wire rope. The endless chain or rope is to be borne up in its entire length by being fastened firmly to the outside and in the center of as many sets of cars as there are stopping places on the whole line of the road. The stopping places are to be all of equal distances apart, and there will be bearing trucks between the different sets of passenger cars to prevent the chain from dragging or rubbing against anything in its passage around the circuit. The endless chain or rope, with the attached cars, is made to pass around a large drum wheel placed at each end of the line, which is to be of sufficient strength and operated by sufficient power to move the whole line of cars. By having stopping places at equal distances apart the rails can be so elevated as to use up the momentum of the cars in their ascent of the elevation at each stopping place. The elevation will be sufficient to bring the cars to rest and hold the power ready to be given out at once by all the cars going over the ascent at the same time. This will give back all the power consumed by forcing the cars up the ascent, and will reduce the necessary propelling power to that required on a dead level.

Mr. William H. Ellis, of Brooklyn, N. Y., has patented an improved umbrella drip cup, which consists of two conical cups connected together at the base, the outer one joined at its smaller end to a tube, into which the lower end of the umbrella stick is entered and secured so that the cup is just under the umbrella; by this means, when the umbrella is folded up, the water runs down and is caught and retained in the chamber between the two cups, from which it slowly runs out through the perforations in the connected base of the cones when the umbrella is again lifted or reversed.

Charles E. Fox, of Mount Pleasant, Mich., has invented an improved washing machine, which consists of one or more rollers arranged transversely in relation to the corrugated face of the wash board, and having a crank and gear attachment, the parts being mounted in a suitable frame, which is attached to the wash board, and adapted to yield so that the rubbing rollers act on both small and large fabrics.

Mr. David L. Towslee, of West Salem, O., has invented an improved drag sawing machine, so constructed that it may be worked by the operator with both hands and feet, or with either his hands or his feet. It is simple in construction, easily operated, and apparently effective in operation.

Mr. Martin Williams, of St. Johnsville, N. Y., has invented an improved thrashing machine, that runs steadily and easily and effects a thorough separation of the grain from the straw.

An improved device for lighting a fire automatically, at any given time, has been patented by Mr. Eibe H. Doescher, of Homestead, Ia. The invention consists in the combination of devices that cannot be readily described without an engraving.

A simple and effective device for automatically regulating the height of water in a steam boiler, has been patented by Mr. John Bridges, of Leon, Iowa. The invention consists of a novel construction and arrangement, in connection with a boiler, of a float, valve, and pipes, and their connections, with a feed pump.

Thaddeus C. Histed, of Junction City, Kan., has invented an improvement in that class of washing machines in which beaters are employed in connection with a rotated tub; and consists in the peculiar construction and arrangement of mechanism by which the work is thoroughly done.

Mr. Sylvanus A. Fisher, of Geneseo, Ill., has invented an improved wire stretcher, which consists in a lever fitted with a cam-acting holding jaw, by which the wire is securely held and from which it may be readily released.

An improved washing machine has been patented by Mr. Melvin A. Tinker, of Fairfield, Ill. The invention is an improvement in the class of washing machines composed of rolls held in yielding contact by means of springs, the bed rollers being arranged in the arc of a circle and inclosed or covered by an endless apron.

Mr. Soren Andersen, of Stronach, Mich., has patented an improved saw grinder for grinding saws down to as thin a gauge as they will work at, thereby rendering the waste in sawing as small as possible. It saves power; and by means of this combined grinder and gummer, saws can be used until they are actually worn out or worn down too small for use.

An improvement in smoke stacks has been patented by William F. Cosgrove, of Jersey City Heights, N. J. It consists in providing the stack with an inclosing jacket, in the double conical head of which is supported an inverted perforated cone and a screen for deflecting the products downward, where they fall upon an inclined collar surrounding the stack which leads them to a spout, whence they are conveyed by a pipe to a chamber formed in an extension of the boiler shell.

Messrs. George Coombs and Charles S. Blakeslee, of Chariton, Ia., have patented an improvement in car couplings. This is a simple and effective self coupler for cars, but it cannot be described without engravings.

Photographic Illustration of Mental Operations.

Professor Huxley illustrates his argument respecting complex impressions which are more or less different from each other by reference to composite portraiture, thus: "This mental operation may be rendered comprehensible by considering what takes place in the formation of compound photographs—when the images of the faces of six sitters, for example, are each received on the same photographic plate for one-sixth the time requisite to take one portrait. The final result is that all those points in which the six faces agree are brought out strongly, while all those in which they differ are left vague; and thus what may be termed a *generic* portrait of the six, in contradistinction to the specific portrait of any one, is produced."

THE HOLLOWAY SANATORIUM.

We present herewith a view of the noble institution, the "Holloway Sanatorium," erected at Virginia Water, Egham, at the sole expense of Mr. Thomas Holloway, the prince of English pill makers. It is intended for persons of the middle class afflicted with mental disease. It is designed for the accommodation of one hundred male and the same number of female patients. The building, of which Mr. W. H. Crossland was the architect, is constructed of red brick, with Portland stone dressings, and in the Gothic style, richly decorated. It stands just facing the Virginia Water station of the Staines and Wokingham Railway, on an eminence, and presents a façade of 640 feet, with a depth of 250 feet. There is a central tower 150 feet high, also turrets 60 feet high at the back of each wing, and a portico, with two tiers of pillared arcades, at the chief entrance. In front is a terrace 45 feet wide. The whole exterior has a very stately aspect. The adjacent grounds extend about twenty-five acres, laid out for an agreeable promenade.

The interior is arranged with great care and skill for the use of the institution. The center block, which divides the male from the female side, contains the administrative department, including the rooms for the staff and the visiting rooms; also the general dining hall, 54 feet by 30 feet; a grand recreation hall, 84 feet by 38 feet, and 50 feet high, which is handsomely decorated; libraries and billiard room. There are thirteen day rooms for each sex, all spacious and convenient, 30 feet long, 20 feet wide, and 12 feet high. Twelve dormitories, of the same dimensions, are provided for the men, and as many on the other side for the women; besides fifty rooms, 12 feet by 10 feet, for single patients. The delay in opening the Holloway Sanatorium has been mainly caused by the length of time required to complete the decorations of the recreation hall and dining hall, and those of the principal entrance and staircase, as well as to finish the building. It will have cost Mr. Holloway more than £200,000.

The London *News*, from which we take these facts, also says the announcement has recently been made of another magnificent institution, a college for women, to be erected on the Mount Lee estate, at Egham, at a cost of more than a quarter of a million sterling, by the liberality of this munificent public benefactor. Mr. Holloway has further promised an endowment fund of £100,000 for the support of this college; and the building, designed by his architect, Mr. W. H. Crossland, of Leeds, under his personal direction, will be constructed within the next four years.

Antidote to Poison Ivy.

Dr. J. M. Ward, in the *Medical Record*, makes another addition to the already extensive list of remedies for poisoning by *Rhus radicans*, or "poison ivy." He recommends the profession to use, in all cases of poisoning by this plant, Labarraque's solution of chloride of soda. "The acid poison," he remarks, "requires an alkaline antidote, and this solution meets the indication fully. When the skin is unbroken it may be used clear three or four times a day; or in other cases diluted with from three to six parts of water. After giving this remedy a trial no one will be disposed to try anything else. It is one of the most valuable external agents known to the profession, and yet seldom appreciated and but rarely employed. It will sustain its reputation as a local application in erysipelas, burns, and scalds."

THE TAMARIND.

This tree is indigenous in various parts of Africa and India, and it grows wild in several of the East Indian Islands. It is completely naturalized in the West Indies and in portions of Brazil and Mexico. It is a handsome tree, 60 to 80

TAMARIND.—*Tamarindus Indica.*

feet in height. Its compound leaves of ten to twenty pairs of small oblong leaflets form a dense foliage. The flowers are white when they first open, but they soon turn yellow. The fruit is an indehiscent legume or pod, 3 to 6 inches long, straight or somewhat curved, and with a hard, brittle exterior shell. The seeds, from 4 to 12 in number, are each surrounded by a tough, papery membrane, outside of which, between it and the shell, there is a firm, juicy acid pulp, traversed by strong woody fibers, which start from the fruit stalk. The ripeness of the fruit is known by the brittleness of the outer shell.

In the West Indies its fruit is picked, deprived of its shell, and packed in casks, and boiling sirup is poured over them until the vessel is full; when cool the package is headed up and is ready for market.

A better kind, rarely found on sale, is prepared by packing the shelled fruit in stone jars with alternate layers of sugar.

The pulp has a brisk acid taste, modified more or less by the amount of sugar used; it contains tartaric, citric, and other acids, and some principle not well ascertained, which gives it a laxative property. Tamarinds are used in tropical countries to prepare a refreshing drink by pouring boiling water over the fruit. This drink is also used as a laxative and refrigerant in fevers. The wood is useful for timber and makes a fine charcoal. The shell of the seed contains tannin, and the kernels are used as food in India in times of scarcity.

White Willow Hedges.

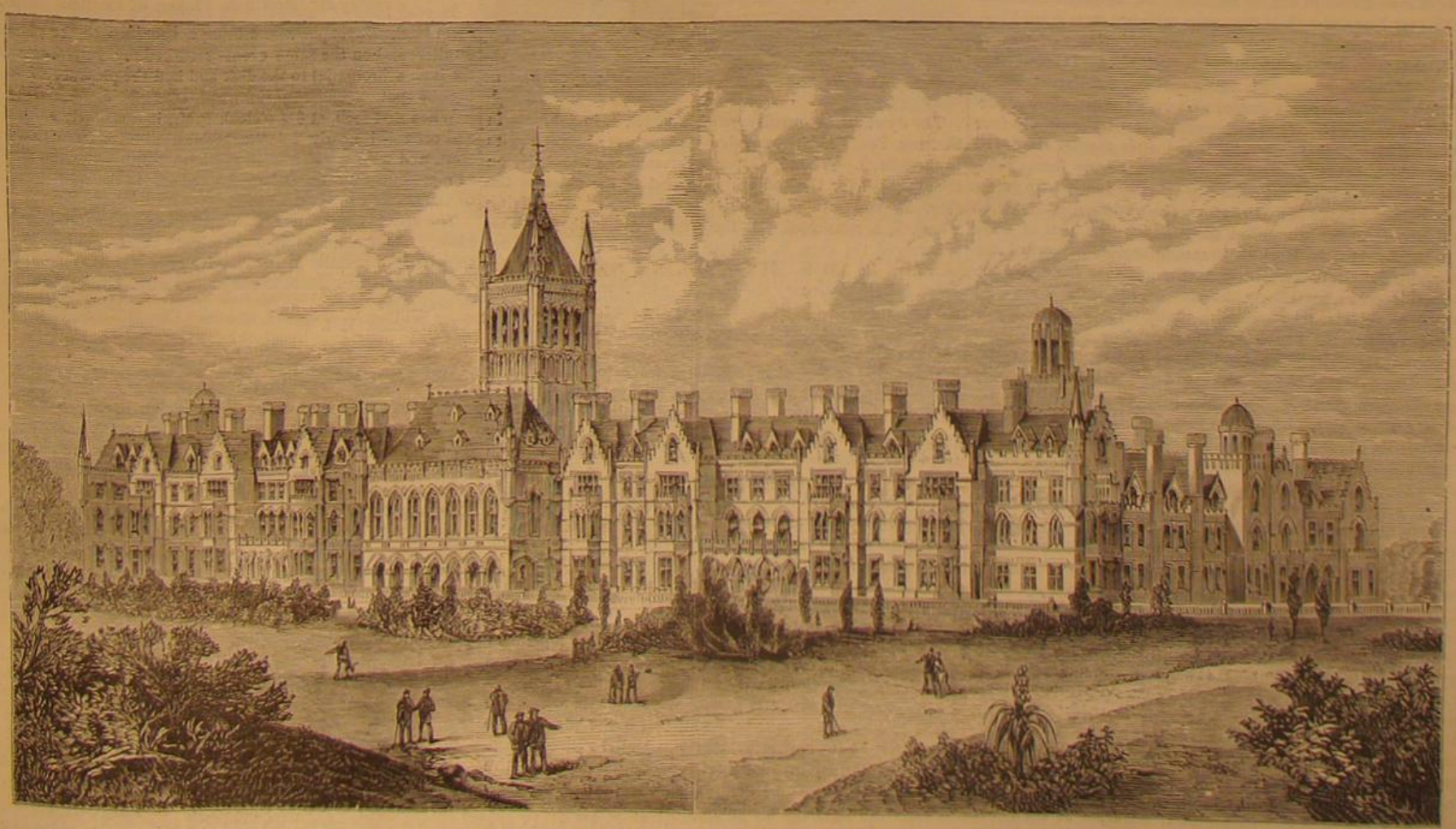
J. W. Myers, of Hampton, Iowa, says, in the "Iowa Horticultural Transactions," that after many trials there are two trees which have endured the ordeal of northern hedging, and have not been found wanting in any particular. These are the honey locust and the white willow. The best management of the willow is to take none but good strong shoots of last year's growth, cut ten inches long and sharpened, assorted as to size, and tied in bundles of twenty-five each. Place them, sharp ends down, in a shallow pond or other water for ten or fifteen days, and if the points are stuck in the mud they will be held in position. Plow the ground deep and harrow well. With a buckskin glove on the right hand, thrust the cuttings, slanting, eight inches into the mellow soil, ten inches apart. Then keep the ground perfectly clear of weeds; cultivate two more years with the shovel plow, and the hedge may be "left alone in its glory," and it will make a good barrier. But if cut to the ground early in spring when two years old, it will be much better. It will be best of all by "laying" or bending the trees down in a horizontal position at three years, and tying them in a line with short pieces of wire. The strong outgrowing shoots may be cut back every few years for fire wood. The simplicity of this method and its perfect success are said to be "astonishing."

The honey locust is similarly treated after the hedge has been planted and has attained a height of eight feet. The plants, however, are set in the row two feet apart, to prevent killing one another out. In laying down, the thorns are avoided by using a plank to bend the trees down, one end against the tree and the other on the ground, the operator sitting on it while tying the trees. The honey locust is more easily kept within bounds than the willow.

The Chemical Reaction of Blossoms.

According to the reports of Frémy and Cloez all red and pink blossoms show an acid reaction, whereas all blue blossoms are neutral and occasionally show an alkaline reaction. In order to examine the validity of these statements, Mr. A. Vogel examined 100 blossoms, of which 39 were blue, 44 red, 6 violet, 8 yellow, and 3 white.

He states that the acid reaction was not equally intense in all cases, but, on the contrary, varied considerably. The bright red, white, and yellow blossoms showed the most intense acid reaction. The acid reaction of the blue and violet blossoms was much weaker than that of the red blossoms, but was nevertheless perceptible. Of the blue blossoms only 10 were neutral or of a slightly alkaline reaction, as 3 violet and red blossoms were likewise. Among the latter were the



THE HOLLOWAY SANATORIUM AT VIRGINIA WATER.

Campanula sepunculoides (light violet), the *Prismatocarpus speculum* (crimson violet), and the bright red *Pisum sativum*.

There is no doubt that a great difference exists in the chemical reaction of red and blue blossoms, but from the above it appears to be erroneous to attribute an acid reaction to red and an alkaline reaction to blue blossoms. The majority of all blossoms show an acid reaction.—*Chemisches Centralblatt.*

A New Coloring Matter.

Mr. T L. Phipson, according to a note recently presented by him to the French Academy of Sciences, has succeeded in extracting from the little blood-red alga (*Palmella cruenta*) found at the base of damp walls, a new rose-red coloring matter, which exhibits very curious properties. Mr. Phipson proposes for it the name of *Palmelline*. Its color resembles no known color except the coloring matter of the blood—the hæmoglobine of modern chemists. Like the latter, palmelline is insoluble in alcohol, ether, benzine, bisulphide of carbon, etc., but dissolves in water. Like the coloring matter of blood, palmelline is dichromic, consisting of a red matter united with an albuminous substance, and being coagulated by alcohol, heat, and acetic acid added to its aqueous solution. Like hæmoglobine, too, palmelline gives rise to absorption bands in the yellow of the spectrum; but these bands did not seem to Mr. Phipson to occupy exactly the same position as those given by blood. Palmelline in solution, like the coloring matter of blood in solution, readily undergoes putrefaction at summer heat, giving out a strong ammoniacal odor and a smell of rotton cheese. Finally, like the coloring matter of blood, palmelline contains iron. This new coloring substance cannot be extracted from the moist plant, for the vitality of the latter is such that it will not part with its color by the action of water; it has to be first dried in a current of air At the end of from twenty-four to thirty-six hours the pellicles are usually pretty dry, for the plant and the matters upon which it grows dry quite rapidly in the air. It must not be dried on paper, for the cells would adhere thereto. On leaving the dried plant in a small quantity of water in a covered porcelain capsule, the coloring matter dissolves out, and, on the following day, the clear liquid may be decanted from it. The coloring matter is of a magnificent rose-red by transmitted light, and of an orange-yellow by reflected light.

From the properties above noted, it will be seen that palmelline appears to exhibit considerable analogy with the hæmoglobine of the blood; and, as Mr. Phipson says, it is the first time that a substance of this nature has been met with in the vegetable kingdom.

Colors of Plants.

At the last meeting of the Philadelphia Academy of Sciences the discussions were mostly confined to botanical matters.

Mr. Martindale stated that in a collection of over twenty selected specimens of Habenaria from the vicinity of Newfield, N. J., he had found all shades of color, from the bright buff to the pure white. He had found no difficulty in assigning all the tinted specimens to the species Ciliaris, while the white ones were undoubtedly Blephariglottis, the petals in the former being linear,and in the latter spatulate, or widened toward the tip about one-sixth of their diameter. The tendency of certain flowers to albinism was considered.

Dr. Hunt remarked that the causes of color variation in flowers was entirely unknown to botanists. It could not yet be explained why the same species in different localities were of different color, or why even the same flower presented varying tints at different parts of the twenty-four hours. He was firmly convinced after further studies of habenaria that the distinctions between the two forms mentioned were not specific, as he had actually found both forms on the same spike. Referring to the variation of color in plants, Mr. Meehan called attention to the case of *Gilia aggregata* of the Rocky Mountain region. Toward the north all these plants, which form a striking feature of the landscape, are white. As the traveler proceeds southward he observes that they assume a pink tint, which gradually deepens, until, when found three or four hundred miles farther south, the same species is of a deep crimson color. He believed that the two forms of habenaria were probably of the same species.

Mr. Redfield was of opinion that, had it not been for the difference of color, the two species of habenaria would probably never have been defined. The distinguishing characters having been pointed out, however, he believed that they were sufficiently permanent to constitute valid species.

The discussion was continued by Mr. Martindale, who believed that the two forms were distinct, although the differences, apart from the color, were undoubtedly very slight.

The Proper Diet for Children.

Here is another case of disease of the cornea. This baby is twenty months old. There is a white spot over the center of this little girl's pupil. It is soft-looking, and I therefore know that it is recent. The child has nasal catarrh. It was weaned when six months old, and it is now just cutting its eye teeth. The mother says it is being fed with whatever there is upon the table; that it receives a little tea and coffee, and that it it allowed to suck pieces of meat, all of which is wrong. Do not allow it among your patients, gentlemen. If the good Lord had wished us to eat meat at the age of twenty months, he would have given us a full set of teeth ready for use at that time.

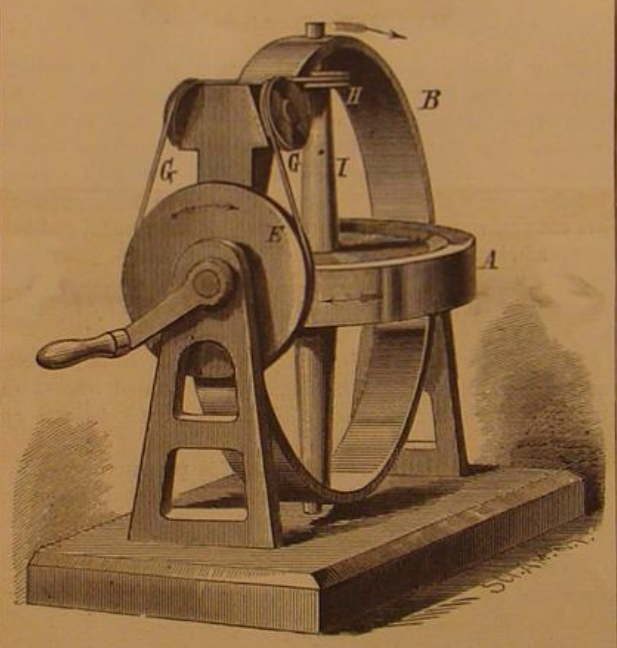
Dr Leaming, of this city, whom you should all know, has for some years had charge of an asylum in which large numbers of children are received and cared for, and he does not allow one of them to have anything except milk, and substances which can be dissolved in milk, until they are seven years of age. I think your professor of materia medica is equally emphatic upon this question, and now your professor of ophthalmology comes to you and beseeches of you to use all possible influence in the direction of having children reared upon milk alone. Not upon tea, not upon coffee, not upon meat, not upon sweet cake and puddings, but upon milk. Every physician will, under rare circumstances, prescribe beef juice for infants, very much as brandy is prescribed upon rare occasions for small children, and I shall not quarrel with them upon that point. But I have a decided opinion that, under ordinary circumstances, no child should have anything except milk and farinaceous food until it has been provided with teeth with which to prepare other articles of diet for the stomach. Follow nature in your practice in ophthalmic as well as in every other kind of disease. I will engage, if this mother, who is anxious for her child, will listen to what I say about feeding it hereafter with milk, barley, farina, corn starch, hominy, with perhaps a small quantity of sugar, that the teething will be easier, the bowels will be more regular, and diseases of the cornea will be less liable to occur.—*Dr. D. B. St. John Roosa, in New York Medical Record.*

Correspondence.

ROTARY MOTION.

To the Editor of the Scientific American:

We are taught in text books on physics that "rotating bodies preserve their planes of rotation, and *will resist a considerable force to change their planes*," and Bohnenberger's apparatus is used to illustrate the same. The proposition holds good with Bohnenberger's apparatus, but the latter half of it will not hold in the case of the flywheel in the apparatus shown in the accompanying illustration.



APPARATUS FOR EXHIBITING ROTARY MOTION.

The flywheel, A, revolves with its axle, I, in journals in the ring, B. The latter revolves on bearings at right angles to the axle, I. A band, G, passes around the wheel, H, on the axle, I, over the pulleys journaled at the sides of the ring, B, and around the driving wheel, E. The driving wheel, E, is connected with the crank. When the band, G, is removed the ring, B, holding the flywheel is free to revolve on its pivots. If the band, G, is replaced and the crank is held stationary the ring, B, will revolve and cause the revolution of the flywheel; or if the ring, B, is held stationary, and the crank is turned, the flywheel will again be set in motion.

If rotating bodies always resist a force to change their planes of rotation, it will be seen that the fly wheel, A, would tend to hold the ring, B, stationary while the crank was turned, and the flywheel might thus be kept in motion, *provided the overcoming of the resistance of a rotating body to change its plane of rotation does not retard the revolutions of that body.* But there is no resistance whatever in changing the plane of the revolving flywheel, A, as can be seen by disconnecting the band, G, leaving the flywheel in motion. The ring, B, can be turned on its pivots without the slightest resistance, and when set in motion, the ring will continue to revolve the same when the flywheel is rotating as when at rest. When the flywheel is in motion and the band, G, disconnected, if the whole apparatus is revolved on a pivot or any other (the plane of revolution bejng parallel with the plane of the base of the apparatus, for instance), the rotating flywheel will instantly assume a position in which the plane of *its* rotation will be parallel with the plane of the revolution of the apparatus, that is, parallel with the base. Moreover, if the direction of the revolution of the entire apparatus on the pivot is a right hand motion, the flywheel will have a right hand motion parallel with it; and if the revolution of the apparatus is reversed so that the base has a left hand motion, the flywheel, A, will cause the rim, B, to make a semi-revolution so as to allow A to rotate parallel with the plane of D, and in the same direction, that is, a left hand motion.

As stated before, when the base is at rest and the flywheel in motion (the band, G, being disconnected) there is no resistance against changing the plane of the rotating flywheel; but *if the base, D, is revolving at the same time, there is a very decided resistance offered against changing the plane of the flywheel.* So strong is this resistance that if the band, G, is connected, the flywheel may be kept continually in motion by turning the crank, showing that *the overcoming of the resistance of a revolving body against changing its plane of rotation does not retard the motion of that revolving body.*

I do not know that this fact has ever before been demonstrated.

By oscillating the base upon a pivot while the flywheel is in motion the ring, B, can be made to revolve; and if the crank is fastened so that the driving wheel is held stationary, the velocity of the flywheel can be accelerated or retarded and kept in continuous rotation. Motion may thus be imparted to the flywheel still better by rotating the base on a pivot eccentric to its axis, no matter how slight the eccentricity, the base remaining comparatively still; or still better, by keeping a point at the center of the wheel stationary, and oscillating the pivots of the ring, B, in opposite directions, in both cases the crank remaining unmoved.

H. J. M. MATTIS.

The Durion.

To the Editor of the Scientific American:

In the July, 1879, EXPORT EDITION of the SCIENTIFIC AMERICAN, I find, at page 49, the views of a writer in the *Gardener's Chronicle* on "A Tropical Fruit," the durion. The article concludes thus: "It does not succeed well in India, and cannot be grown in the West Indies." This assertion, as regards India, I am not in a position to disprove; but it is decidedly erroneous in respect to the West Indies, as the durion grows most luxuriantly in this island, in proof of which I had purposed by this opportunity sending you one but have been disappointed in its receipt. You may, however, rely on my so doing at an early date.

GEORGE LEVY.

Kingston, Jamaica, September 4, 1879.

Bitten by a Skunk, but Still Alive.

To the Editor of the Scientific American:

I notice in your issue of September 20 an article on skunk bites, in which the writer says that the bite is *always* fatal, sooner or later. Permit me to say that when a youth of 19 I was badly mangled by a skunk which I seized in the dark, believing it to be a rabbit. I am now 55, hale and hearty. I have personal knowledge of two similar cases, and have heard of others, and have yet to learn of the first case of death attributable directly to the bite, or causes arising therefrom.

I am inclined to think that the fatal cases are of the same order as those of the centenarians who die from the use of tobacco (?). JAMES L. HOWSON.

Washington, D. C., September 12, 1879.

The Spot on Jupiter.

To the Editor of the Scientific American:

In your issue of September 12 I noticed a communication from F. S. Davenport, describing a spot seen on the planet Jupiter; and on the same evening turned my instrument (a six inch achromatic) to the disk and had the pleasure of seeing the spot.

When first seen, at 6¾ o'clock P.M., it was nearly central, and occupied nearly 1-3 the breadth of disk from east to west, and with a width from north to south about the same as represented by Mr. D., and passed off to the right in line of the planet's rotation.

The above observation was made with a terrestrial eyepiece. There seem to be some mighty changes going on on the planet, especially in the vicinity of the belts, the nature of which it is impossible to conjecture with any probability of accuracy. R. L. ALLEN.

Providence, R. I.

Note on a Peculiar Case of Corrosion of the Metal Tin.

BY J. W. OSBORNE, OF WASHINGTON, D. C.

The writer exhibited before the American Association a block tin tube, which had been used in the construction of a filter for household purposes, large quantities of water having passed over it for 20 months.

The tube formed one leg of a siphon. It passed through a stratum of charcoal and one of pure sand, the water to be filtered rising high above the latter. The outside of the tube, in that part of it only which corresponded in position to that of the sand, was deeply pitted, oxide of tin having been formed. The difficulty was to explain in what manner the sand determined the oxidation.

An interesting discussion followed the reading of this paper, many members of the section taking part, but no satisfactory solution of the problem was reached.

Action of Aqua Regia on Platinum.

Mr. Edison finds that platinum, after it has been rendered homogeneous under the vacuum treatment, is dissolved with great difficulty in boiling aqua regia. He subjected a specimen of the vacuum-treated platinum to the action of boiling aqua regia for five days without dissolving it.

JAPANESE BRONZE VASES.

We engrave on this page a group of bronze vases, which illustrate in an excellent manner the beauties and oddities of the peculiar artistic methods of the Japanese. As metal-workers, these wonderful people surpass in certain respects their European brethren, and some of their processes are to this day inimitable.

The central piece of this group stands some four feet high. It is composed entirely of bronze, save the panels between the dragon handles, which are damascened with silver and gold. The panel on this side represents a knight doing penance by standing under a cataract, and on the obverse he is seen, his sins washed away, having a quiet cup of tea with a couple of friends. So far the European can trace a meaning in the design; but when it comes to explaining the half human monsters, the dragons, sea serpents, and other animals, it is only possible to suppose that they may be the representations of traditional creatures such as figure in the Arabian Nights, and the like of which learned scientists assure us once walked or crawled upon the face of the earth and swam across the seas. The decoration of the smaller vases, saving the winged beasts that serve as handles, is more easily understood. The panels in these have birds and butterflies copied with wonderful fidelity and spirit after nature, and are really beautiful; and in these pieces, as in all the articles of Japanese manufacture, we see a minuteness of workmanship and finish such as no Christian people can afford the time to emulate.

JAPANESE BRONZE VASES.

The International Dairy Fair.

The executive committee of the International Dairy Fair Association announce that the proposition to hold a second fair at the city of New York, during the year 1879, has been so well received by the trade at large that its ultimate success is already assured, and it only now remains for the dairying interests throughout the country and the different dairy organizations to co-operate with the International Dairy Fair Association, and through their united efforts secure an exhibition worthy of the interests involved, surpassing anything of the kind ever before presented. The experiences gained at the last fair enable the committee to more readily comprehend the necessities of this, and having this in view, the whole of the American Institute Building has been engaged this year, thereby enabling the management to devote a much larger space to the exhibition of goods, and at the same time give that attention to proper display of dairy implements and tests of cream raising which want of space prevented at the last exhibition. Machinery Hall, a part of the Institute not used last year, will be devoted exclusively to this branch of industry, where, having ample steam power and connections, every facility will be afforded for the manufacture of butter and cheese upon a much larger scale than heretofore, and opportunities for displaying dairy implements by hand or power greatly increased. A separate apartment will be arranged with every requirement for making the fullest tests of the different processes for raising cream, and the trial of inventions claiming superiority. Accommodations for a large number of cattle will be provided, and the exhibition of herds, as well as specimen animals, made a feature. From promises already received from owners and breeders, it is confidently believed that an unprecedented number of choice animals will be exhibited, comprising selections from the most celebrated herds in America and Europe. The display of foreign products will be far greater than last year, assurances having been received from the officers of the Association resident and traveling abroad, of extensive preparations being made to send specimens of every kind of dairy products manufactured, as well as some thoroughbred cattle.

Torpedo Boats.

The Admiralty have entered into a contract with Messrs. Yarrow & Co., of Poplar, for the construction of some of their second-class torpedo boats. These little vessels are fitted with Yarrow's patent tubular boiler, by means of which steam can be raised from cold water, and the craft got under way, in six minutes from the time of lighting fires. The system of steering adopted is that introduced by the manufacturers, and which is now recognized as the most suitable for steering this class of vessel. It consists of a drop rudder forward, which is worked in conjunction with the usual rudder aft. These torpedo boats will be completed early next year, and the trials of them on the Thames and at Portsmouth are looked forward to with considerable interest.—*London Times.*

Tape Worms in Eggs.

Various instances have been recorded of the discovery in hens' eggs of minute specimens of the *distoma ovatum*. They appear like a small speck, the size of a millet seed or a pin's head. It is believed by helminthologists that these will develop into one of the varieties of tape worm, and it is wise, therefore, to take eggs hard boiled or otherwise well cooked. A writer in one of the late numbers of *Nature* cites several instances where these parasitic bodies have been found.

International Patent Law.

The following are the resolutions passed at the meeting of the Patent Law Committee of the International Law Association held recently in London. The committee, after having deliberated on the subject, recognize that it seems impossible at the present time to propose one common law upon patents for inventions, on account of the numerous points of contact which the subject presents with divergent civil, commercial, and criminal law in general. Nevertheless, it is advisable to select a certain number of general principles which may be accepted in the laws of all countries. Consequently the committee adopt and propose to the congress of the association the following resolutions:

General Principles.—(1) The right of inventors over their productions is a right of property; the law does not create, it only regulates it. (2) A temporary privilege of sufficient duration to insure the remuneration of their labors and outlay should be accorded to inventors, less in their own interest than in that of industry in general.

Law and Treaties.—(3) Patents for inventions should be the subject of a special and complete law in each country. (4) Foreigners ought, with respect to patents, to be treated in exactly the same way as citizens. (5) Stipulations for the reciprocal protection of patent rights between different countries should be contained in special conventions, independent both of treaties of commerce and of conventions for the mutual recognition of literary and artistic copyright.

Patent Office.—(6) A special department for patents, trade marks, and registered designs should be established in each country. A central depot of patents, etc., should be attached to it for the use of the public. Independently of any other publication the Administration of Patents, etc., should publish a periodical official journal.

Fees.—(7) The fees levied on patents should not be larger than is necessary to cover the expenses of the patent office, and should be levied by periodical payments.

What is Patentable, and by Whom.—(8) All inventions, whether of procedures or of products, should be patentable, except financial combinations or inventions contrary to public order or to morality. In particular, chemical, alimentary, and pharmaceutical preparations should be patentable. (9) In the absence of fraud, the first applicant should be deemed the inventor. (9*a*) No person, except he be engaged in the patent office, should, by reason of his employment, be debarred from obtaining patents for his own inventions.

Provisions as to International Exhibitions.—(10) Provisional protection should be granted to patentable inventions exhibited at international exhibitions, or such as are officially recognized. (11) The term during which inventions are thus protected should not be deducted from the term of the patent. (12) Such provisional protection should extend to all the countries represented at the exhibitions. (13) The fact that an article is an exhibit at an international or officially recognized exhibition should not interfere with the right of seizing it as an infringement.

Provisional Protection.—(14) Provisional protection for twelve months should be granted on the applicant for a patent filing a provisional specification containing an outline description of the nature of his invention, in which no details should be required.

Procedure on Application.—(15) No description of the invention—except its name—should be published before the issue of the patent, except as mentioned in paragraph 19. (16) The deposit of provisional specifications should, if desired by the inventor, be allowed to be made at the authorized local office, and at the consulates of the various nations, and on such deposit at a consulate, and the payment of the patent fees, provisional protection should commence as if the deposit had taken place in the patent office of the country represented. (17) Prior to the expiration of the term of provisional protection, if the applicant desires to complete his patent, he should be required to file a full specification. (18) Where a patent has been applied for in one country, subsequent publication of the invention should not during a period of twelve months prejudice the original applicant's right to patent in other countries.

Examination.—(19) On the filing of the complete specification, or the expiry of the term of provisional protection, if no complete specification has been filed, the provisional specification should be published. After the filing of the complete specification, and previously to its publication, the patent office should examine it, having regard exclusively to the following points: (*a*) Whether the specification is clear. (*b*) Whether the invention is contrary to public morals. (*c*) Whether the invention is wanting in novelty, regard being had solely to prior publications in the patent office of the country. (20) For the purposes of examination, an invention should not be deemed to be wanting in novelty, unless a prior publication be found which comes strictly within one or other of the following conditions: (*a*) It should be not more than twenty-five years old, and be in the form of a full description, identical with the applicant's description. (*b*) If the prior description be more than twenty-five years old, it should be proved that the identical invention as claimed by the applicant has been openly used within twenty-one years last past. (21) Should some parts of the invention come within these objections the applicant should be allowed to amend his specification. (22) Subject to such amendment, the patent should be granted, except in cases of fraud, or when the invention is contrary to public morals. (23) Reports and opinions of examining authorities, as respects applications for patents, should not be open to the public.

Procedure on Grant of Patent.—(24) The complete specification should be published immediately on the granting of the patent. (25) The provisional protection should continue until the final grant or refusal of the patent.

Amendment.—(26) Should it appear, after a patent has been granted, that the claims are too extensive, or that the specification is otherwise open to objection, it should be competent to the patentee to disclaim or amend his specification.

Term.—(27) All patents should be granted for a term of twenty-one years. There should be no prolongation. (28) A patent, whenever granted, should bear date from the deposit of the provisional specification.

Effect of Patent.—(29) All patents should, throughout their whole term, insure to the inventors or their legal representatives or assignees the exclusive right to the patented invention, and not a mere right of receiving royalties from third persons. (30) No one should be permitted, without the leave of the patentee, to produce, use, or sell the article which forms the subject of the invention, the patented machinery, process, or combination, or the article produced by such patented machinery, process, or combination. (31) A patent should have no effect on vehicles or ships, or appliances to vehicles or ships, which come but temporarily within the boundaries of the country, and the owners of which do not carry on business within the country. (32) The patentee should not be prevented from introducing from abroad articles manufactured under his patent. (33) A patent should be held to confer an indefeasible title to the invention described in the complete specification, unless it be proved that there exists a prior patent covering an identical invention, or that the identical invention has been publicly used within twenty-one years prior to the date of the patent, or fully described in a publication bearing date or printed within twenty-five years prior to that date. (34) Where it is proved that the public interest requires that a patent should be worked, and that the holder of the patent is not attempting to meet the demand, and refuses licenses, the legislature should step in to prevent the public injury by a special law in each case. (35) The principle of expropriation for public utility is applicable to patents, but this should only be by virtue of a special law in each case, containing proper provisions for compensation. (36) Patents granted in different countries should be perfectly independent of each other in all respects.

An esteemed correspondent writes us from the province of São Paulo, Brazil, stating that severe frosts occurred there in August last during several nights, which had so seriously injured the coffee trees that the crop for 1880 will be reduced one half.

To Make Cloth, Paper, etc., Fireproof.

Several preparations for rendering textile and other inflammable fabrics incombustible and practically fireproof have been brought out by MM. Martin and Tessier, of Paris. The compositions are said to be of an inexpensive nature, and capable of rendering incombustible all kinds of readily inflammable substances, such as woven and other fabrics of cotton and other fibrous materials, paper, printed or otherwise, including bills of exchange and other securities, woodwork, theatrical scenery, straw, etc. The first composition, which may be applied to all kinds of fabrics without deteriorating them in any way, consists of:

	Kilos.
Sulphate of ammonia (pure)	8
Carbonate of ammonia	2·5
Boracic acid	3
Borax (pure)	1·7
Starch	2
Water	100

It is simply necessary to steep the fabrics in a hot solution composed as above until they have become thoroughly impregnated, after which they are drained and dried sufficiently to enable them to be ironed or pressed like ordinary starched goods.

A second composition to be used for theatrical scenery (or the mounted but unpainted canvas to be used for this purpose), and also for woodwork, furniture, door and window frames, etc., is to be applied hot with a brush like ordinary paint. It is composed of:

	Kilos.
Boracic acid	5
Hydrochlorate of ammonia or sal ammoniac	15
Potassic feldspar	5
Gelatine	1·5
Size	50
Water	100

To which is added a sufficient quantity of a suitable calcareous substance to give the composition sufficient body or consistency.

A third composition, to be used for coarse canvas or sail cloth, cordage, straw, and wood, is applied by immersing the articles therein or by imbibition, and consists of:

	Kilos.
Boracic acid	6
Hydrochlorate of ammonia or sal ammoniac	15
Borax (pure)	3
Water	100

A fourth composition, applicable to all kinds of paper, whether printed or not, including securities, books, etc., is formed of:

	Kilos.
Sulphate of ammonia (pure)	8
Boracic acid	3
Borax	1·7
Water	100

The solution is to be placed in a vat heated to 50° C. (122° Fah.) at the end of the paper-making machine, and the paper as it leaves the machine is passed through the solution in this vat, so as to be completely impregnated therewith, after which it is dried upon a warm cylinder and then wound on a reel. If the paper be in sheets or printed it is simply immersed in the above solution, heated to 50° C., spread out to dry, and afterward pressed to restore the glaze destroyed by the moisture.

The above compositions are said to insure a degree of incombustibility without precedent as regards the preservation of the materials to which they are applied. The proportions of the several ingredients are given as examples only, and may be varied as found necessary in practice.

The Social Science Association.

The last day's session began with a paper by Frederick Douglass on the exodus of negroes from the South. Mr. Douglass strongly opposed the movement, holding that the South was not only the best place for the negro as a field of labor, but best on the grounds of his political powers and possibilities. The position taken by Mr. Douglass was opposed by Professor T. R. Greener, of Howard University, and President Anderson, of Rochester.

William A. Hovey, of the Boston *Transcript*, read a striking paper on co-operative stores in England and America. Mr. James Samuelson, of Liverpool, England, presented certain schemes for the material advancement of the working classes, and Mr. Joseph D. Weeks, of the *Iron Age*, gave an address on industrial arbitration and conciliation. Debt making and debt paying in American cities was discussed by Mr. William F. Ford, of Philadelphia. In the department of social economy, Mr. F. B. Sanborn, secretary, presented his annual report; and there was read a paper sent by Charles L. Brace, of the Children's Aid Society, discussing the methods of dealing with poor and vicious children. Institution life for children was treated in a paper by Rev. T. K. Fessenden, of Connecticut, and debated by several members. The closing paper was by Mr. Robert P. Porter, of the Chicago *Inter-Ocean*, on the industrial, agricultural, and financial outlook of the West. It presented an array of facts and figures that astonished even those who had a general idea of the rapid industrial progress of the West during recent years.

A Remarkable Pompano.

Mr. C. A. Lewis, at the Washington Fish Market of this city, has recently had on exhibition the largest pompano ever known. It was taken with Spanish mackerel off Norfolk, Va., and weighed twenty-three pounds. Usually these fish range between one and three pounds in weight. A four pounder is rare. Above that weight but one specimen has ever before been brought to this market, and that weighed nineteen pounds. Mr. Lewis' fish was perfect in every particular, though a monster in size. It was sent to the Smithsonian Institution at Washington.

RECENT DECISIONS RELATING TO PATENTS, TRADE MARKS, ETC.

By Judge Clifford.—U. S. Circuit Court—District of Massachusetts.

BOOT AND SHOE SEWING MACHINES.—THOMAS *et al.* v. THE SHOE MACHINERY MANUFACTURING COMPANY *et al.*

1. Reissued patents are presumed to be for the same invention as the original, and will only be adjudged to be void because for a different invention where it clearly appears that the reissue contains some new feature of a material character not described, suggested, nor substantially indicated in the specification, drawings, or Patent Office model.

2. The fact that a reissue patent has been granted is *prima facie* evidence that satisfactory proofs have been given to the Commissioner of such a state of facts as warrant the reissue, even though the patent may contain no recitals that the prerequisites to the grant have been fulfilled.

3. After reissue the Commissioner's decision in the premises *in a suit for infringement* is final and decisive, and is not re-examinable in such a suit in the circuit court, unless it is apparent on the face of the patent that he has exceeded his authority, and that there is such a repugnancy between the old and the new patent that it must be held as matter of legal construction that the new patent is not for the same invention as that embraced and secured in the original.

4. The applicant for reissue cannot interpolate new features not described, suggested, or substantially indicated in his original specification, drawings, or model. Such interpolations in a reissue patent, if material, show that the Commissioner exceeded his jurisdiction; and where that is done it clearly becomes the duty of the court to declare the patent void.

5. The courts will in no case declare a reissue patent void if, by the true construction of the two instruments, the invention secured by the reissue is not substantially different from that embodied in the original patent. Inquiries in such a case are restricted to a comparison of the terms and import of the two patents in view of the drawings and models. If from these it results that the invention claimed in the reissue is not substantially different from that described, suggested, or indicated in the original specification, drawings, or model, the reissued patent must be held valid, as all other alterations and amendments plainly fall within the intent and purpose of the statute which allows a surrender and reissue.

6. Inventions secured by letters patent are presumed to be new and useful until the contrary is shown; and, in the absence of countervailing proof, that *prima facie* presumption is sufficient to entitle the complainant to a decree in a suit for infringement.

By the Commissioner of Patents.

ANVIL.—EX PARTE DUCSH.

The combination of a drill, adjustable standard, and vise with an anvil, as such, is not a legitimate mechanical combination, for the anvil, as such, can make no contribution to any distinct operation of the entire machine. But the combination of a drill, adjustable standard, and vise, by means of a base to which the standard and vise are attached, is a legitimate combination, embracing no supernumerary elements, and, if novel, is patentable.

TIME LOCK.—EX PARTE KOOK & HALL.

When the different forms referable to one genus are such that the substitution of one for another involves invention, the differences are patentable, and the several forms constitute different species of the genus, all subject to one generic patent, but each legally patentable in a distinct and specific patent. When, however, the substitution of one for the other involves no invention, but only mechanical skill, the differences are not patentable, and the forms do not constitute several species of the genus, but are all modifications of the same species.

VEGETABLE LIFE-DESTROYER AND SPROUT-KILLER.—EX PARTE RODGERS.

A decision of the Examiners-in-Chief, lawfully made in any case, constitutes a rule for the Primary Examiner in that case until the decision is overruled by the Commissioner.

METALLIC LINES OR CORDS FOR SUSPENDING PICTURES, ETC.—EX PARTE HOOKHAM.

A claim for an improvement in metallic cords for suspending pictures and other articles may be united in one patent with a claim for an improvement in fastenings for connecting pictures and other articles to cords; but these claims cannot be united with a claim for a reel for holding such cords in stock.

SCYTHES.—EX PARTE ROBY.

The substitution of edge steel enveloped in soft steel, in lieu of edge steel enveloped in iron or other material, in the manufacture of scythes, is a patentable improvement if the scythes in which the soft steel is used have more elasticity, less weight, and take a better polish than those constructed in any other form.

TRADE MARK.—EX PARTE COATS.

1. Minor non-essential elements of a composite symbol of trade, when used in connection with other parts which constitute its main features, cannot be registered as a trade mark; but those parts, when so used as obviously to constitute the main features of the aggregate symbol, are registrable as a trade mark.

2. Two parallel scales of inches and fractional parts thereof, when so used as to be the main features of the entire symbol or device in which they are shown, will constitute a lawful trade mark; but when used as a mere border to inclose ornamental designs or other trade marks of the applicant cannot constitute a lawful trade mark.

By the Acting Commissioner of Patents.

VENT PLUGS.—EX PARTE HICKS.

1. A claim for an article of manufacture cannot be changed by reissue into a claim for a process when the process was but a legitimate function of the particular article, and the article described was indispensable to the conduct of the process.

2. Where an application or a patent is restricted to a description and claim of a particular apparatus, neither the one nor the other can be subsequently enlarged to embrace a claim for a method that would include the same and all other means for producing the same result performed by that apparatus.

Part of One Day's Shipments of Food.

On Saturday, September 13, seven large steamers sailed from this port for Europe laden with American produce.

The Helvetia, of the National Steamship Line, for Liverpool, had on board 1,200 bales of cotton, 84,000 bushels of grain, 800 boxes of bacon, 900 boxes of cheese, 150 packages of butter, 700 sacks of flour, 200 cases of canned meats, 200 packages of sundries, and 45 tons weight of fresh meat.

The Germanic, of the White Star Line, for Liverpool, took out 1,600 boxes of bacon, 31 tierces of pork, 100 barrels of pork, 700 barrels of sugar, 210 barrels of sirup, 2,800 sacks of flour, 1,300 bales of cotton, 48 hogsheads of tobacco, 18,000 bushels of corn, 500 barrels of flour, 450 bales of hops, 11,000 boxes of cheese, 3,000 boxes of butter, and 60 tons of fresh meat.

Among other articles of merchandise the Olympus, of the Cunard Line, for Liverpool, had on board 2,200 bales of cotton, 13,000 bushels of wheat, 12,000 bushels of corn, 100 sacks of flour, 60 casks of skins, 30 tons of leather, 500 boxes of bacon, 400 cases of canned meats, and 500 dried hides.

The cargo of the steamship Oder, of the Imperial German Mail Line, for Bremen, was composed of 8,032 bushels of corn, 5,370 bushels of wheat, 340 hogsheads of tobacco, 550 cases of tobacco, 190 bales of tobacco, 2,200 packages of butter, 1,500 sides of leather, 350 tierces of lard, 50 tierces of grease, 200 barrels of flour, 100 barrels of peas, 75 boxes of bacon, 300 boxes of corned beef, 180 boxes of sausages, and 50 barrels of corned beef.

The Ethiopia, of the Anchor Line, for Glasgow, carried 40,000 bushels of corn, 1,700 barrels of flour, 6,000 sacks of flour, 4,000 boxes of cheese, 20 hogsheads of tallow, 150 tierces of beef, 900 boxes of bacon, 7,000 packages of butter, 900 quarters of fresh beef, and 200 carcasses of sheep.

The Australia, of the Anchor Line, for London, had on board 5,800 sacks of flour, 550 sacks of oatmeal, 4,035 packages of canned goods, 230 boxes of bacon, 125 boxes of hams, 50 tierces of beef, 470 barrels of tongues, 7,800 boxes of cheese, 450 barrels of lard oil, 450 barrels of flour, 8,000 bushels of wheat, 790 quarters of beef, 300 carcasses of sheep, and 125 live bullocks.

The Assyria, of the Anchor Line, for Bristol, took out 32,000 bushels of wheat, 2,000 barrels of flour, 3,000 boxes of cheese, 400 boxes of bacon, 100 tons of tallow, 400 barrels of lard oil, 900 packages of lard, 140 tons of oil cake, and 1,400 bags of flour.

This, it must be borne in mind, includes only the more important shipments by steamers. A vast amount of produce, particularly grain, is exported in sailing vessels.

Ship owners report a rapidly increasing demand for American products in Europe—a demand so urgent that the carrying rates for grain have been raised from thirty to forty per cent above those that obtained three months ago.

A Lady Patent Lawyer.

For the first time in the federal courts of this district a lady practitioner appeared the other day in this city before Judge Blatchford, in the United States Circuit Court, and argued in person a motion for an injunction in a patent suit for the alleged infringement of a patent of her own. The lady is Miss Helen Marie MacDonald, of Boston.

It will be remembered that for the last ten or fifteen years a considerable number of ladies have been employed in the Patent Office at Washington, some of whom have occupied the positions of examiners. In general they have shown activity and ability in the discharge of their official duties, and the experience gained ought to qualify them to serve acceptably as attorneys.

Our Trade with England.

The British Bureau of Statistics report that America is exporting to Great Britain three times as much as Great Britain sends to this country, and that with the rapid increase in American exports there is a correspondingly rapid decrease in British exports. In round numbers, the exports from the United States to Great Britain for the last fiscal year amounted to $333,000,000, while the exports from Great Britain to this country in the same period amounted to about $111,000,000.

American Gynecological Society.

The fourth annual convention of the American Gynecological Society met at Johns Hopkins University, Baltimore, Md., Sept. 17, for a three days' session. Dr. T. G. Thomas, of New York, presided. There was a good attendance, embracing many of the most eminent physicians in the United States.

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.

The best results are obtained by the Imp. Eureka Turbine Wheel and Barber's Pat. Pulverizing Mills. Send for descriptive pamphlets to Barber & Son, Allentown, Pa.

Portable Railroad Sugar Mills, Engines and Boilers. Atlantic Steam Engine Works, Brooklyn, N. Y.

Brass or Iron Gears; Models. G. B. Grant, Boston.

Self-Balanced Slide Valve. Wanted, a party to build and introduce engines with self-balanced valve. Monopoly to party. For particulars, address R. G. Bishop, Chetopa, Kan.

Draw'g Insts. & Mat. Woolman, 116 Fulton St., N.Y.

Wanted—to correspond with parties who will make and sell new Steam Engine Governor on royalty. Address S. Whinery, Wheeler, Ala.

The Best Invention for Butter Shippers. "Byram's Patent Refrigerating Butter Carrier." Send for circular. S. D. Byram, Liberty, Ind.

For Sale.—48 in. x 12 ft. Planer, in good order, price $300. E. P. Bullard, 14 Dey St., New York.

Gear Cutlery Attachment for Lathes, Fine Tools, Lace Leather Cutter, Belting, etc. Jackson & Tyler, Baltimore.

The greatest success ever attained in the production of materials for structural purposes has been achieved by the H. W. Johns Manufacturing Co., 87 Maiden Lane, New York, in the production of their Asbestos Liquid Paints, which are not only in use upon the finest and largest structures in this country, among others the Metropolitan Elevated Railroad, the U. S. Capitol at Washington, etc., but are also rapidly taking the place of all others for dwellings, on account of their superior durability and beauty, which render them the best and most economical paints in use.

Wanted for cash.—A 24 hand Engine Lathe, 36 in. swing, to turn 16 ft. Moltz & Bro., Williamsport, Pa.

Wanted—The Agency for a good Washing Machine; also other patented articles. Address Bragdon Bros., 16 Federal St., Allegheny, Pa.

For Sale.—Sole right, patterns, engravings, and tools, all sizes, ready to manuf. Steam Heating Apparatus. Send for illustrations. Kafer & De Lacy, Trenton, N.J.

For Sale Cheap.—Two Amateur Sham Engines. D. Gilbert & Son., 712 Chester St., Philadelphia, Pa.

Patent For Sale.—Solid Die Rivet Making Machine. G. A. Gray, Johnston Building, Cincinnati, O.

Experimental Machinery and Patent Office Models. Cheap at W. Gardam & Son, 112 John St., New York.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and

Steam Excavators. J. Souther & Co., 12 P.O. Sq. Boston.

All makes and sizes of Steam Hammers bored out. L. B. Flanders Machine Works, Philadelphia, Pa.

The Secret Key to Health.—The Science of Life, or Self-Preservation, 300 pages. Price, only $1. Contains fifty valuable prescriptions, either one of which is worth more than ten times the price of the book. Illustrated sample sent on receipt of 6 cents for postage. Address Dr. W. H. Parker, 4 Bulfinch St., Boston, Mass.

The Baker Blower runs the largest sand blast in the world. Wilbraham Bros., 238 Frankford Ave., Phila., Pa.

Magnets, Insulated Wire, etc. Catalogue free. Goodnow & Wightman, 176 Washington St., Boston, Mass.

Forsaith & Co., Manchester, N. H., & 213 Center St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

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

H. Prentiss & Co., 14 Dey St., New York, Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

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

Linen Hose.—Sizes: 1½ in., 20c.; 2 in., 25c; 2½ in., 29c. per foot, subject to large discount. For price lists of all sizes, also rubber lined linen hose, address Eureka Fire Hose Company, No. 13 Barclay St., New York.

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

Eclipse Portable Engine. See illustrated adv., p. 189.

Bradley's cushioned helve hammers. See illus. ad. p. 206.

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

Band Saws a specialty. F. H. Clement, Rochester, N.Y.

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

Yacht Engines. F. C. & A. E. Rowland, N. Haven, Ct.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

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

New 8½ foot Boring and Turning Mill for sale cheap. A first class tool. Hilles & Jones, Wilmington, Del.

A well equipped Machine Shop desire to manufacture special machinery. Address T. H. Muller, care of P. O. Box 532, New York.

The New Economizer, the only Agricultural Engine with return flue boiler in use. See adv. of Porter Mfg. Co., page 206.

Walrus Leather and Bull Neck for Polishing all Metals. Greene, Tweed & Co., 18 Park Place, New York.

Oak Tanned Leather Belting, Rubber Belting, Cotton Belting, Polishing Belts. Greene Tweed & Co., N.York.

Pays well on small investments; Magic Lanterns and Stereopticons of all kinds and prices; views illustrating every subject for *public exhibition and parlor entertainments*. Send stamp for 80 page Illustrated Catalogue. Centennial medal. McAllister, 49 Nassau St., New York.

Cooper Manufacturing Company, Mt. Vernon, Ohio, Manuf's of Stationary, Portable, and Traction Engines, Saw Mills, Grist Mills, Mill Machinery, etc. Engineers and Contractors. Circular free.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

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

Cut Gears for Models, etc. (list free). Models, working machinery, experimental work, tools, etc., to order. D. Gilbert & Son, 212 Chester St., Philadelphia, Pa.

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

Self-feeding Upright Hand Drilling Machines of superior construction. Pratt & Whitney Co., Hartford, Ct.

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

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

Steam and Gas Fitters' Tools a specialty. Send for circulars. D. Saunders' Sons, Yonkers, N. Y.

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

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

NEW BOOKS AND PUBLICATIONS.

ON THE USE OF THE BAROMETER ON SURVEYS AND RECONNOISSANCES. By Lieut. Col. R. S. Williamson. Washington: Government Printing Office.

A compendium (without plates) of Lieut. Col. Williamson's paper on the barometer, professional papers of the Corps of Engineers, No. 15, which puts this useful manual in a form convenient for field use.

A PRACTICAL TREATISE ON LIGHTNING CONDUCTORS. By H. W. Spang. Philadelphia. 12mo, paper, pp. 44.

Advocates Mr. Spang's system of non-insulated lightning conductors, instead of the ordinary insulated lightning rods.

THE ILLUSTRATED SYDNEY NEWS.

The *Illustrated Sydney News* has sent out a special invitation issue, designed to attract visitors to the International Exhibition at Sydney. It is an exceedingly creditable bit of enterprise, the numerous and excellent illustrations making a particularly good impression. There are given besides a four column leader on the Exhibition, descriptions of the buildings and grounds, and a large amount of information as to the climate, geography, population, and products of the colony.

SPONS' ENCYCLOPEDIA OF THE INDUSTRIAL ARTS, MANUFACTURES, AND COMMERCIAL PRODUCTS. Edited by G. G. Andre, F.G.S. New York: E. & F. N. Spon, 30 parts, each 75 cents.

Parts 5 and 6 of this Encyclopedia complete the article on potash, and add soda, alloys, alum, alumina, arsenic, asbestos, asphalt, assaying, atomic weights, baryta, and beverages, the last including aerated waters and beer.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

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

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

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

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

(1) W. E. M. writes: I am proprietor of a meat market at this place, also a subscriber for your paper. Last night, when going in my cooler, I noticed that a quarter of beef killed the day before gave forth a phosphorescent light, also blood that had dropped to the floor when spread over quite a surface lit the room so that I could distinguish objects for five feet. Can you explain this phenomenon? A. Many organic as well as inorganic substances exhibit the phenomenon of phosphorescence under certain circumstances. The cause is not definitely understood. Consult Phipson's "Phosphorescence in Minerals, Plants, and Animals;" also Becquerel's "La Lumiere, ses Causes et ses Effets." See article on p. 199, Vol. 40, SCIENTIFIC AMERICAN.

(2) A. W. P. asks: 1. Is there an instrument or anything that a man can use to find gold or silver coin that has been hidden underground? If so, please inform me where one can be obtained. A. A pick and shovel answer a good purpose. 2. I have a small engine, cylinder 5x10, makes 200 revolutions per minute; how much lead must I give the cut off valve—it cuts off at full stroke? I use 60 lb. of steam and the engine will pound. The pump piston is made fast to cross head. A. You should give the cut off valve at least 1-16 inch lead, and you may increase it, provided it does not reopen before the main valve closes.

(3) E. R. asks: 1. How does a vacuum rate as an insulator of electricity? A. Electricity cannot pass through a perfect vacuum. 2. What is the best metal to use for ½ inch pipe to contain cold drinking water, as cheap as is consistent with regard to health? A. Iron. 3. Are the contributions that you weekly announce under head of "Communications Received" all printed in the AMERICAN, or are part printed in the SUPPLEMENT? A. Some are published in the SCIENTIFIC AMERICAN, some in the SUPPLEMENT, and some not at all.

(4) E. S. asks for the surest method of silver plating large quantities of steel knives. The silver peels. I have no trouble with other metals. My solution deposits beautifully, but in burnishing comes up very blue. What is the cause? A. Your trouble is doubtless due to imperfectly cleansing the work or putting it in the bath before closing the circuit. Clean with hot potash or soda, and with dilute sulphuric acid and pumice stone or fine clean sand if necessary. The whitening bath should not be too strong, and should be worked with an extra cell or two.

(5) E. S. N. asks whether the black oxide of manganese will answer to mix with copper and tin to make the manganese bronze, mention of which was made in a late number of the SCIENTIFIC AMERICAN. I find the metallic manganese is too expensive (costing some $200 per lb.) I find manganese classed among the metals difficult to fuse. Will the oxide melt at the temperature of molten copper? A. Yes; reduce the oxide to an impalpable powder (120 mesh), mix it with an excess of powdered charcoal, and add the mixture gradually to the copper. Under these circumstances the latter will take up the small quantities of the manganese reduced by the carbon.

(6) E. A. E. asks: 1. In the freezing of 25 lb. of water at 60° Fah., how much heat must be given off? A. Sufficient to raise about 22 lb. of water from the freezing to the boiling point. 2. What quantity of crushed ice and salt, mixed in the proportion to produce the greatest cold, will, in passing to the fluid condition, absorb this quantity of heat? A. In practice from 50 to 70 lb. of a mixture of 2 parts ice and one of salt would ordinarily suffice to cool the water to the freezing point.

(7) B. A. asks: Which is strongest or preferable for general work, a pulley (from 18 to 60 or more inches diameter) with curved or straight arms, and why? A. Formerly pulleys were cast with curved arms, with the idea that they would produce less shrinkage strain, as upon cooling they would yield or spring to the pressure, but the art of proportioning and casting pulleys has been so improved that we think the curved have little or no advantage over the straight arms.

(8) E. F. M. would like to know (1) if ships of medium size are propelled with screw propellers of four blades. A. Yes, from 8 to 14 feet diameter. 2. What size and how long are the blades? A. The length of the blades is the radius of the propeller, less the radius of the hub. 3. What width? A. From 20 to 30 inches. 4. At what angle do they strike the water? A. Generally from 55 to 70 degrees. 5. How wide a space of water would be displaced if turned without any forward or backward movement of the vessel? A. They are assumed to displace a column equal to their own diameter.

(9) O. T. G. writes: 1. In steam engine with 7 inch cylinder, 10 inch stroke, what should be proper dimensions of area of induction ports in square inches? A. ⅝ inch x 4½ inches. 2. Area of eduction ports in square inches? A. 1 inch x 4½ inches. 3. Inside diameter of steam pipes? A. 2½ inches diameter. 4. What number of revolutions should such engines make with 50 lb. pressure in cylinder. A. It depends upon the amount of work it has; the speed of an engine is generally determined by the character of the work or machinery to be driven. 5. Please give rules for calculating the above. A. The above will give about the usual proportions for engines of this class. There are no rules for proportions applicable to all kinds of engines.

(10) D. & C. ask: 1. Can you tell us of a better way to smooth spokes, as they come from the lathe, than the sand belt? A. No. 2. We have trouble in getting the ground glass to adhere to the ducking belts. If there is no better way than to use the belts, is there a better cement than common glue for fastening the glass or emery to the belts? A. Apply a rather thick coating of good tough glue to your belt; heat the sand to 300° and press the belt into it. This method allows the sand to become deeply embedded in the glue. 3. How can we season oak hubs without their cracking, and the quickest way? We want to season them in three months, if possible. A. They are sometimes seasoned quickly by steaming, but this method cannot be recommended. Dry the ends superficially, and apply a coat of raw linseed oil.

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

T. L. F. & Co.—No. 1. A compact limestone resembling that from the celebrated Solenhofer mines, used extensively for lithographic purposes. No. 2. Quartz. No. 3. Impure crystallized lime carbonate. No. 4. A variety of calcite. No. 5. A fine marble. No. 6. Semi crystalline impure limestone.—C. A. B.—The clay will probably make excellent bricks, but contains too much iron oxide, lime carbonates, silica, etc., to be useful for pottery.—J. W. K.—It is a rich magnetite—magnetic oxide of iron. A valuable ore of iron if free from phosphorus.—S. B. M.—The sample of resinous substance appears to be of vegetable origin. A larger sample would be requisite to properly classify it.—E. C. W. —Galena—sulphide of lead. It probably carries traces of silver. To ascertain the value would require an assay. —A. L. F.—1. Flint containing crystals of feldspar. 2. Similar to No. 1. 3. Feldspar rock with crystals of hornblende. 4. Similar to No. 1. 5. Conglomerate.—T. B. M.—Feldspar, of little commercial value.

COMMUNICATIONS RECEIVED.

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[OFFICIAL.]

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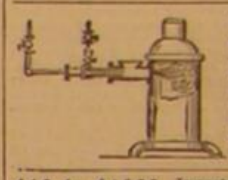

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Vol. XLI.—No. 15. [NEW SERIES.] NEW YORK, OCTOBER 11, 1879. [$3.20 per Annum. [POSTAGE PREPAID.]

THE HYDROMOTOR.

The vessel represented in our engraving is propelled by a new apparatus invented by Dr. Fleischer, and the patents are managed by Fleischer's Patent Hydromotor Company, of Kiel, Germany. The craft is propelled without engine, paddle wheels, or propeller, and it is steered without a rudder. The invention is based on the principle of hydraulic reaction, and it embodies several novel and valuable features, which, according to the reports that have reached us, have rendered the hydromotor a success.

The use of a reactive jet of water as a means of urging a vessel forward is not of itself new, but the means employed by the inventor of the hydromotor to draw the water in and eject it are quite novel.

In the engraving Fig. 1 is a side elevation of the vessel, having a portion of the side broken away to show the arrangement of the propelling apparatus; Fig. 2 is a plan view of the boiler and steam cylinders; and Fig. 3 is a transverse section of the vessel, showing a rear elevation of the propelling apparatus.

Two cylinders, B, are connected with the steam boiler by suitable pipes, and the steam supply is controlled by the valve, A. Each steam cylinder has two suction pipes, F, and two discharge nozzles, H, connected with the cylinders by pressure pipes, G. The suction pipe is provided with a valve, E, and the discharge pipe has a valve, D. Below the cylinders and between the discharge pipes there is a condenser, I, having connected with it the air and feed pump, K. The steam used in the cylinders passes through superheaters which surround the chimneys, and its admission to the cylinders, B, through the valves, A, is controlled by a float in each cylinder.

The discharge nozzles are swiveled so that they may turn in any direction, and thus control the course of the vessel by changing the direction of the propelling force.

The great difference between this apparatus and its predecessors is that the steam pressure acts directly upon the surface of the water without the intervention of pistons or intermediate machinery. Friction, complications, expense of repairs, liability to breakage, are in a great measure, if not entirely, avoided, and it is said that the method of applying the power has proved highly economical and satisfactory. The boilers of the Pellworm and their appurtenances are precisely like other boilers. The steam is admitted to the upper part of the cylinders through the valves, A, which are controlled by floats, as before observed. The steam forces the water out through the discharge nozzles with considerable velocity, and the reactive force carries the boat forward. The steam is cut off at the early part of the stroke, and the expansive force completes the work. It may be imagined that considerable loss of power might arise from condensation in the cylinders, but as the water is covered with a film of oil, and a certain amount of oil and hot water clings to the surface of the cylinders and covers the inflowing water, the loss

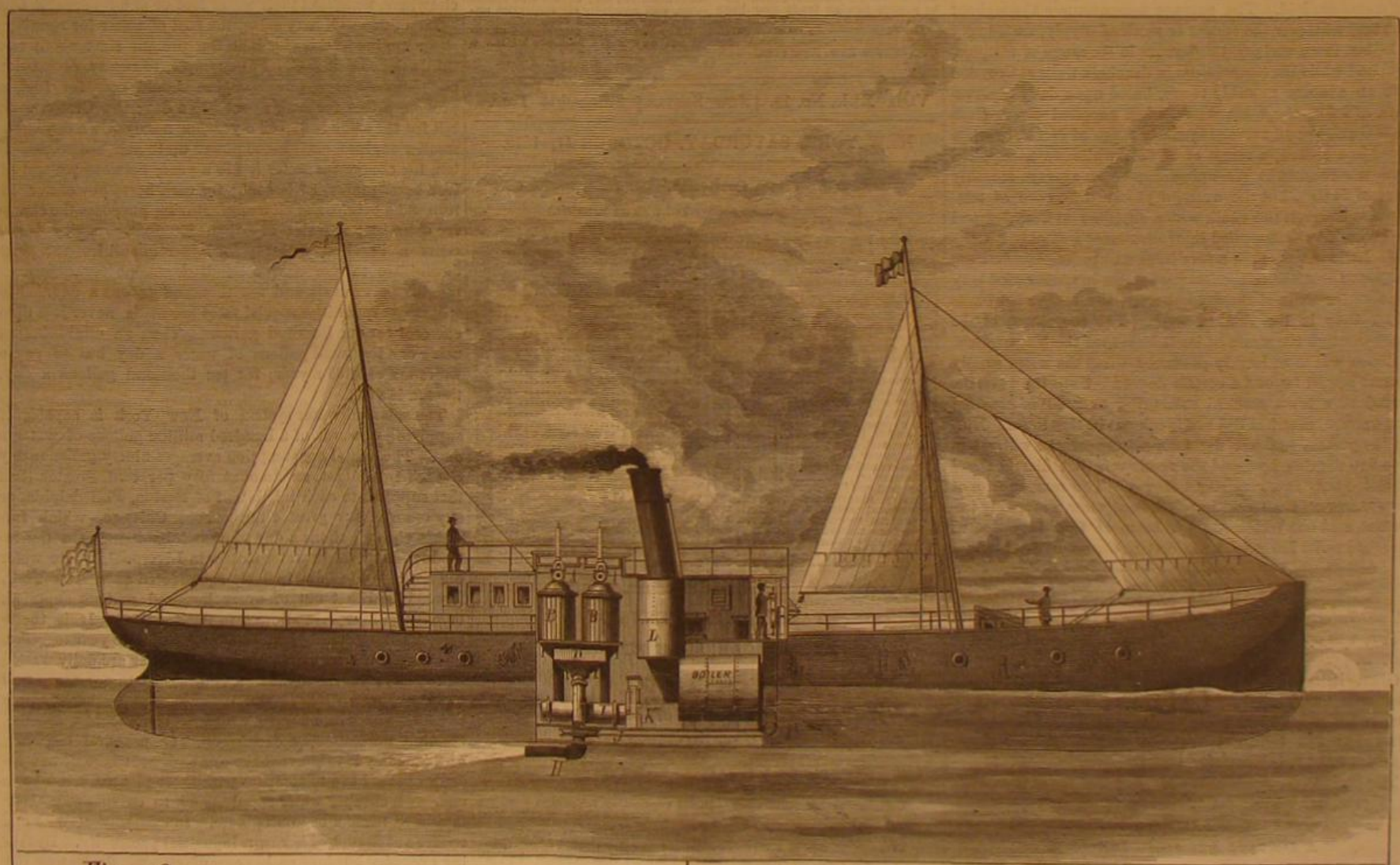


Fig. 2.

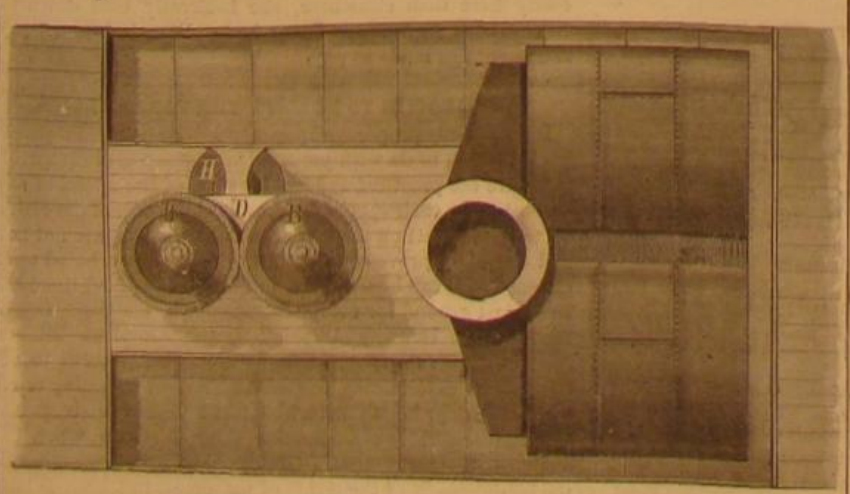
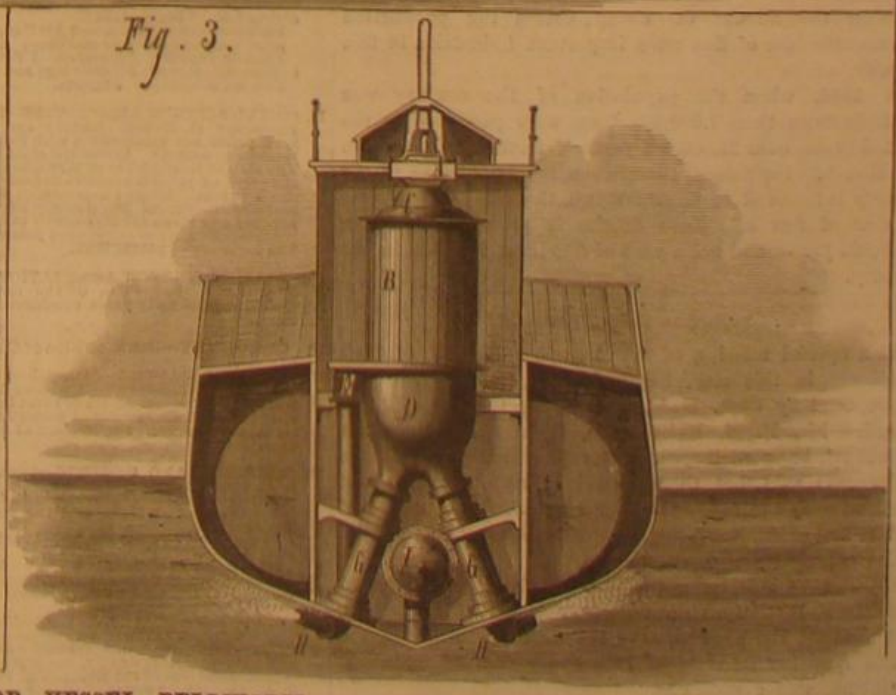


Fig. 3.



THE NEW HYDROMOTOR VESSEL PELLWORM.

is slight. When the water in the cylinders reaches the prescribed level the exhaust valve communicating with the condenser is opened, and as the vacuum is formed water enters the cylinders through the supply valves, and the operation is repeated.

We have been informed that Commander Grenfell, of the British Navy, a Russian engineer, and the technical director of the Flensburg Ship Yards, recently inspected the hydromotor as applied to the Pellworm, and were all highly pleased with its performances. It is said that the technical director wrote Mr. Howalt, the associate of Dr. Fleischer, that he had been converted from a decided opponent to a friend and champion of the invention, having figured over the formulas used in building the hydromotor and finding them both new and correct. Our informant also tells us that the Imperial German Navy has adopted the hydromotor after a personal inspection by the War Minister

The Pellworm is 75 feet long, 12 feet beam, draws 3½ feet of water, is flat bottomed, and is capable of steaming 6 knots per hour The apparatus develops 25 horse power. It has been ascertained that 40 per cent of power of the steam is realized in the propulsion of the boat.

THE TEMPERATURE OF WATER SUPPLY.

At the recent meeting of the British Association for the Advancement of Science a paper was read by Mr. Baldwin Latham on the temperature of the water supply of towns. The author pointed out the fact that any increase in the temperature beyond 55° rendered the water unwholesome. The temperature of the water supply of a town, as furnished by public waterworks, was totally independent of the temperature of the water at its source of supply, and invariably the temperature of the water was the temperature of the ground at any season of the year at the depth at which the distributing mains are laid. The average temperatures throughout the year, whatever the source or mode of supply, varied very little, but there was great difference in the range of temperature; and while the temperature in the chalk wells at Croydon gave an average monthly range, based upon daily observations, of 0·61°, the same water, when supplied direct from the mains, gave an average monthly range of 21·14°, or when stored in a cistern, a range of 28·05°; while water supplied from the Thames in Westminster gave an average monthly range of 24·69°, but the average yearly difference of temperature between the chalk water supplied at Croydon and the Thames water supplied in Westminster was only 0·67°.

Mr Latham had taken a very large number of observations, and found that the temperature of water in wells varied very greatly. In some of the deepest wells the temperature was colder than in the shallow wells. The movement of the water through the strata of itself increased the temperature. Diarrhea was most largely produced when the water supply became heated beyond a certain degree. Until the water delivered to a town reached something over 60° of constant temperature, diarrhea did not break out in that town. During the present summer the temperature of the water had been five degrees less, and the result was that diarrhea had prevailed only in a very slight degree. The temperature of the water was, from a sanitary point of view, extremely important, and one which ought to be more fully investigated in regard to its influence upon certain classes of disease.

THE SYDNEY EXHIBITION.

The International Exhibition at Sydney, New South Wales, was opened September 17th, with promises of great success.

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Isthmus Ship Transit.

At a special meeting of the American Society of Civil Engineers, in this city, September 24, the ship railway, as proposed by Capt. Eads, was among the subjects discussed. Mr. F. M. Kelly, who, more than any other individual, has contributed to the exploration of the Isthmus of Panama, said that there would be no difficulty about building such a railway. It would be merely a matter of dollars and cents, but it might be difficult to select a route with the proper grades.

Mr. T. C. Clark, who presided at the meeting agreed with Mr. Kelly that a ship railway was perfectly feasible, and thought the suggestion of Admiral Ammen, that the whole question be referred to a convention of American engineers, was a good one.

Scientific American.

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Demonstration of the Rotation of the Earth by the Gyroscope. By J. M. ARNOLD. 1 figure.

WATER FOR INDUSTRIAL USES IN NEW YORK.

A significant feature in connection with the water supply of this city is the increasing resort to artesian wells by large brewing establishments and other users of much water. Among the brewers who have made or intend to make themselves independent of the Croton water supply, are Elias & Betz, 54th st. and 1st ave., who have a well 425 feet deep; Clausen & Price, 59th st. and 11th ave., whose well is 625 feet deep; David Jones, 44th st. and 1st ave., well 662 feet deep; Geo. Ringler & Co., 92d st. near 3d ave., well 390 feet, and going deeper; and P. Doelger, 55th st. near 1st ave., whose well in process of construction is intended to be 600 feet deep.

As a rule these wells have a bore of 6½ inches, and cost from $6 to $10 a foot. Their great advantage lies in the cheapness of the water thus secured. The first well named is said to have paid for itself the first year. The Croton water tax paid by the larger breweries rises as high as $6,000 a year, and an equal outlay will usually sink an artesian well, securing a permanent supply independent of Croton water. The purity of the deep well water is also an advantage, and the same may be said of its average low temperature—about 52° Fah. The difference between that and Croton water at summer heat may make a saving of $20 a day in the ice bill of a large brewery. Artesian wells have also been sunk by manufacturers of mineral waters, that of John Matthews going down 300 feet. The deepest well, 1,001 feet, supplies the Higgins Carpet Factory with pure water for dyeing.

Only large establishments, however, such as require a large volume of water daily, can afford the first cost of artesian wells. The vast multitude of smaller manufacturing concerns, which need water chiefly or solely for steam power, are burdened by a Croton water tax which places them at a serious disadvantage in competition with shops elsewhere, which get their water free or at a reasonable cost.

Incredible as it may seem, the cost of water for running a steam engine in this city is at the present time about two-thirds the cost of fuel. For example, to run an economical one thousand horse power engine should cost for fuel, at present prices for coal, about $25 a day; the Croton water bill for the same is $5,062 a year, or nearly $17 a day. For smaller engines, each horse power up to and not exceeding ten, the charge for water is $10 a year; between ten and fifteen horse power, $7.50 each; for each horse power over fifteen, $5 a year. For all manufacturing purposes the charge for quantities of water less than 250 gallons a day is five cents a hundred gallons; for larger quantities the price diminishes to two cents a hundred gallons for quantities ranging between six and ten thousand gallons a day. For still larger quantities special rates are made, never less than one cent for one hundred gallons. Thus an establishment using one thousand gallons of water a day has to pay a water tax of $105 a year; for ten thousand gallons a day, the tax is $600.

The splendid water system of New York is capable of supplying upwards of a hundred million gallons of water a day. The actual consumption averages ninety gallons a day to each inhabitant, an amount fifty per cent. greater than that supplied to each inhabitant of Boston, Philadelphia, or any other of our great cities except Chicago, which furnishes eighty gallons a day to each inhabitant. On the introduction of waste water meters in Liverpool, where water did not begin to be so lavishly squandered as in New York, it was found that out of every hundred gallons supplied, seventy gallons were allowed to run to waste. It is, therefore, speaking within bounds to say that, the year together, an average of fifty million gallons of water are daily wasted in our city; yet the moment a man wishes to use any small portion of such water productively, the tax gatherer comes down on him with charges which, if not needless, are cercertainly unreasonably excessive. The practical tendency of this policy is to prevent the establishment here of new industries that have to compete with those planted in localities offering a cheaper water supply, and to drive away those that have made a beginning here. In this way New York strikes at the root of her own industrial prosperity. By laying excessive burdens on her manufacturers, she lessens the variety and volume of the employment possible to her working citizens; and by making production relatively more costly here than elsewhere, she indirectly cuts down the wages of her workmen. It is a bad policy; it does not pay, and cannot be made to pay.

CONSPIRACIES TO NULLIFY THE PATENT LAWS.

It is perfectly proper, and possibly a good policy, for parties having much to do with patented inventions to club together to secure the practical and legal testing of the merits of new inventions in their special field, and the validity of the claims on which patents on them rest. All inventions are not new and useful improvements, nor are all patents based upon claims which can be sustained in the courts. And there can be no just ground for complaint when the members, say of the Western Railway Association, the American Millers' Association, or the Car Builders' Association, resolve to act together in determining the advisability of adopting or refusing to adopt inventions which come within their special departments. It is quite another thing, however, when the members of such associations agree to sustain each other in the infringement of the rights of patentees, in lobbying bills for the invasion or destruction of the inventors' constitutional privileges, or in thwarting the purpose of the patent law by refusing to consider or adopt improvements which are patented, simply because they are patented.

To encourage men to seek for new devices, for instance, for increasing the comfort and safety of travelers by rail, the United States declare that the inventor of such a device shall enjoy—if he wants it—the exclusive right for a term of years to make, use, and sell his invention. In their private capacity the managers of railway corporations have a perfect right to decline to buy or use any and every invention, whether intended for railways or otherwise, without giving a reason to anybody. As railway managers they have no such right, nor is it good policy for them to assume it.

The charter of a railway company is, in a sense, equivalent to a patent. It is granted by the people—just as a patent is—for a specific purpose, namely, the public convenience and profit. It conveys certain privileges, not for the benefit of the railway managers, but because they are essential to the attainment of the end aimed at. The road has, for example, the right of way through an inventor's farm, and in their official capacity its managers can demand what they cannot as private citizens. With official privilege goes official responsibility. As they have a right to take the inventor's land for the public good, if such be the case, so they are morally, if not legally, bound to use his invention, if the public good demands it. They cannot safely play fast and loose with official rights and responsibilities, demanding the one and shirking the other, as suits their personal pleasure and profit. The public gives, and it may take away, to the pecuniary loss of those who misuse the public trusts confided to them.

There is another view of this matter which anti-patent associations may profitably take into account. Since its foundation the government of the United States has manifested a desire to multiply and improve our industrial arts by the encouragement of new inventions. Experience has proved the desire to be a wise one, and has practically justified the means adopted to attain the objects of that desire, especially the means which costs least and yields the most—the granting of patents for new inventions. More than ever before the American people are now satisfied that the encouragement of invention pays.

Are they likely, then, to be pleased with the systematic discouragement of invention—the organized thwarting of the popular will, to say nothing of the attendant hazarding of public comfort and safety—by corporations which owe the possibility of their existence to public grants of privilege?

At the last meeting of the Car Builders' Association certain draw-bar appliances were substantially condemned, so far as it could be done by that body, simply because they were patented. The *National Car Builder* tersely puts their position in this wise:

"A freight brake is wanted—something that will enable a locomotive engineer to handle a long, loaded train as easily as he does his throttle lever. The thing is invented, let us suppose, and the inventor asks the association to give it their formal approval. The members reply, collectively: It is an excellent invention—all we want or could expect, and more too—but we cannot recommend it, because it is patented. Annul or cancel the patent, and make the brake public property, free to all, and we will sound its praises through the length and breadth of the land."

In refusing to "recommend" an invention, the association substantially declares the determination of its members not to use it in building or equipping cars.

We would respectfully suggest that action of this sort is as hazardous as it is unjust and unwise.

If inventions looking to the public benefit are thus to be killed, for the sole reason that they are patented, the public, which offers the patent as encouragement to invention, may take steps to prevent or punish such conspiracies against the public weal and will. And in retaliating it is quite possible for the people to be too severe in their enactments compelling the adoption of improvements. We should prefer to have inventions left to force their way by inherent excellence; but if they should ever be pushed into use by legislative enactments, those who have conspired to nullify the patent law as it stands will have only themselves to blame for the change.

EXTRACTION OF OILS BY MEANS OF SOLVENTS.

The extraction of oils and fats by means of the solvents, benzine, gasoline, and bisulphide of carbon, has grown up to be an important industry in the United States during the past ten years. At the present time, the capital invested in business is probably about $500,000, and the number of independent factories, four to six. The solvents employed are the petroleum benzines of the lowest boiling points, and the gasolines, the latter being used in the cases where it is necessary to remove all traces of the solvent from the finished products. Bisulphide of carbon was once used on a considerable scale for the extraction of oil from corn (maize) under the theory that the oil from corn would be much more valuable for the production of alcohol and starch. The industry, however, was discontinued mainly by reason of the high cost of the bisulphide and the risk in its use from inflammability and unhealthfulness. It is not likely that bisulphide of carbon will come into extensive use in this country, so long as the supply of petroleum is continued. It is well known that it is a much more rapid solvent than the petroleum products, but it is believed that this advantage is more than overbalanced by the objections to it. The petroleums, when heated to the normal boiling point or over, are nearly as rapid as the bisulphide.

The materials operated upon with benzine are especially the residues from fat rendering, and castor oil seed cake or pomace. The largest establishment of this kind is at Philadelphia, and is carried on by a joint stock company, under the patents of Adamson. The dissolving cylinders are horizontal—one say 8 feet in diameter and 20 feet long. The cylinders are provided with a railway, and the material is brought into the cylinders closely packed on trucks or cars. At the bottom of the cylinders are steam pipes traversing the whole length. When the cylinders are charged and their doors bolted on, benzine is let in so as to cover the steam pipes, the steam is let on, the benzine evaporizes, and condenses through the material, dissolves the fat, and the solution falls down to the bottom. The solvent again vaporizes and rises again to extract more oil. The dissolving cylinders or extractors are provided with suitable instruments to determine the temperature, height of the solution, etc. The fat or oil, after distilling off its solvent, undergoes a special refining treatment. The favorite raw material for this process is "beef scrap" and "pork scrap," containing 12 to 15 per cent of fat, which is practically extracted in the process. The residues are ground and used as fertilizers, under the name of azotine, and contain about 15 per cent of ammonia. The extraction process lasts from 24 to 36 hours. The extraction of oil from castor pomace is conducted in all respects as above. The fats and oils resulting from the process are mostly used as lubricants for machinery, and are not of the quality needed for good soap.

The works at Philadelphia have suffered severely from fire, having been at least twice wholly consumed. It is evident from the fact that they are just reconstructed that the industry is found to be profitable.

About ten years since an incorporated company began the manufacture of extract of hops under the plans of Professor Charles A. Seeley, making use of gasoline of specific gravity 80° to 90° B., as the solvent. The industry has steadily and healthily grown, and promises to become of the first importance. The useful matter of the hops by this process is completely extracted, is of small bulk compared with the hops, and is not at all deteriorated by keeping. The extractors of Seeley's system are vertical, are charged at the top, and discharged at the bottom. They are heated by steam, being jacketed on the lower half for that purpose, and the pressure of the vapor of the solvent serves as the motive force for discharging the solution into a separator or still. The apparatus is so constructed that the solvent travels in a circuit and does not go out of the connected parts of the apparatus. The separator or still consists of a vertical iron coil surrounded by steam, into which the solution is fed at the top. During the descent of the solution, the solvent is volatilized and escapes through a stand pipe to the condenser, while the oil or extract of hops, etc., flows away at the bottom.

Gasoline, according to the above plan, has been used upon meat scraps, cotton waste, seed cake, etc., quite successfully, as to the quality of the produce from it, as it is wholly free from petroleum contamination. In respect of the quality of the produce, gasoline is probably to be preferred to bisulphide of carbon, and in first cost and ease of working it is also plainly superior.

The oil extracting industry by means of solvents may be considered as firmly established in America, and as promising a very great extension in the near future. There are at present 20 to 50 patents relating to the industry, and there is no doubt that it will continue to employ the talent of inventors. S.

THE POLICY OF PATENT LAWS.

At the recent meeting of the Social Science Association at Saratoga, Mr. Frederic H. Betts, of this city, read a paper tracing at considerable length the historical development of patent laws, and traversing with singular skill and cogency the arguments of those who oppose the theory and practice of granting patents for new and useful inventions. The positions taken by Mr. Betts are those which have been advocated in detail, over and over again, in this paper—those which every friend of industrial progress and the rights of inventors will justify and applaud. And he developed his thesis so coherently, so forcefully, and with such aptness of illustration, that his paper makes the most readable and convincing argument for mantaining the integrity of our patent law that we have seen for a long time. In view of the probable renewal of the assault upon our patent system in Congress next winter, the paper is as timely as it is admirable.

In every congressional district the friends of the patent system—that is, as to its underlying principle and policy—should see to it that their representatives do not go to Washington without an opportunity, at least, for becoming acquainted with the actual standing of patent rights in law and equity and sound industrial policy, as therein set forth.

Mr. Betts begins by sketching the early history of patent rights for inventions, tracing meanwhile the development of the idea that patents are to be regarded as a fair bargain, the inventor contracting to contribute a new item to the stock of common knowledge of practical utility for purposes of trade, the public offering in return the means of retaining the exclusive use of the invention for a term of years. He then takes up and answers the objections raised against patent laws, both theoretical and practical, and proves the claims of inventors to be consistent with natural justice. He shows that the right of property in ideas, so far from being exceptional in the case of patents for invention, is widely recognized among men, and that its increasing recognition is one means of estimating progress in civilization. To the objection that inventions are intangible, incapable of precise definition, and unsuited to be the basis of property rights, he replies by showing that all civilized men recognize and respect incorporeal rights. The difficulty of defining the exact limits of such rights may be great, but that has never been successfully urged as a reason for their abolition. Of all incorporeal rights, that of character and reputation is the least capable of measurement, yet for that very reason it has been most jealously guarded.

The objection that any individual inventor is but one of many working in the same field, all drawing from the common stock of knowledge and experience, and that to grant a patent to the first claimant is to set up a barrier to further progress, is considered at length and effectually disposed of. The alleged fact of the frequent simultaneous invention of the same device by several independent workers is shown to be untrue; and the asserted hinderance to progress by patenting the successive steps of it, is equally shown to be inconsistent with common experience.

On the contrary, the evidence is abundant that the grant of patents directly and powerfully promotes the progress of science and the arts.

Particularly interesting and valuable is the review of the growth and progress of ideas in respect to patents as shown in judicial decisions and legislative enactments—a development of a true appreciation of the rights of inventors, due not to mere change of sentiment, but to an increasingly full and exact understanding of the nature of trade and the proper province of laws in relation to it. This section will be found of special value in combating those reactionists who so boldly assert that the progress of thought is in a direction opposed to the principles underlying patent laws.

In closing, Mr. Betts proves statistically the exact coincidence of industrial progress with the increase in patent rights. Patents and trade go hand in hand. Take away the motive of invention and an important ally of improvement is destroyed. This has been the experience of industrial nations the world over. And American experience has shown that the more widely that motive is brought to bear on all classes, the more accessible patents are made to the multitude, the more rapid will be industrial progress, the more steadfast and general the country's industrial prosperity.

Mr. Betts' paper will be found in full in this week's issue (No. 197) of the SCIENTIFIC AMERICAN SUPPLEMENT.

The Movement of Breadstuffs and Provisions.

The movement of breadstuffs continues extremely active. The receipts of flour at this port the week ending Sept. 23, were 104,361 barrels, chiefly by rail. The receipts of grain were:

	By Canal.	Railroad.	Coastwise.	Total.
Wheat, bush	1,229,400	817,770	200	2,057,370
Corn, bush	1,075,450	45,850	....	1,121,300
Oats, bush	28,100	150,015	....	178,915
Rye, bush	204,800	7,602	400	212,802
Barley, bush	12,000	29,068	588	41,656
Total bush	2,560,550	1,050,305	1,188	3,612,043

The clearances of sailing vessels and steamers carrying breadstuffs from this port, the week ending Sept. 19, numbered one hundred and five. The total grain export was 50,643 barrels of flour; 2,329,279 bushels of wheat; 973,506 bushels of corn; 44,317 bushels of oats; and 107,613 bushels of rye.

During the same week there were exported 4,529 barrels of pork; 6,259,932 pounds of bacon; 3,293,122 pounds of lard; 2,466 pounds of beef; 611,005 pounds of butter; 2,684,468 pounds of cheese; and 917,021 pounds of tallow.

The Highest Telegraph Station.

A telegraph station has been lately established at the Ryffel Hotel, under the Ryffelhorn, in the Valais. It is about 8,500 feet above the level of the sea, and is the highest telegraph station in Europe. A Swiss paper has claimed that it is the highest telegraph station in the world, but this is a mistake. The station on Pike's Peak, in the Rocky Mountains, is 14,000 feet above sea level, and is, therefore, something higher than that at the Ryffel Hotel.

The Ship of the Future.

After pointing out the great faults and failures of the present style of ocean vessels, a writer in the *American Ship* avers that the ship of the future will carry no ballast. If a sailing vessel, her sail area and displacement will be so well balanced that, if the rudder were lost or disabled, the vessel could be guided on her course by her sails. The center of effort of sails and of gravity of vessel will be adjustable, so as to harmonize with the griping influences of the lee line of flotation.

The ships of the future will be profitable, for they will be built for and under a specific service, on scientific principles; they will be designed, built, loaded, and navigated, as they have never been, with direct reference to their equilibrium of stability, the safety of vessel and cargo, with the lives of those on board. The rating characterization of vessels will then be determined by an international, or an independent, board; the British Lloyds will have passed away, only to be remembered as a corrupt organization. The material of vessels will be steel for metallic, and bent timber frames for wooden vessels. Under this new dispensation of genius, ocean, mail, and passenger steamers will be non-sinkable, and make their Atlantic trips in six instead of seven-and-a-half days, with a roll angle not exceeding eight degrees.

MECHANICAL INVENTIONS.

Mr Montague S. Hasie, of Vicksburg, Miss., has patented a novel mechanism to be employed for the utilization of refuse cotton, technically known as "cotton motes." This consists of the refuse of the cotton gin after the process of ginning, and it has heretofore been thrown away as useless, although known to contain a large proportion of cotton fiber, the difficulty of separating the cotton from the foreign substances being considered too great to justify the expenditure of the necessary time and labor in that direction. By this machine the cotton fiber is separated from the foreign substances, and is cleaned and condensed, so as to produce from the motes a large proportion of cotton of a good quality, and thereby to make use of what was formerly a total loss.

Mr. Charles S. Adams, of Marshfield, Vt., has invented an improvement in devices for cutting and screw-threading metallic wagon axles. It is especially designed for shortening axle spindles to compensate for the wearing of the wheel boxes.

Mr. Lemuel W. Young, of Elk City, Pa., has invented an improvement in tubing tongs, designed more particularly for screwing and unscrewing the sections of tubing for oil wells, but applicable to general use as pipe tongs.

An improved roller bracket for attachment to the corners of photographic and other screens, for the purpose of supporting them and facilitating their movement on the floor, has been patented by Mr. John G. Stewart, of Carlinville, Ill.

Mr. Louis W. Ott, of Indianapolis, Ind., has patented a bed lounge that forms a lounge or couch when closed, and when open forms a bed. It consists in a movable front piece hinged to the upper portion of the bottom, and connected by a link with the lower portion, so that as the upper portion of the bottom is turned on its hinges the front piece is carried with it and drops down out of the way.

Mr. Charles H. Appel, of Shimerville, Pa., has invented an improved bretzel machine, which is simple, convenient, and forms the bretzels quickly and uniformly.

An improved spur has been patented by Mr. August Buermann, of Newark, N. J. The invention consists in spurs in which the heel band is provided with an elastic or yielding covering of rubber or gutta percha.

Messrs. T. R. Williams, E. R. Williams, and W. J. Williams, of Pittsburg, Pa., have patented an improved sand washing machine. The object of this invention is to furnish an improved machine for washing and cleaning sand as it is raised from a river. The invention consists in the combination of a tapered cylindrical rotating screen, provided with scroll paddles and an elevator for carrying the sand out of the box or well after it has been washed.

An improved hub-boring machine, patented by Mr. Alexander J. Mougey, of Carthage, N. Y., consists in a novel arrangement, a mandrel, a pair of chucks, a series of adjustable centering plates, and an adjustable bit or cutter, whereby provision is made for centering the work, holding it securely in position, and accurately boring the hub.

Mr. Aaron C. Vaughan, of Shane's Crossing, O., has invented a simple and effective form of nut lock which is applicable to the ordinary screw-threaded bolt without alteration. It consists in a nut of the ordinary form having a screw-threaded hole through the center, and having its face slotted about half way through the thickness of the nut, and the edges of the slot drawn together.

Mr. Alexander Gordon, of New York city, has patented an improved ship's log, which is so constructed as to count and register the number of knots run out in a quarter of a minute, and also indicate the knots by sound. It can be readily used by one man, and it is simple in construction and apparently reliable. We call attention to an advertisement in another column.

Mr. Richard H. Hill, of New Haven, Conn., has patented an improved safety elevator, which is so constructed that the motion of the operating mechanism may be reversed automatically as the platform reaches the upper and lower points of its movement, and which will apply a brake automatically when shifting the driving belts, so that the platform cannot run down accidentally.

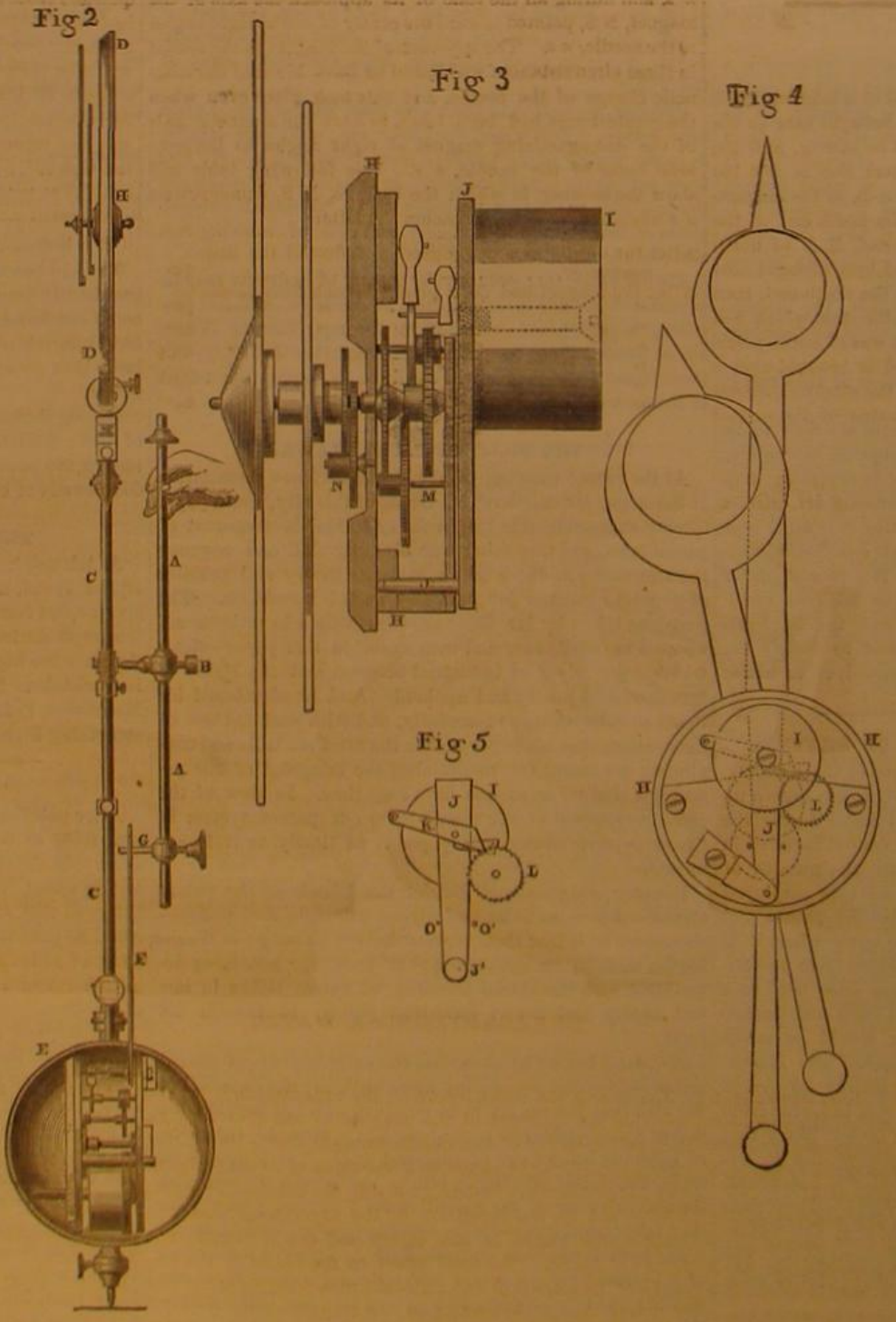
Mr. Martin J. Racer (William Racer, administrator), of La Grange, Texas, has patented an improved suspender button that may be quickly and firmly attached to garments, and that is not liable to tear the cloth or become accidentally loosened.

ROSSET'S CLOCK.

This novel and interesting clock is suspended from the arm of a statuette by a spring on which the pendulum swings.

ROSSET'S CLOCK.

The pendulum is of the gridiron compensating style, and carries at its upper end a glass dial, and the pendulum ball consists of a hollow sphere containing the clock movement.



ROSSET'S MYSTERIOUS CLOCK.

In our engraving, Fig. 1 is a perspective view; Figs. 2, 3, 4, and 5 are detail views showing the construction of the operative parts. The compensated pendulum, C, carries at its upper end a transparent glass dial, D, and to its lower end is attached the hollow globe, E, containing the movement. A forked arm, F, extends upward from the movement, and embraces the pin, G, attached to the lower end of the rod, A, held in the hand of the statuette. In this clock the movement of the arm, F, as it is actuated by the escapement of the clock, gives the pendulum sufficient impetus to keep it in motion.

To the center of the glass dial a small casing, H, is attached which contains the mechanism that moves the hands. In this casing is pivoted an arm, J, carrying the weight, I, and the pawl, K. As the pendulum is oscillated, the weight, I, shifts its position in the casing, H, and the pawl, K, is by this means made to act on the ratchet wheel, L, which, being connected by a train of gearing with the arbor carrying the hands, moves the hands forward regularly. The dial mechanism is shown considerably enlarged in Figs. 3, 4, and 5. In a complete clock, like that shown in Fig. 1, the pendulum oscillates without any apparent cause, and without some explanation it would be difficult to imagine how motion is communicated to the hands, as the casing, H, which contains the dial mechanism is very small.

Protagon.

In the year 1865 Dr. Oscar Liebreich published a memoir in which he announced the discovery in the brain of a definite proximate principle containing phosphorus. Unlike the numerous bodies possessed of ill-defined properties, which had by different writers received the names of cerebrin, cerebric acid, lecithin, or phosphorized fats, this new body could be extracted by an easy process in a state of purity, and to it, probably to indicate it as the first definitely specific constituent of brain matter, Dr. Liebreich gave the name of "protagon." The brain was subjected to a special process, by which the protagon was separated in the form of microscopical needle-like crystals, differing a little in arrangement and form according to the concentration of the solution. As the result of several analyses, Liebreich ascribed to protagon the formula $C_{118}H_{242}N_4O_{22}P$. It was difficult of solution in cold alcohol, more easily so in warm alcohol and ether. In water it swelled and presented the appearance of an opaque jelly, ultimately dissolving so so as to form an opaque solution. For a time observers admitted it to be a definite phosphorized constituent of the brain, and they began to seek for it in various liquids and solids of the body. Hermann announced its discovery in the blood corpuscles, and connected many of the physical properties of these bodies with its presence. Parke found it in the yolk of egg, but Hoppe-Seyler thought that the yolk of egg contained not protagon but lecithin, and though this very distinguished investigator did not commit himself to a denial of the existence of protagon in the brain, still he seemed to have commenced to entertain some doubts about it. In 1868, however, Dr. Diaconow, a pupil of Professor Hoppe-Seyler's, published a paper on the subject which seemed to have an immense influence over the physiological chemists, causing them all to come to the conclusion that Liebreich's protagon did not exist as a definite proximate principle, but that it consisted of a mixture of lecithin with a body free from phosphorus, cerebrin, and causing the master himself to write, "As to protagon, I believe that I must decide for its being a mixture of some glucosid free from phosphorus, as cerebrin, with lecithin;" and so the matter rested until recently, when the whole subject was once more most carefully reinvestigated in the physiological laboratory of Owens College, Manchester, by Professor Gamgee, F.R.S., and Mr. E. Blankenhorn. The process employed in the preparation of protagon, and the result of the ultimate analyses thereof, with a very interesting account of all its previous history, will be found in the current number of Professor Foster's *Journal of Physiology*. As to the result, the fact of Liebreich's discovery is now left beyond a doubt; but the empirical formula for this important principle would appear to be $C_{166}H_{333}N_5PO_{55}$—an alteration from Liebreich's, in all probability owing to the extreme care and the improved methods employed in these late investigations.

PRACTICAL EXPERIMENTS IN MAGNETISM, WITH SPECIAL REFERENCE TO THE DEMAGNETIZATION OF WATCHES.—No. 3.—[Concluded.]

BY ALFRED M. MAYER.

On the Magnetization and Demagnetization of Steel.—To understand thoroughly our process of taking the magnetism out of a watch one must be in possession of certain facts which have been discovered about the magnetization and demagnetization of steel. These facts I will now give.

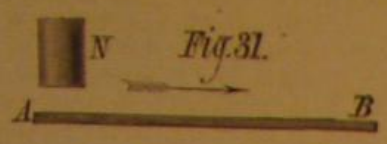


Fig. 31.

Let A B, Fig. 31, represent a piece of steel laid on the table. N is the north pole of a bar magnet, which is held vertically over the end, A, of the piece of steel. Bring the end, N, of the magnet to touch the end, A, of the steel and slide the magnet over the steel, in the direction of the arrow, to the end, B. Slide it off the end, B, and lifting it in the air, again bring N down on A, and repeat the operation. Even after one stroke of the magnet on the steel, the latter will be found to have received a charge of magnetism, which generally increases in strength up to a certain number of strokes of the magnet; after which further strokes of the magnet have no effect in increasing the magnetic charge in the steel. On now taking the steel, A B, to the magnetometer and testing its magnetic condition, as has already been explained in Figs. 7 and 10, you will find that the end, B, of the piece of steel is of S. magnetic polarity. If the bar magnet, N, strokes the steel from B to A, then B will be found of S. magnetic polarity. In other words, it is a general law that the end of the piece of steel *toward* which the magnet slides is of the opposite polarity to that of the end of the magnet which stroked the steel.

It is, however, not necessary for the magnetization of the steel that the magnet should rest on it while it glides over it If the magnet be strong enough, and if the steel be not too hard, the latter may be magnetized by passing the magnet along the length of the needle and at some distance above it, as shown in Fig. 31

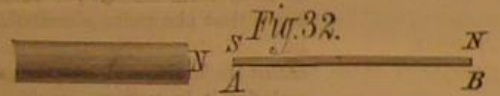


Fig. 32.

Let N, in Fig. 32, stand for the N. end of a magnet, while A B is a piece of steel which has been brought near to the end, N, of the magnet. If the magnet be strong, and the steel of the quality of sewing needle steel, that is, not too hard, you will find on testing the steel, A B, at the magnetometer, that the end, A, which faced the north end of the magnet is of south polarity, while the end, B, is of north polarity. If the piece of steel, A B, had been brought near the south end of the magnet, instead of the north end, then you would have found that the end of the steel which had been nearest the south end of the magnet was of north polarity. In other words, when a steel rod is brought near a magnet it is magnetized, and the end of the steel rod nearest the magnet is of a polarity opposite to that of the end of the magnet toward which the rod points.

If, instead of holding the steel rod at a distance from the magnet, we bring it to touch its end, then the magnetic charge given to the steel will be greater than in the former experiment. The polarity given to the end of the steel which touches the magnet is always opposite to that of the end of the magnet touched.

So much for the magnetization of the steel rod. Its demagnetization consists in taking the magnetism out of it, and is effected by operations similar to those just described in magnetization. These processes we had better describe by the aid of Figs. 31 and 32.

In Fig. 31, let A B be a magnetized rod of steel, with its north pole at A, its south pole at B. We have found out that this rod was magnetized, with its poles as just described, by stroking it from A toward B with the north pole of the magnet, N. The reverse direction of stroking will demagnetize it, that is, if the north end of the magnet be drawn over A B, from B toward A, then the magnetism will disappear from the rod, A B; and if the operation be repeated after the magnetism has disappeared we will even remagnetize the rod; but this remagnetization will place its north pole at B and its south pole at A.

It is not necessary, however, that the magnet should touch the steel rod during the operation of demagnetization. It is sufficient, if the magnet be powerful, to pass it over the steel rod at a distance above it and in a direction always opposite to that in which the magnet moved when it magnetized the rod.

In Fig. 32, let A B be a magnetized rod of steel, having its south pole at A and its north pole at B. This condition of magnetism has been given to it by the presence of the north pole of the magnet, N. Now, if we take away the magnet, N, and then bring up to the bar, A B, the south pole of the magnet, we will find that the rod, A B, will be demagnetized. If the rod, A B, be of very hard steel and the magnet not very powerful, it may be necessary for the magnet actually to touch the rod, A B, in order to demagnetize it.

Here it is in order to describe more explicitly the operation of demagnetization. To demagnetize a rod does not require as strong a magnetic action as that which was required to give the rod its present magnetic charge. So, in performing the operations of demagnetization, we should be careful not to give too many reverse strokes to the rod nor to approach it too near to the demagnetizing magnet. It is better to pass the magnet over the magnetized rod at a short distance above it, and after such operation to test its gradually falling magnetic charge at the magnetometer. The critical point is when this residual charge becomes small; for then the danger is that you will not only demagnetize the rod by the next operation, but will actually remagnetize it, with, of course, its poles reversed.

In the course of my experiments on the demagnetization of watches I made a series of novel experiments on the demagnetization of steel rods placed at right angles to the demagnetizing magnet. The steel subjected to experiment was of the hardness of that of sewing needles. These experiments explain some curious facts in our mode of demagnetizing watches, and therefore form a natural introduction to the practice of our process.

The rods of steel on which these experiments in demagnetization were made were formed of pieces of No. 1 sewing needles. The points and eyes of the needles were broken off, thus leaving rods of about two and one eighth inches long. The rat-tail file magnet was used for the demagnetizing magnet.

The manner of experimenting was as follows: The needle was magnetized by stroking it repeatedly with the end of the magnet. It was then placed pointing toward the center of the magnetometer needle and at right angles to the magnetic meridian. In this position the needle produced a certain angular deflection in the needle of the magnetometer. The needle was now placed in an upright position, as shown at *n s* in Fig. 33. The demagnetizing magnet, N S, was mounted on a block which slid between guides, so that the magnet, N S, could be gradually brought up to the needle, *n s*, and during all the time of its approach the axis of the magnet, N S, pointed toward the center of and at right angles to the needle, *n s*. The approach of the magnet to the needle in these circumstances was found to have lowered the magnetic charge of the needle, and this took place even when the greatest care had been taken to have the magnetic axis of the demagnetizing magnet at right angles to the *magnetic center* of the needle, *n s*. The following table will show the manner in which the magnet, N S, demagnetizes *n s* when the former approaches the latter.

After the needle was magnetized it deflected the magnetometer	22°
After the magnet had been placed ¼ inch from needle	18°
" " " " " " "	18°
" " " " " " "	18°
" " " " ⅛ " "	15½°
" " " " " " "	15½°
" " " " 1/16 " "	12°
" " " " " " "	12°

Examining the above record of the experiments it will be seen that the approach of the magnet to one quarter of an inch of the center of the needle brought down its magnet charge from 22° to 18°, and that a repetition of this experiment had no further effect in demagnetizing the needle. The same is observed on the repetition of the experiment when the magnet was placed at one eighth and one sixteenth inch from the needle. The total effect on the needle of the presence of the magnet at one sixteenth inch from its center was to lower the needle's effect on the magnetometer from 22° to 18° of deflection. Of course it will be understood that in any one series of experiments the end of the needle was always placed at the same distance from the center of the magnetometer needle.

In another series of experiments the needle had its magnetic charge lowered from 61° to 35° deflection on the magnetometer.

The reader will be careful to observe that I have stated that in these experiments I took every care to have the magnetic axis of the demagnetizing magnet at right angles to the magnetic center (or equator) of the needle. If this could be really done it might be a question whether the magnet would have any effect on the needle. Yet, all of our experiments show that it *always* has an effect of demagnetization. For a long time it has been known that for the demagnetization of a magnet it requires a far weaker magnetic action than that of the magnet which gave it its magnetism; now when the magnet is at right angles to the needle, as in Fig. 33, the north pole, N, of the magnet acts *equally* on the two poles of the needle, *n s*. It tends to repel the magnetism in *n* and hold that in *s*. It may be that the freeing power of N on the needle is greater than its holding power. It is also here to be stated that, in a long series of experiments made exactly as described above, only with the demagnetizing magnet two feet long and the needles one quarter inch thick and six inches long, and hardened to the greatest degree possible before magnetizing them, this large magnet had no effect whatever on these *intensely hard needles*, though every care was taken to get the magnetic axis of the demagnetizing magnet truly at right angles to the axis of the needles and pointing toward their centers.

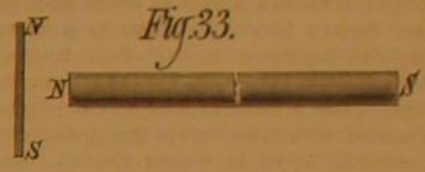


Fig. 33.

We will now describe another series of experiments in demagnetization in which the needle is *rotated* before the pole of a magnet, with the center of the needle on a line in the prolongation of the axis of the magnet. In Fig. 34, N S is the demagnetizing magnet, and *n s* is the needle operated on. The following description of one of the series of experiments will give an accurate idea of all of those made:

The center of the needle, *n s*, was one inch and three quarters from the end of the magnet, N S. After the needle had been magnetized it was placed opposite the magnetometer, and caused a deflection of 61° in its needle. The needle was now placed in a vertical position at right angles to the magnet, N S, and with its center one inch and three quarters distant from the end, N, of the magnet. The needle was now turned around its center so that its south pole went through 90°, and approached the north pole, N, of the magnet. The magnet was now removed and the needle tested at the magnetometer. As might have been expected it produced the same deflection of 61° as it did before the experiment. The needle was again placed in its old position, the magnet brought to the same distance from its center, and the needle again rotated before the magnet; but this time the north pole of the needle turned round 90° toward the north pole of the demagnetizing magnet. After this operation the needle had had its magnetic charge lowered so that it now only produced a deflection of 32·5° in the magnetometer. A repetition of the experiment brought down its magnetic charge to 30°. A third experiment brought it to 27°, while after the fourth experiment its deflection on the magnetometer needle amounted to only 16°. Further experiments had no effect in reducing the magnetic charge. It should have been mentioned above that in all these experiments the needle was really oscillated around its center before the magnet; that is, its *south* pole was always brought before the magnet (this tended to magnetize the needle); then its north pole was brought before the magnet (this tended to demagnetize the needle); then the needle's south pole was again brought before the magnet, and the experiment terminated. Thus we see that the magnet first tended to magnetize the needle, then to demagnetize it, and lastly to magnetize it. Notwithstanding that the needle was subjected to a magnetizing influence from the magnet after its demagnetization it had its magnetism lowered, so much less magnetic force being required to demagnetize than to magnetize a magnet.

In the following series of experiments the needle was placed as in the preceding experiments, and it was rotated through a whole revolution before the pole of the magnet instead of through only a half revolution as in the preceding experiments. Before an experiment was made on the needle it deflected the magnetometer needle 51°. The needle was now rotated before the magnet through a whole revolution, its south pole approaching first the magnet, then passing it and turning over the circumference of the circle till it had made an entire revolution and had come back again to its

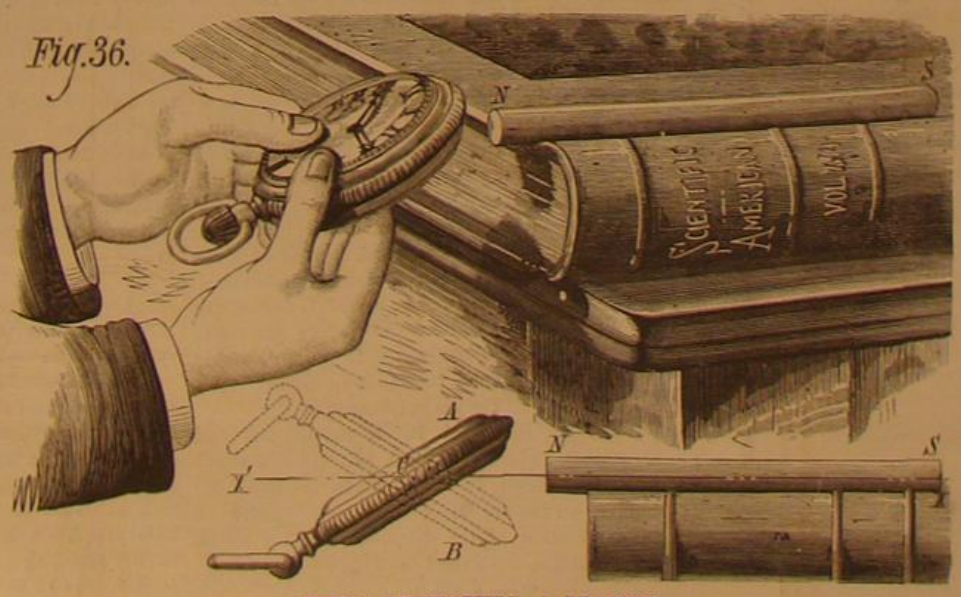


Fig. 36.

DEMAGNETIZING A WATCH.

first position at *s*, in Fig. 34. After the first revolution the needle was demagnetized so that its effect in deflecting the magnetometer needle was only 9°, instead of 51°, the deflection which it caused before it was rotated before the magnet. The whole of this demagnetization was caused by the passage of the north pole of the needle across the N. end of the magnet, N. The passage of the *s*. pole of the needle athwart the N. pole of the magnet could have had no other effect than to magnetize it.

A second rotation similar to the above reduced the deflecting power of the needle on the magnetometer to 5°. A third experiment brought it down to 4°; after which no further rotation had any effect in reducing the magnetic charge of the needle.

ON THE DEMAGNETIZATION OF WATCHES.

The reader who has made for himself the magnetic experiments, which we have so minutely described, or who has even read the accounts we have here given of them, will have no difficulty in seeing the reasons for the various operations which I will now describe in giving an account of the way to take the magnetism out of a watch.

A watch is formed of a case of gold or silver, and glass inclosing brass or nickel plates, between which are a number of steel arbors forming the axles and pinions of the brass wheels. There is also the spring of steel which uncoils itself in the plane of the watch. The older watches have in addition a steel chain which uncoils from the fusee on to a brass barrel inclosing the mainspring. The hairspring, parts of the balance wheel escapement, stem winding apparatus, etc., are also of steel. So we see that there is abundance of material for magnetization in a watch. Fortunately, these parts are formed of steel, which is only moderately hard, and, therefore, as we have already seen, easy to demagnetize.

Of these various parts some have their lengths at right angles to the plane of the watch, like the arbors; others, like the main and balance wheel springs and the nickel (nickel takes a magnetic charge like steel or iron, only feebler) plates inclosing the movements, have their greatest dimension in the plane of the watch. The position of these bodies determines to a great extent the directions of their magnetic axes. By magnetic axis we mean an imaginary line joining the two poles of a magnet. The arbors will have their magnetic axes in the direction of their lengths, whereas plates are most likely to have theirs in the direction of one of their diameters. But we have already seen that no matter in what direction their magnetic axes are in the watch, all of these bodies (thanks to the facts already shown in our experiments) may be demagnetized *by properly oscillating the watch before the pole of a magnet.* How this is to be done I will now show, and in order to shorten what might otherwise be a long story, I will give an account of the process by describing the experiments actually made in the course of demagnetizing an old Tobias fusee watch, which I saturated with magnetism by deliberately placing it on one of the poles of the large magnet of my laboratory in the Stevens Institute of Technology, and thus purposely obtained a very badly magnetized watch to practice a cure on.

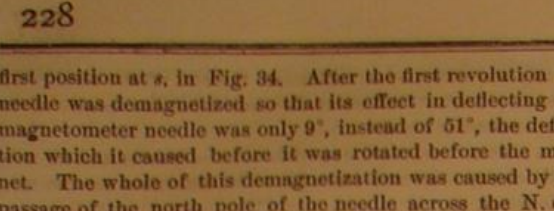


Fig. 34.

The watch is placed quite close to the magnetometer, and with the center of the thickness of the watch about on a level with the center of the needle of the magnetometer, and with the line, connecting the center of the watch, C, Fig. 35, and the center, *c*, of the needle, at right angles to the magnetic meridian; in other words, at right angles to the direction which the needle has when no magnetic body is near it. The watch is then turned slowly around on its center as an axis, and each hour on its dial is in succession brought opposite to the center, *c*, of the magnetic needle of the magnetometer.

The following were the results of such experiments on our magnetized watch. We give them in the form of a table: N. and S. indicate the kind of magnetic polarity at each hour, and the angles show the effect in angular deflection on bringing that hour of the dial opposite the center of the magnetometer needle:

TABLE I.

Hour.	Ang. of Deflection of Magnetometer.	Kind of Magnetism.
XII.	20°	N.
I.	5°	N.
II.	18°	S.
III.	72°	S.
IV.	56°	S.
V.	22°	S.
VI.	5°	N.
VII.	17°	N.
VIII.	16°	N.
IX.	16°	N.
X.	20°	N.
XI.	24°	N.

When the hour III. was brought opposite the magnetometer needle the fusee axle and the center of the semicircular steel catch of the inner cover of the works were presented to the magnetometer. The strong south magnetism of hour III. was due to the magnetization of these bodies, which deflected the needle of the magnetometer 72°. The strong north magnetic action of hour XI. was due to the magnetized mainspring.

We may now regard this watch as a magnet, having the form of a disk, and with its north magnetic pole at the hour XI. and with its south pole at III. o'clock.

This being the information given by our magnetometer, we are in possession of facts which enable us to take the north magnetism out of eleven o'clock and the south magnetism out of three o'clock.

You have already found, by your experimenting, that when your bring the north pole of one magnet near the north pole of a more powerful magnet, the powerful magnet will take the magnetism out of the weaker one because it tends to make the north pole of the latter a south pole. Similarly the south pole of a powerful magnet will demagnetize the weaker magnet when the south pole of the latter is brought near the south pole of the former.

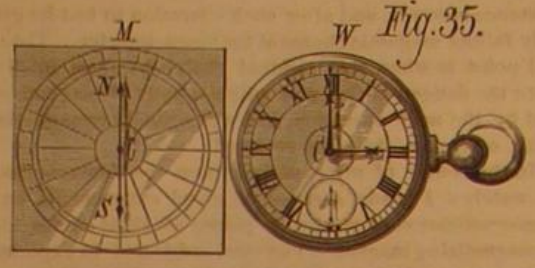


Fig. 35.

You have also found out by your experiments that when a small magnet, made of steel not too hard, is vibrated around its center in front of the pole of a powerful magnet, the small magnet is demagnetized. These facts show how we must proceed in the demagnetization of the watch.

The hour XI. is of the strongest north magnetism of any on the dial; therefore we place this hour opposite the north pole of our rat-tail file magnet, as shown in Fig. 36. The center of the watch, C, is placed so that the prolongation of the axes of the magnet (shown by the dotted line, X X') passes through it. The watch is now vibrated around an axis passing through C and at right angles to X X'. By this operation the watch is successively brought into the positions, A and B, of Fig. 36. After several vibrations of the watch before the north pole of the magnet, I turned the hour III., of strong south polarity, opposite the south pole of the magnet, and vibrated the watch as in the previous experiment. By these vibrations the watch cuts across the lines of magnetic force, and, as we have seen, any magnetism in it is thus taken out. After these operations performed on the hours XI. and III., the watch was again examined before the magnetometer, and the following table shows the effect of the vibrations before the magnet:

TABLE II.

Hour.	Ang. of Deflection of Magnetometer	Kind of Magnetism.
XII.	2°	N.
I.	5°	N.
II.	4°	N.
III.	0°	
IV.	5°	S.
V.	8°	S.
VI.	2°	S.
VII.	4°	N.
VIII.	4°	N.
IX.	2°	N.
X.	1°	N.
XI.	0°	

There is certainly a great difference between the magnetometer deflections of Table I. and these of Table II. It is observed at once that the hours III. and XI., which were respectively of strong south and north magnetism in Table I., are in Table II. marked 0°. This result was not attained, however, at one trial, as might be inferred from our description of the experiments, but after each series of vibrations before the pole of the demagnetizing magnet the magnetic condition of hours III. and XI. was tested. Sometimes their magnetism almost disappeared. Then we found it had changed, or rather inverted, so that hour III. had north instead of south polarity, and hour XI. had south instead of north magnetism. When this happened we had to present hour III. before the north pole of the magnet, the hour XI. before the south pole. After repeated trials I succeeded in demagnetizing hours III. and XI. so that they produced no action whatever, or 0°, on the needle of the magnetometer.

I now again brought the watch before the magnet and vibrated its V. o'clock before the south pole till this south magnetism had disappeared; in other words, produced no deflection whatever on the needle of the magnetometer. I then made an examination of the magnetism of the watch before the magnetometer, with the following results:

TABLE III.

Hour.	Ang. of Deflection of Magnetometer.	Kind of Magnetism.
XII.	1°	
I.	0°	
II.	0°	
III.	0°	
IV.	2½°	S.
V.	3°	S.
VI.	2°	N.
VII.	6°	N.
VIII.	5°	N.
IX.	2°	N.
X.	1°	S.
XI.	2½°	S.

I now demagnetized hour VII. of its 6° of north magnetism by vibrating this hour opposite the north pole of the demagnetizing magnet, and after I had succeeded in this I found that no hour on the dial of the watch when presented to the magnetometer caused a deflection of even one degree, so I considered the watch demagnetized; in which conclusion I was justified, for the watch has kept as good time and with about the same rate as it did before it was magnetized.

The "accident" to which I referred in the first of these articles happened to a valuable watch made with special care by Lange, of Dresden. It was so strongly magnetized that IV. o'clock on its dial produced a deflection of 83° south magnetism on the needle of the magnetometer, and VII. o'clock a deflection of 40° of north magnetism. This watch I demagnetized exactly as has been described, and after its demagnetization, though it had lost a half hour in three hours when magnetized, it kept a rate even more uniform than before its magnetization. Before its magnetization it lost about one second per day; after its demagnetization it has gained from ¼ to ½ second per day, and has a very uniform rate, indeed, as uniform as one could wish for in a pocket watch subjected to daily vibrations on the railway.

New Pencil as a Substitute for Ink.

We do not refer here to the aniline pencils which have been in use for some time, but to a quite different pencil which gives a very black writing, capable of being reproduced by the copying machine, and which does not fade on exposure to light. The mass for these pencils is prepared as follows: 10 pounds of the best logwood are repeatedly boiled in 10 gallons of water, straining each time. The liquid is then evaporated down till it weighs 100 pounds, and is then allowed to boil in a pan of stoneware or enamel. To the boiling liquid nitrate of oxide of chrome is added in small quantities, until the bronze-colored precipitate formed at first is redissolved with a deep blue coloration. This solution is then evaporated in the water bath down to a sirup, with which is mixed well kneaded clay in the proportion of 1 part of clay to 3½ of extract. A little gum tragacanth is also added to obtain a proper consistence.

It is absolutely necessary to use the salt of chrome in the right proportion. An excess of this salt gives a disagreeable appearance to the writing, while if too little is used the black matter is not sufficiently soluble.

The other salts of chrome cannot be used in this preparation, as they would crystallize, and the writing would scale off as it dried.

The nitrate of oxide of chrome is prepared by precipitating a hot solution of chrome alum with a suitable quantity of carbonate of soda. The precipitate is washed till the filtrate is free from sulphuric acid. The precipitate thus obtained is dissolved in pure nitric acid, so as to leave a little still undissolved. Hence the solution contains no free acid, which would give the ink a dirty red color. Oxalic acid and caustic alkalies do not attack the writing. Dilute nitric acid reddens, but does not obliterate the characters.—*Moniteur Scientifique.*

How to Remove Nitrate of Silver Stains from Clothing.

In the manipulation of the nitrate of silver bath solutions in photography the operator frequently receives stains of the salt upon his clothing, which are not very attractive in appearance. The question of their removal has been a puzzle to many. Nitrate of silver, it will be remembered, is the base of most of the so-called indelible inks used for marking linen in almost every household. Stains or marks of any kind made with the above silver solution or bath solution may be promptly removed from clothing by simply wetting the stain or mark with a solution of bichromate of mercury. The chemical result is the change of the black-looking nitrate of silver into chromate of silver, which is white or invisible on the cloth. Bichromate of mercury can be had at the drug stores. It is slightly soluble in water, is a rank poison, and we would not advise anybody to keep it about one's house.

Cheap Wheat.

A late number of the Walla Walla (Washington Territory) *Watchman* says:

The question is frequently asked, What does it cost to raise wheat in the great valley of Walla Walla? After a careful inquiry, we adduce the following answer: It costs about $1 90 per acre to plow, sow, and seed; $1.25 to cut and head, and about seven cents per bushel to thrash and sack it. This includes wages, board, and hired help, and horse feed. A header usually works up from fifteen to twenty acres, and thrashes, with good machinery, clean up from 2,000 to 3,000 bushels per day. Harvest hands receive from $2 to $3 per day and board. The yield this year is larger and heavier than usual, and ranges all the way from twenty-five to sixty bushels to the acre. Wheat, according to the above figures, can be raised and sacked for twenty-four cents a bushel, and is worth to-day fifty cents, which shows conclusively that our farmers have a perfect little bonanza.

The Dominion Exhibition.

The first Dominion Exhibition was formally opened by the Governor General at Ottawa, Canada, Sept. 23, with a large attendance and upward of 10,000 exhibitors. Among the prominent visitors were the Governors of Maine, Ohio and Vermont, with their respective staffs.

Toadstool Poisoning.

Along with the cool, refreshing weather and the occasional cold rains of autumn, come the great mass of toadstools and mushrooms—poisonous and edible, and of all shapes, sizes, textures, colors, odors, and flavors. In every wood, meadow, or pasture where there is sufficient moisture and decaying vegetable substance they are sure to be met with. As autumn is pre-eminently the season of toadstools, so is it also the season in which oftenest occur fatal accidents through eating poisonous species; and doubtless the papers will soon be called on to chronicle, as usual at this time of the year, a few more cases like that which occurred but a few weeks ago in the family of Mr. Frederick Sussik, of Linden, N. J., and in which two children lost their lives and three other members of the family were made dangerously sick, by partaking of certain toadstools that had been mistaken for the common edible mushrooms (*Agaricus campestris*). The Rev. Washington Rodman, who called on the family a few days after the sad occurrence, collected some toadstools, which were identified by Mrs. Sussik and a lady friend as the species that were eaten by the victims of the accident. Through the kindness of Mr. Rodman, we have been able to examine the specimens, and find them to be the quite common *Agaricus vaginatus*, Bull. There seems to be considerable doubt among different authorities as to the qualities of this species of toadstool. Fries regards it as suspicious, Vittadini and others say that it is esculent, and Berkeley states that according to some accounts it is poisonous, but that it is eaten in Russia. Still, the fact of its being eaten in Russia would not go far to prove that it was innocuous, for the Russian peasants, like the Patagonian savages, eat fungi that are regarded as absolutely poisonous by other peoples.

In the two words—"mushrooms and toadstools"—is embraced the whole of the knowledge possessed by the people at large regarding the immense fungus tribe of our country. Taking, as an example, the mushroom type of a fungus, we have in the United States upward of a thousand distinct species, all possessing a general similitude of form; very many of these are edible, and superior in flavor to the common mushroom; others, while not poisonous, are undesirable on account of toughness, bad flavor, or want of flavor; and a large number are dangerous on account of their exceedingly poisonous nature. The fact of the general similarity of form possessed by these plants has caused many to look upon them as mere fortuitous productions—difficult or impossible to distinguish as permanent species; but when once the literature of the subject has been obtained, and the study of these organisms entered upon in earnest, the student will soon perceive that the species, as a rule, are marked with great distinctness and immutability, rendering them as easily recognizable as those of flowering plants. In view of the fact that we have such a large number of edible species, in addition to the common mushroom, it may be pertinent to inquire whether there is any sure way of distinguishing them from the poisonous kinds. We may answer that there is no royal road to such a knowledge; there is one way, and only one way, by which edible fungi can be discriminated from noxious ones with absolute certainty, and that is by acquiring a knowledge of the individual species, either by the study of books, or under the guidance of an experienced fungologist. One might as well lay down a code of rules for the discrimination of wholesome from poisonous fruits and vegetables, as for fungi. Indeed, people do occasionally mistake aconite and poke roots for horseradish, or fool's parsley for parsley proper; but we have no general rules drawn up to meet such cases. In many books—cookery manuals, popular science works, encyclopedias, etc.—certain general rules are given for ascertaining whether a fungus may be eaten with impunity or not; they are so exquisitely absurd, however, that botanists simply smile and never think of refuting them. Perhaps one of the most important of these rules is that esculent species never change color when cut or bruised. But the meadow mushroom (*Agaricus arvensis*) turns yellow when broken; the red-fleshed mushroom (*A. rubescens*), when bruised or broken, becomes sienna-red, the orange milk mushroom (*Lactarius deliciosus*) turns from bright orange to dirty green when cut or broken; and these are among our common and justly esteemed edible species. Another rule is that such toadstools as deliquesce, or speedily run into a dark watery fluid, should be avoided. This at once shuts out two of our commonest, and, to our mind, most delicious species—the maned coprinus (*Coprinus comatus*) and inky coprinus (*C. atramentarius*), the former of which we have gathered in great abundance on the Battery and in Central Park. Still another rule very commonly relied on is that if a fungus be pleasant to the taste, and its odor not offensive, it may be safely eaten. But this is not only a fallacious but an exceedingly dangerous guide. It is very true that some acrid fungi are irritant poisons; yet one of our best edible species (as its specific name implies), *Lactarius deliciosus*, when eaten raw, causes a very unpleasant tingling of the mouth and tongue; and the same sharp taste also characterizes several other excellent fungi. It is far more important to remember the fact that a toadstool may have a pleasant odor and taste, or in fact be nearly destitute of either, and yet be most virulently poisonous. The fly agaric (*Agaricus muscarius*) has no acridity, and indeed, to our own taste (for we once had the temerity to chew a little of it to ascertain the fact), it is perfectly insipid, yet its extremely poisonous properties have been known for centuries. It should be known that toadstools may be irritant, narcotic, or narcoto-irritant poisons, and that while it is possible to recognize an irritant by the taste, a narcotic may be nearly tasteless. Finally, to refer to one more canon, which has been repeated time after time in all kinds of books, the fallacy of the possibility of distinguishing an edible from a poisonous fungus by the use of tin or silver spoons has been so often exposed, that it is hardly necessary to do more than remark that any one who relies on such a test merely runs the risk of furnishing a subject or subjects for the coroner. The ultimate composition of toadstools has been pretty well ascertained, but our knowledge of the proximate constituents is as yet quite meager, being confined to comparatively few species. From the fact that each poisonous fungus does not produce its own special symptoms, but that all the differences observed can be reduced to varieties in the degrees of action on different systems of the animal organism, it is possible that the same poisonous principle, modified by other noxious principles coexisting and varying in different species, pervades each and all. This active principle was separated in 1866 by Letellier, and named by him *Amanitine*. More extended researches were made in 1869 by Profs. Schmiedeberg and Koppe, of Strasbourg, and in their memoir they have called the same substance *Muscarine*, from the specific name of the fungus upon which they experimented—*Agaricus muscarius*. This principle, which is regarded as an alkaloid, is obtained as a tasteless, amorphous black mass, the physiological action of which has been well ascertained. Its chemical properties, however, are not so perfectly known. In addition to this, these plants contain a number of acids, some of them peculiar to fungi, and perhaps having irritant properties, such as *polyporic*, *fungic*, and *boletic* acids; and this we might expect from the very nature of these organisms. We know that flavoring plants absorb carbonic acid and exhale oxygen during the day and reverse the process at night; and we know further that the leaves of certain plants which are bitter become acid at night through the oxidation of the products formed in them during the day. Inasmuch as toadstools, like animals, absorb oxygen continuously, and exhale carbonic acid, it is reasonable to suppose that acidity would be a predominating characteristic. Indeed we find this to be the case. The poisonous properties of fungi, like the properties of flavoring plants, such as the opium poppy, tobacco, hemp, etc., vary with climate, and probably also with the season; and for this reason, perhaps, the common edible mushroom, which is esteemed a safe and delicious article of food in most countries, becomes noxious in Italy, and its sale forbidden by law. Some persons are liable to be affected even by those species which are usually regarded as innocent; such instances may be considered as due to personal idiosyncrasies. As above stated, the poisonous principle (muscarine) seems to be the same, or nearly the same, in all noxious species of toadstools, inasmuch as a close study of numerous cases has shown that they all have a similarity of action. They all act more or less on the intestinal canal and heart, and apparently also on the brain. The usual symptoms are uneasiness in the stomach, vomiting, purging, and a feeling of constriction in the neck, want of breath, giddiness, fainting, prostration, and stupor. Sometimes the intestinal symptoms are most prominent, sometimes the cerebral ones. Often an affection of the salivary glands is a prominent symptom. The most extraordinary action of muscarine is on the heart. One curious point about nearly all cases of poisoning of this kind is the very small quantity of the fungus which is so deleterious. Happily, through the investigations of Prevost of Switzerland, Brunton of England, and Schiff of Italy, we now know the proper antidote to the poison, and the fact should be known (although it does not seem to be) by every physician living in the smaller cities and villages, just where cases of poisoning by these plants generally occur. The symptoms above enumerated being opposite to those produced by belladonna, datura, and other solanaceous plants, the experimenters just mentioned were led to investigate the capabilities of these to act as antidotes to poisonous fungi, and with successful results. Dr. Brunton recommends (*British Medical Journal*, Nov. 14, 1874, p. 617) in cases of poisoning by toadstools, that the stomach be emptied by proper emetics, and then atropia injected subcutaneously. But the antidote may also be given by mouth in the form of tincture of belladonna or solution of atropia (*Liquor atropiæ*, Ph. B.). The dose for subcutaneous injection should be about $\frac{1}{100}$ of a grain, or about one minim of solution of atropia, repeated if necessary until the dyspnœa is relieved. Professor Schiff, pursuing the same line of investigation still more recently, indorses the treatment proposed by Dr. Brunton, and further recommends the use of stramonium in substances or as an alcoholic extract, or of its alkaloid *daturia*. Still more recently Dr. Ringer (*Lancet*, March 2, 1878) has shown that another solanaceous plant, the *Duboisia myoporoides*, of Australia, is also a perfect antidote to the poisonous principle of toadstools, but the belladonna treatment, proposed above by Dr. Brunton, will perhaps prove the handiest for our own physicians.

From the facts stated in the former part of this article, it will seem that the gathering of toadstools for food purposes cannot be safely recommended to the inexperienced in such matters. It is to be regretted that nature has placed so many stumbling blocks in the way of a popular acquisition of a knowledge of these cryptogams; for the edible species, of which we have a large number in this country, would prove wholesome and pleasant articles of food, their great value in this respect being due to the fact that they have an astonishing resemblance to animal food. Of all vegetable productions they are the most azotized—that is, animalized—in their structure. Chemistry demonstrates that they yield the several component elements of which animal structures are made up; and many of them, in addition to sugar, gum, resin, the peculiar acids above mentioned, and a variety of salts, furnish considerable quantities of albumen, adipocere, and osmazome, the principle which communicates its peculiar flavor to meat gravy. Notwithstanding this, it is better that the would-be mycophagist should confine his gastronomic proclivities to the ordinary articles of food in common use, than to run the risk of committing *felo de se* by partaking of fungi that have not been selected for him by experienced hands. Better, in fact, to adopt the wise precautions of a certain young lady, who remarked that she "never partook of these dainties till she had seen the effect they produced on somebody else."

Since the foregoing lines were written, another fatal case of toadstool poisoning has occurred, the victim in this case being a student at Stamford, Conn. We have long been desirous of knowing with what toadstool or toadstools people are constantly killing themselves in this country, and we would feel obliged if physicians who have cases of poisoning of this kind under their care, would send us for identification specimens of the fungi which were the cause of the accident.

A New Pipe Line.

The Parker *Daily* published the following: For some time past surveys have been in progess along the line of the New Jersey Central Railroad, but the object has been kept a secret. A theory has been advanced, and it appears to be very plausible, to the effect that they are preliminary to the continuation of the great oil pipe line to the seaboard. This line, recently put in operation to Williamsport, has proved a great success, and it seems but natural that there should be a desire to carry it directly to the market. It is stated, in connection, that the railroad company has offered the Singer Sewing Machine Company $1,000,000 for their property at Elizabethport, as an inducement for that company to remove to Plainfield. If the transfer is made the sewing machine works will be converted into an oil refinery. This movement is probably for the purpose of breaking down the Pennsylvania Rail road Company should the latter succeed in getting the right of way for their road from Point of Rocks to Claremont, the preparations of which are being carried on vigorously. The Central Railroad and the Standard Oil Company make a very strong combination, and the fight will be waged bitterly on both sides.

Large Crank Shafts.

At the late meeting of the Institution of Mechanical Engineers, at Glasgow, a paper was read "On the Forging of Crank Shafts," by Mr. W. L. E. McLean, of the Lancefield Forge. The author gave an interesting account, well illustrated by diagrams, of the methods of forging large crank shafts generally in use, and especially of the building-up system, which had for many years been adopted at the Lancefield Forge, an establishment which, as is well known, has a high reputation for this class of work.

In the discussion that followed, Mr. Jamieson believed that at no very distant day the Atlantic steamship service would be such that it would be possible to leave Great Britain early in the week and arrive at New York at the end of it; but this of course would necessitate the employment of larger vessels and more powerful engines. He had had considerable experience in the building up of large shafts in several pieces, and the firm with which he had lately been connected (Messrs. J. Elder & Co.) had constructed in this way a shaft weighing 56 tons, this being a three-throw shaft and built up of fifteen pieces. Within the next ten years, shafts weighing 100 tons would, he considered, probably be required, and he believed that the proper way to construct such shafts was to build them up, a shaft so built up involving much less loss of time for repairs or renewal, in the event of failure, than would be the case with the old shafts.

Spontaneous Combustion of Stuffed Silks.

According to the *Färber Zeitung* the authorities at Vienna, in consequence of the frequent cases of spontaneous combustion, have decreed special arrangements for the packing and transport of weighted silks. [We should strongly advise railway companies and other public carriers to place such silks in the class of dangerous goods, to be carried only at extra freight and under special arrangements. Fire insurance companies should also be aware of the special risk run when such goods are stored up in shops and warehouses.]—*Chemical Review.*

A Saw Accident.

A singular accident and narrow escape is reported from Bay City, Mich. It is stated that while a Mr. Farmer was standing in front of a six foot revolving circular saw, at Bradley's mill, one of the teeth of the saw flew out and struck Mr. Farmer in the breast. He escaped with his life only because the tooth happened to strike and embed itself in his gold watch, which was of course sadly damaged. The best way is to keep clear of circular saws, especially those having inserted teeth.

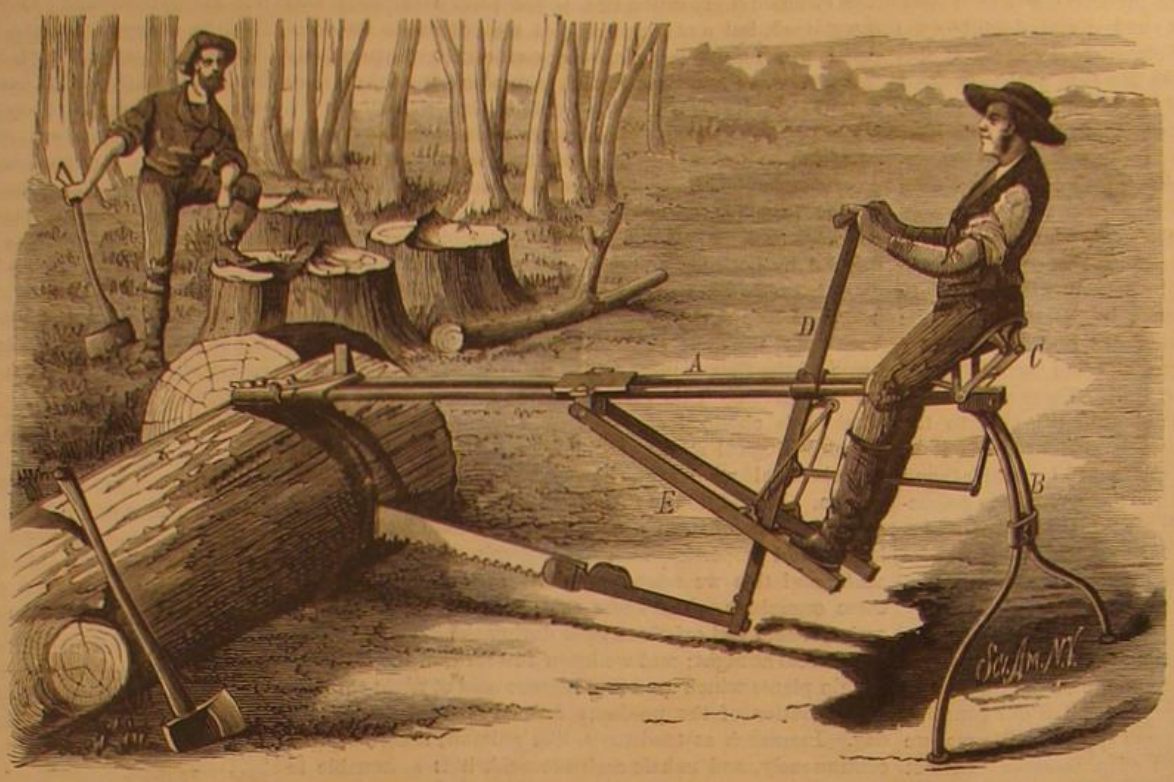
A PRE-HISTORIC CLAMBAKE.—In excavating for the Jacksonville (Fla.) water works, recently, there was found, twenty-eight feet below the surface, an ancient clambake. In a bed about six feet by four in area, the clam and oyster shells, many with gaping mouths, were arranged as for a modern clambake, intermixed with hardened sand, charcoal, and fragments of decayed wood.

A NEW DRAG SAWING MACHINE.

The accompanying engraving represents an improved drag sawing machine, the invention of Mr. William W. Giles, of Chicago, Ill. The first machine devised by this inventor on the same general principle was the subject of an application for a patent in 1862. We are informed that the recently patented improvements have rendered the machine a marked success. It is so clearly shown in the engraving that but little explanation will be required.

The main frame of the machine is about eight feet long, and the front end rests upon the log being sawed. A wedge is fastened with a hinge to the main frame, and when the log pinches the saw the wedge is turned over and driven into the saw kerf. The seat upon which the operator sits is capable of sufficient motion to allow the machinery to work. The operator, by pressure of the feet upon the treadles, E, throws the saw forward; this movement is also supplemented by pulling the main lever, D, with the hands. By this means the saw is propelled with great force, as the most of the weight of the body and the strength of the arms are employed in doing the work. When the operator pushes the lever, D, before him, he transfers his weight from the treadles to the seat, and the latter will be pressed down; in fact, the operator may put more than his weight upon the seat in this way, and when the power is applied thus the saw is drawn backward. In using this machine the weight of the operator and the muscles of his arms and legs are all brought into action. The saw has a three-foot stroke, and is capable of doing considerable execution.

The manufacture of this machine is conducted at 741 W. Lake street, and the office is at room 20, No. 149 Clark street, Chicago, Ill.



GILES' DRAG SAWING MACHINE.

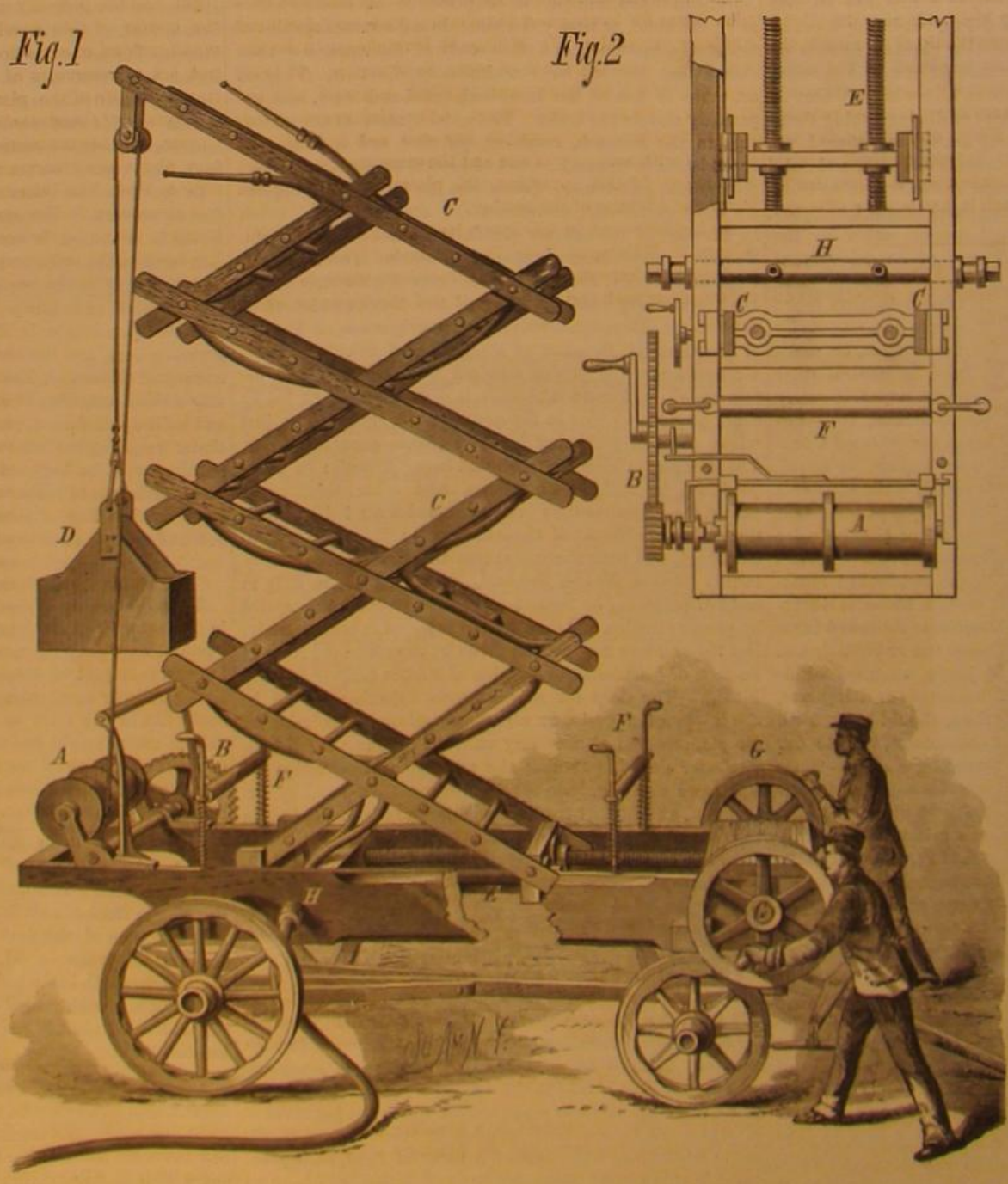
A NEW FIRE ESCAPE.

The fire escape ladder shown in the accompanying engraving is the invention of Mr. Joseph R. Winters, of Chambersburg, Pa. It is designed to be used both as a fire escape and a support for fire hose.

The main frame is mounted upon wheels and supports two screws, E, and the lazytongs, B. The screws, E, are provided with miter wheels, which are driven by miter wheels on a shaft at the end of the main frame. On the ends of this shaft there are fly wheels, G, provided with cranks set diametrically opposite each other. A bar pivoted to two of the lower levers of the lazytongs carries nuts which travel on the screws, E, as they are turned by the mechanism already described. The other pair of the lower levers of the lazytongs rests upon a support that is adjustable vertically by two screws which are turned by the gearing seen below the main frame. This adjustment alters the level of the base of the ladder, and consequently varies its inclination.

Hose, C, suitable for fire purposes, extends from the fixed pipe, H, to the top of the ladder, and is provided with nozzles. One of the upper pairs of arms is longer than the other, and reaches over to receive the pulley that supports the rope from the windlass, A. This rope carries a box or basket, D, used for lowering goods or persons.

The truck carrying the windlass and the basket, D, afford a means of escape for invalids and children, and the ladder itself affords ample means of escape to such as are able-bodied, while at the same time it is convenient and efficient as a fireman's ladder. This invention is patented in this country and in Europe. The New York office is in the Coal and Iron Exchange Building.



WINTERS' FIRE ESCAPE LADDER.

MISCELLANEOUS INVENTIONS.

An improved fountain brush has been patented by Mr. Martin J. Sunderlin, of Watkins, N. Y. This apparatus is designed for washing and cleansing horses, mules, and cattle, and articles such as wagons, carriages, etc., and also for washing and shampooing the human head and body. The invention consists in a brush having combined with it a sponge, and having a water distributing chamber, a flexible tube for supplying water, and a stopcock for controlling the supply, these parts being arranged so that the water is conducted to the distributing chamber in the brush, and passes to the sponge, from whence it passes in a uniform and continuous supply to the object to be cleansed.

Mr. Benjamin F. Fuchs, of Tiger Mill, Texas, has invented an improved washing machine having several novel features which cannot be described without an engraving.

Mr. Benjamin B. Blewett, of New York city, has invented an improved picket stake for picketing or tethering horses and cattle. It can be readily entered into the ground or removed therefrom without requiring the use of a mallet or other implement to drive it. It consists in a picket stake having the pin that enters the ground made as a blade, semicircular in cross section, and tapering lengthwise, and fitted at the base with a plate for driving the blade by pressure of the operator's foot, and the handle for holding the stake while it is being driven. The rope is attached to the handle, and the handle fitted to revolve to prevent winding.

An improvement in oil press plates has been patented by Mr George W. Campbell, of West New Brighton, N. Y. The object of this invention is to prevent the rapid destruction of the bag or wrapper that contains the ground seed while being pressed, and to avoid the use of the ordinary mats, so as to lessen the expense. The invention consists in providing the ordinary corrugated oil press plates with projections and indentations or short grooves.

An improvement in bridge walls for furnaces has been patented by Mr. John Mailer, of Pacheco, Cal. The inventor places a movable bridge wall in a boiler furnace to contract the area of outlet from the fire surface to the boiler flues

Mr Henry Morrison, of Pittsburg, Pa., has patented an improved device for holding ribbon-gold while teeth are being filled, to facilitate the operation, lessen the time required, the labor of the operator, and the exhaustion of the patient. It consists in one or more spools mounted upon rods, connected together by ball-and-socket joints, and provided with a clamp for holding the device in position in the mouth.

Mrs. Henry Dormitzer, of New York city, has recently patented improvements on the window cleaning chair for which letters patent Nos. 200,441, 206,935, and 206,936 were granted to the same inventor, February 19 and Aug. 13, 1878. The object of the present invention is to simplify the adjustment of the chair and to make it more reliable and complete. This device, although very simple, cannot be described without engravings.

Mr. Benjamin N. Shelley, of Anderson, Ind., has invented a combined implement for domestic and other

purposes, which presents in a single device and compact form, the functions of a hammer, screw driver, corkscrew, can opener, ice pick, glass cutter and breaker, stove lifter, tack drawer, saw set, knife sharpener, wrench, steak tenderer, and putty knife.

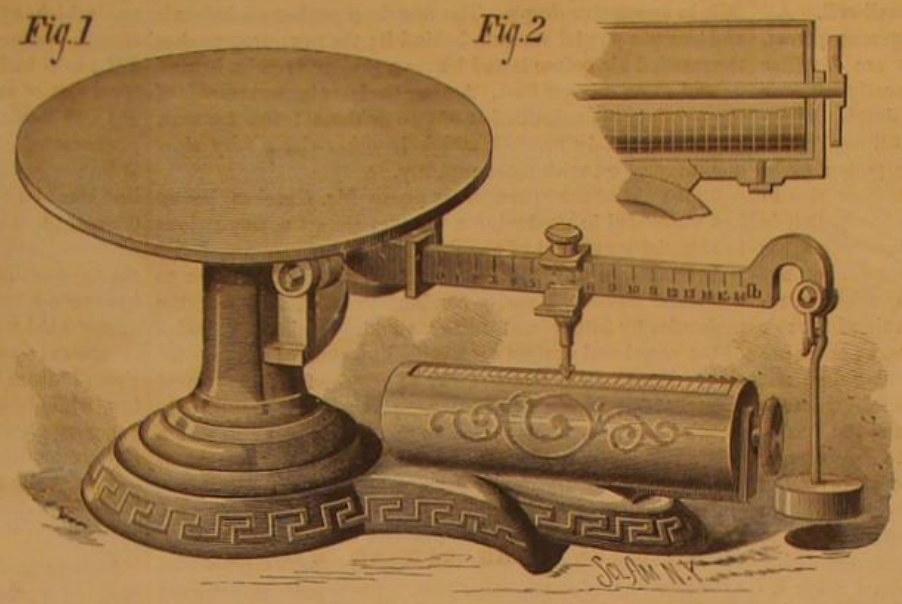
NEW CALCULATING ATTACHMENT FOR WEIGHING SCALES.

The improved attachment for weighing scales shown in the accompanying engraving was recently patented by Henry H. Ham, Jr., of Portsmouth, N. H. The object of the invention is to indicate the price of any number of pounds or ounces of the article being weighed.

The scales are of the usual construction, and to the base is attached a cylindrical case, slotted along the top, and containing a cylinder upon which are placed a number of rows of figures arranged in arithmetical progression, each row representing the price per pound or ounce of some particular article. The numbered cylinder may contain any desired number of rows of figures, and the row representing any particular class of goods may be brought opposite the slot in the casing.

The sliding weight on the scale beam is provided with an index which points to one of the numbers on the cylindrical scale. This number represents the price of the total quantity of the substance on the scale. It will be seen that this device avoids all calculating and insures accuracy.

Fig.1 *Fig.2*



CALCULATING ATTACHMENT FOR WEIGHING SCALES.

Carica Papaya.

Not long since notice was taken in this paper of the strong digestive power of the juice of the pawpaw, *Carica papaya*, used in Brazil for giving tenderness to fresh meat. Dr. Bouchut, of Paris, has been experimenting with this remarkable vegetable product, and finds that it dissolves the false membranes which form in the throat of patients suffering from croup. It is also found to kill and dissolve intestinal worms. It would appear to have no injurious action upon the living mucous membrane. The pawpaw thrives in all tropical countries.

THE OTOCYON.

This animal is found in South Africa and in parts of East Africa, generally upon the bushy highlands near the rivers. It is about three feet in length from the tip of the nose to the end of the tail, the tail being about one-third of the entire length. The ears are enormous, entirely disproportionate to the rest of the animal. The eyes are sharp, the nose pointed, the legs are of good length. It sleeps during the day and goes out for its prey in the night. It lives on small animals and upon grasshoppers. The natives hunt it down for its fur and even eat its flesh, although it has a very offensive taste.

A Horse Crazed with Tea.

Lord William Beresford, in addition to his distinction as a gallant and chivalrous soldier, will be distinguished in history as the owner of a horse which was poisoned by tea. The *Veterinary Journal* reports the "case," and characterizes it as "unparalleled in the annals of veterinary or even human toxicology." A staff cook having left some pounds of tea in a sack, a Kaffir groom filled it with corn, and serving out the contents to a troop of horses, gave Lord William Beresford's charger the bulk of the tea, which was eaten greedily, and produced the most startling results. The animal plunged and kicked, and ran backwards, at intervals galloping madly around, finally falling into a donga, where it lay dashing its head on the rocks, and was dispatched by an assegai thrust through the heart. The *post-mortem* appearances indicated extreme cerebral congestion. The occurrence as an accident is probably unique. The phenomena exhibited were, however, characteristic of the action of caffeine—namely, cerebral excitement, with partial loss of sensibility, convulsions, and death. The sensory nerves are paralyzed without any corresponding paralysis of the motor nerves, so that the muscular action, which proceeds from ideation and volition, remains unaffected. The reversal of limb movements, which produce running backwards in quadrupeds, is a common symptom of brain disturbance, frequently witnessed, for example, in the case of puppies with unclosed crania. The case is one of great interest, and may help to throw light on the action of tea, which has not been sufficiently studied, and must be still classed as unexplained.—*Lancet.*

RECENT AGRICULTURAL INVENTIONS.

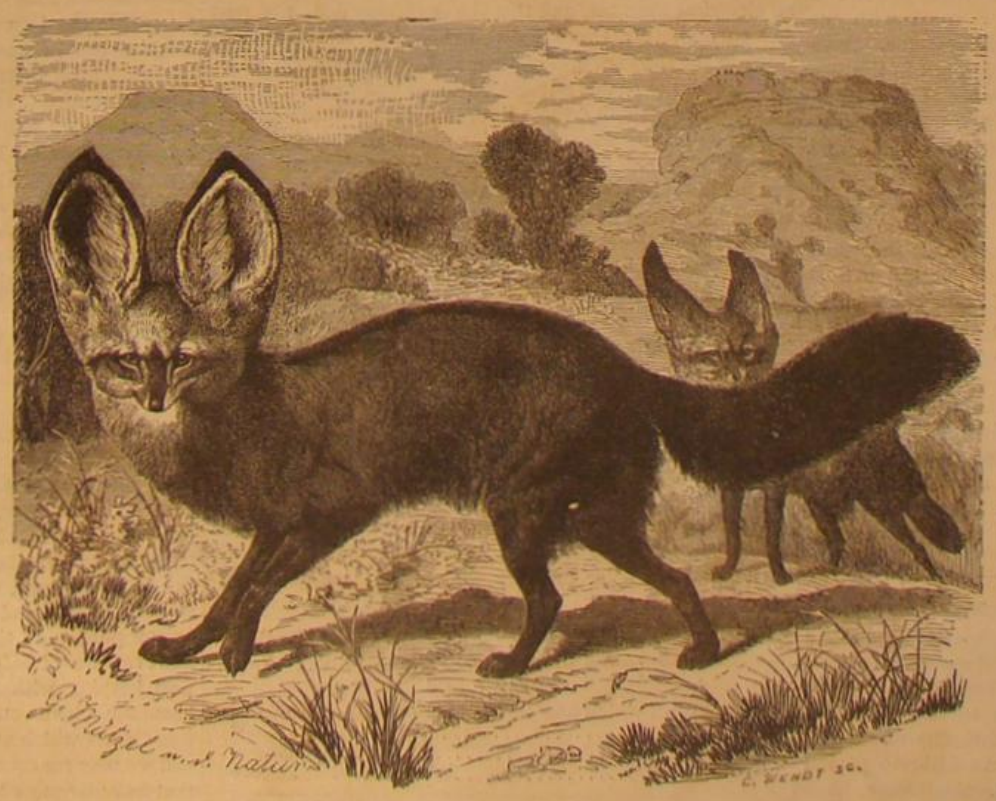
An open-work partition for cattle stalls, formed of bars crossing each other diagonally, has been patented by Mr. Joseph B. Greenhut, of Chicago, Ill. By means of these partitions the cattle are kept in their places without chaining or tying, and yet ventilation is not perceptibly obstructed, nor is admission of light from the ends of the stable materially hindered. The expense of constructing the partitions is also small as compared with the usual close or tight board partitions.

An improvement in plows has been patented by Mr. Fernando Gautier, of West Pascagoula, Miss. The invention consists in combining with the plow an oscillating knife operated by means of an eccentric. The advantage of an oscillating knife over a rotary one is, that when plowing very deep or turning under coarse material it is not so liable to come into contact with the ground.

An improved machine or apparatus to be mounted on a plow beam for sowing and distributing seeds and fertilizers has been patented by Mr. William G. Humphreys, of Pendleton, S. C. Any two kinds of seeds, such as corn and beans or pease, which are often sown together, can with this machine be sown at the same time. Corn and guano, cotton seed and mineral phosphate, or any seed and fertilizer can be sown with accuracy at one and the same time, or in quick alternation, by this apparatus, the plowshare marking the furrow in advance of the sowing.

An improvement in harvesters has been patented by Mr. Alonzo N. Wilson, of Coon Rapids, Iowa. This is an improvement in harvesters whose platforms are made vertically adjustable at each end independently of the trucks to which they are hinged. It consists in a peculiar arrangement of parts for raising and lowering the platform without changing its horizontal angle.

Mr. Samuel L. Waters, of Genoa, Ill., has patented an improved harrow for loosening, pulverizing, and smoothing land. It consists in a harrow frame formed of a rod bent in its middle to form a loop or bail, and having its arms parallel and connected by cross rods, and supporting tubes which carry harrow knives of peculiar form.



THE OTOCYON.—(*Otocyon Caffer.*)

NATURAL HISTORY NOTES.

Relations of Flowers and Insects.—For some years past—since the publication of Darwin's researches—we have been accustomed to look on the forms, colors, perfumes, and nectar-like secretions of flowers as so many adaptations and contrivances to secure the visits of insects, and the consequent fertilization of the flower. Recently, however, an observer has been found who is bold enough to challenge these opinions of Darwin, Delpino, Mueller, Lubbock, and others. M. Gaston Bonnier, after having observed during the last seven years some 800 plants in various parts of Europe, comes to the following conclusions, the details upon which he founds them being given in recent numbers of the *Annales des Sciences Naturelles* and of the *Bulletin* of the Botanical Society of France:

"1. The development of colors in flowers has no relation to the development of nectar. In closely allied species of the same genus, the most conspicuous flowers are not those which are most visited by insects.

"2. In dicœcious flowers provided with nectar the insects do not visit first the male and afterwards the female flower.

"6. Bees become accustomed to colors, but as much so to those which are inconspicuous as to those which are brilliant. For the same weight of honey a green surface is as freely visited as a green surface with a background of red.

"4. The development of spots and stripes on the corolla has no relation to the production of nectar."

M. Bonnier, who has studied the anatomy and disposition of the nectar-secreting organs in a great number of plants, points out that these accumulations of saccharine material occur usually in parts of the plant where development is going on actively, as in young leaves or young ovaries. When the emission of liquid ceases, the saccharine matters contained in the nectaries return into the plant, and are probably used up by the neighboring parts in the course of this development. In fact, the nectaries, whether floral or extra-floral, whether they excrete liquid or not, act as reservoirs of nutriment which is in direct relation to the life of the plant.

Vegetable "Commensalism."—I wonder, says Mr. J. E. Taylor, whether botanists will ultimately discover that certain plants are "commensal," as well as certain animals, such as Prof. Van Beneden has told us about in his "Animal Messmates." For several years past, I have been particularly struck by the occurrence in the eastern counties (of England) of the yellow wort (*Chlora perfoliata*) so constantly in company with the bee orchis (*Ophrys apifera*), that when I have found one plant I have almost instinctively looked for the other. Has this association been noted elsewhere? It seems possible to imagine that flowers generally obscure should reap some advantage by growing in the neighborhood of more attractive kinds (although the bright yellow wort hardly needs to associate with the bee orchis on that account), just as you see little confectioners' booths springing up by the side of the itinerant circus, in order to profit by the greater attraction of the noisy exhibition. Again, I conceive it possible that other flowers may be advantaged in quite a different way, by growing in company with plants possessing some poisonous, stinging, or other defensive property. Thus, it is noticeable how certain kinds of umbelliferous flowers are always found growing in the midst of dense patches of nettles, or amid the thorny brambles and hedge rows. Have any of our botanical readers noticed anything approaching such "commensalism" as here suggested?

Multiplication of Weeds.—It has been found, says the *American Agriculturist*, by careful and patient counting of the number of perfect seeds produced in a number of seed pods, and then counting the number of mature pods, that on a single plant of purslane (*Portulaca oleracea*) there will be 1,000,000 seeds matured. This will furnish a seed for every square foot of ground on 23 acres. Suppose each of these plants of the second generation does as well as the single parent, we will have the enormous sum of 1,000,000,000,000,

as the seeds of the second generation from a single plant, or a seed for every square foot of 23,000,000 acres.

Recent Researches on Pollen.—All the more recent manuals of botany assert that the two groups of flowering plants—the gymnosperms and angiosperms—are differentiated, the one from the other, by certain striking peculiarities relating to their reproductive systems. One of these is that in the former the pollen grains are multicellular, a nice, and it ought to be an easily ascertained distinction, but one that turns out on investigation not at all true; for Fredr. Elfring, of Helsingfors, working under the eye of Strasburger, and in his physiological laboratory at Jena, has lately proved that the pollen cell of wind-fertilized or self-fertilized angiosperms is also compound, or, in other words, that each pollen grain becomes divided into two cells, the one of which plays the part of a vegetative cell merely, and the other takes upon itself the growth and functions of the pollen tube. There is thus, as it were, a thallus formed, one cell of which performs the function of an antheroidal or small cell. All this has long been known to be the case in the gymnosperms, of which our cone-bearing trees and shrubs are familiar types; but in the angiosperms, embracing nearly all our showy flowering herbs, shrubs, and trees, despite Strasburger's researches, published in 1877, it is still most generally stated that inside the inner coat of the pollen grain there is but a single protoplasmic mass which gives rise to the pollen tube. So far as this difference in the pollen is concerned, it will now probably not be again insisted on, for a glance at the copious figures drawn from nature by Mr. Elfring will satisfy the most skeptical that the angiospermous pollen grain is really a compound body, entitled to rank as a thallus, and in which, as in the gymnosperms, there are both functional and vegetative cells. Mr. Elfring does not seem to have examined the pollen of such cleistogamous plants as some of violets, wood sorrel, etc., and the future study of this may reveal some interesting facts.

The Acidity of Flowers.—As a result of the observations of MM. Frémy and Clöez it was stated that the juices of all red and rose-red flowers showed an acid reaction, whereas the juices of blue flowers were always neutral, or even feebly alkaline. The subject has recently been studied anew by Herr Vogel, who examined one hundred species—thirty-nine blue, forty-four red, six violet, eight yellow, and three white flowers. The experiments (which the investigator has described to the Munich Academy) confirm the view that it is not warrantable to attribute the red coloring of flowers to the action of acids or acid salts on blue coloring matter, or to attribute the latter to the influence of alkalies on red coloring matter, though doubtless there is a certain relationship between certain red and blue plant colors. It further appears that the opinion that plant juices generally, and even the majority of flower juices, have an acid reaction, is pretty correct; among 100 flowers, there were only twelve which did not react acidly. On the other hand, the rule above referred to is not found to apply universally, for among thirty-eight blue flowers, twenty-eight showed a decidedly acid reaction, though the degree of the acid was less than in red flowers.

A Mouldy Apple.—Says Professor Williamson, in *Science for All:* A rotting apple is allowed to remain neglected in some corner of a closet, and there springs up from its decaying surface a crop of one or more forms of mould. Two such apples, obtained from the same tree, and otherwise identical in every respect, shall be similarly exposed in two different closets; the one may become covered with one species of mould, and the other with a different one. Such differences as these have been observed to result in the case of experiments conducted within a few inches of each other, and can only be explained on the supposition that the germs of various species of mould were floating in the air, and that some of one species fell upon one apple, while those of a different species reached the other. These germs, or spores, are so exceedingly minute and light, even when freshly gathered from their parent plant, that they float before the breeze with the greatest readiness; but when dried up—a process which they are capable of enduring without any loss of their vitality—they become almost imponderable: hence feeble atmospheric currents are capable of carrying them into the most remote and sheltered corners. That they mingle freely with the visible dust is shown by the observations to which I have alluded; though it is difficult, perhaps impossible, to identify the spores of these moulds and other fungoid plants with absolute certainty, since objects that are not distinguishable from them are also readily caught in the glycerine traps to which I have referred.

Aluminum in Telegraphy.

The value of aluminum in telegraphy has for some time been well known, and has lately attracted special attention. This metal possesses double the conducting power of iron, and can be formed into extremely thin wires for various purposes; but the high price, and the difficulty of its production on a sufficiently large scale, have hitherto proved obstacles in the way of its employment. According, however, to a recent statement in the *Allgemeine Polytechnische Zeitung*, aluminum can be produced in considerable quantities, and at a comparatively small cost, by reducing it from the cryolite of Greenland in smelting works by means of silicious iron or zinc ore. With iron aluminum forms an alloy capable of being made into wire which is eminently suitable for telegraphic purposes, as, in consequence of its higher conducting power, thinner wires could be employed than the iron wires in present use. Owing to its light weight (which would be an additional point in its favor for general purposes), such wire would be specially adapted for use in military telegraphy, since great lengths of the compound wire can be carried on one bobbin.

Dr. Crookes' Remarkable Discoveries.

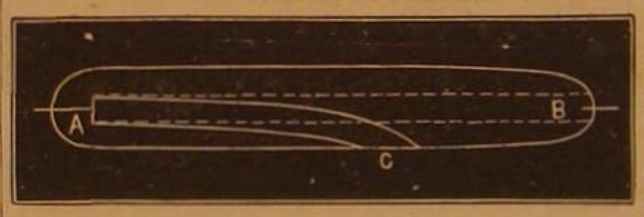
Dr. William Crookes, F.R.S., brought some of the results of his recent researches on the action of molecules in high vacua before the British Association at the recent Sheffield meeting. One experiment showed that light seems not to travel always in straight lines. Mr. Crookes has been enabled to carry on all his experiments by the aid of the invention of the Sprengel air pump—an instrument which will give a vacuum of a high order altogether impossible to be obtained with the old valvular instrument.

The Sprengel pump consists, in its simplest features, of a long and narrow vertical tube of glass, through which mercury falls in successive drops. The first drop pushes air before it and leaves a partial vacuum behind it; the next drop pushes the rarefied air before it and leaves a greater vacuum behind it; and so on *ad infinitum*. Among the later improvements of the pump is the substitution of two or three tubes for one, so that the whole process, which is otherwise a very slow one, may go on with more rapidity.

By the aid of the Sprengel air pump Mr. Crookes has at last succeeded in producing a vacuum almost as impervious to electricity as a rod of ebonite.

According to the generally received ideas in relation to molecular physics, if gas be confined in a glass vessel the molecules fly hither and thither, striking against the sides of the vessel and against each other in a state of wild confusion. Mr. Crookes pumps away so much of this confused mass that the remaining atoms have much less liability to knock against each other; and in the high vacuum in which this result is obtained an electrical discharge is divested of many of its ordinary characteristics. He has also discovered the curious effect that, if the negative pole of an induction coil be made in the shape of a flat disk or a concave mirror, the molecules will fly across the vacuum tube at right angles to the surface of the metallic pole. Their path is rendered visible by him by means of the luminous effect they produce upon any fluorescent object upon which they strike. Glass of all kinds is made fluorescent by them when they strike against it.

In the following diagram, A is the negative pole of a vacuum tube, which normally causes these molecules to fly across the tube in the direction A B, but on applying a magnet at C he can draw down this cylinder of molecules, as shown in the diagram, so that the column of light no longer passes in a straight line. When the two cylinders of molecules are sent side by side in a straight line through the same tube, they repel each other when their component molecules are similarly electrified, which tends to show that the little atoms are charged with electricity like the pith balls of an electrical machine, and that the electricity does not pass as a current. Mr. Crookes divests his discoveries of everything in the shape of speculation, and, consequently, leaves no loopholes to enable adverse critics to find fault with him. It seems probable that these lines of light produced by molecular action are due to the flying atoms discharging their electricity in infinitely small sparks whenever they strike against the side of the tube, or against any fluorescent substances so placed as to come within the range of their impact.—*British Jour. of Photography.*



Artificial Madder, or Alizarine.

Taking the lowest estimate, viz., 9,500 tons, and calculating its selling prices at £150 per ton, the annual value amounts to no less than £1,425,000, or nearly a million and a half.

As a dye, it is now at most not more than one third of the average price of madder in 1859–1868. Consequently in the United Kingdom, when the annual value of madder imported was £1,000,000, the annual saving is very great.

While collecting the statistics about alizarine, I thought it would be of interest to get, if possible, the statistics of the entire coal tar color industry, and to the kindness of H. Caro, of the Badische Aniline und Soda Fabrik, I am indebted for most of the following particulars:

ESTIMATED VALUE OF THE PRODUCTION OF COAL TAR COLORS IN 1878.

Germany (of which four fifths are exported)	£2,000,000
England	450,000
France	350,000
Switzerland	350,000
Total	£3,150,000

There are now in this country six coal tar color works; in Germany, no less than seventeen; in France, about five; and in Switzerland, four. There are also three works in Germany, and three in France, which manufacture aniline in enormous quantities for the production of coal tar colors.

Such is the wonderful growth of this industry, which dates only from 1856. It is the fruit of scientific researches in organic chemistry, conducted, mostly, from a scientific point of view; and while this industry has made such great progress, it has, in its turn, acted as a handmaid to chemical science, by placing at the disposal of chemists products which otherwise could not have been obtained, and thus an amount of research has been conducted through it so extensive that it is difficult to realize, and this may, before long, produce practical fruit to an extent we have no conception of.—*Journal of the Society of Arts.*

The Supposed Compound Nature of the Elements.

BY J. NORMAN LOCKYER, F.R.S., ETC.

Continuing my researches into the nature of the so-called elements, I have found that when carefully distilled metallic sodium was condensed in a capillary tube, placed in a retort and heated in a Sprengel vacuum, it gave off twenty times its volume of hydrogen. Phosphorus, carefully dried and submitted to the same treatment, gave off 70 volumes of a gas which appeared to consist chiefly of hydrogen. Although it gave some of the lines of phosphorus, it was not PH_3, as it had no action on solution of cupric sulphate. A specimen of magnesium, carefully purified by Messrs. Johnson and Matthey, gave me a magnificent series of colored phenomena. The hydrogen lines first appeared, then the D line—not the sodium line, be it understood, for the green line was absent—and, lastly, the green line of magnesium (*b*), and then, as the temperature was increased, mixtures of all these lines, with the blue line, the D line being always the most brilliant. In this experiment only two volumes of hydrogen were collected. From gallium and arsenic no gas of any kind was obtained. From sulphur and some of its compounds sulphurous anhydride was always obtained. From indium hydrogen was given off in vacuo before heating, while from lithium no less than 100 volumes of hydrogen were given off. The conditions of the experiments were always the same, the only variable being the substance itself. —*Proceedings of British Association.*

A New Mexican Railway.

In June last Mr. Edward Learned, of Pittsfield, Mass., received a grant from the Mexican Government for building a railway 150 miles long across the Isthmus of Tehuantepec, starting from the mouth of the Coatzacoalcos river, 110 miles southeast from Vera Cruz, and extending to the inland lake on the Pacific coast, called the Upper Lagoon. The road is to have a single or double track four and a half feet in width, and is required to be completed within three years from the date of the approval of the contract, the company being required to construct yearly, to the satisfaction of the government, a section 39 miles in length. The right of way is 229·64 feet along the entire route, and the government gives the company such a strip of unoccupied public lands as may be required for the line of the road, and in addition one half of the unoccupied public lands that may be found within one league from each side of the railroad. Lands are also granted for the sites of wharves, docks, and other improvements required in the harbor of Coatzacoalcos and the Upper Lagoon, at which point the company is bound to construct and maintain two lighthouses of the first class, which shall, however, be the exclusive property of the government. The privilege of erecting a line of telegraph is also accorded by the grant.

Mr. Learned tells the *Tribune* that the work is already in progress, and that large purchases of rails and material to be used in the improvement have been made. Such of the work as can be conveniently done in this country will be executed here, in order to avoid the expense of more costly labor in Mexico. He claims that the cost of the entire work will not exceed $5,500,000, which estimate he believes to be considerably in excess of the actual amount necessary to open the road, well supplied with the requisite appliances for the performance of its business. The climate is salubrious, the thermometer ranging throughout the year between 60° and 80°; the country is productive, has easy grades, and presents no unusual or serious obstacles. The route, it is claimed, will materially shorten all lines of communication and facilitate the transmission of traffic between the principal ports of the Atlantic and Pacific Oceans.

Ailantus Silk.

For a long time the mulberry silk worm has been the sole producer of silk known in Europe, and no other species has been able to rival it for the beauty of the silky staple of its cocoon. But now, after more than 30 years' persistent epidemics, it is really at a loss that European producers attempt to maintain here and there, without any certainty for the following year, a few silk worm nurseries. Commerce seeks in China and Japan, where labor is so cheap, the greater portion of the silks used for weaving. These silks, however, are of inferior quality, the people of the extreme East keeping with jealous care their finest products for home use. Thus our silk stuffs are no longer the magnificent tissues which were the glory of French manufactories, and we may see every day in the shop windows cheap stuffs that have far more "dressing" than silk. In these circumstances French manufacturers have been looking about to discover if no substitute exists for the time-honored mulberry silk worm. For about a dozen years an imported moth has become a French insect, living in a free state and effecting its reproduction without any interference on the part of man. On the other hand, there is necessary for the rearing of ordinary silk worm, the purchase of healthy eggs, a nursery, and mulberry trees, implying expenses which

lead to a great loss if the rearing is a failure. Many persons may have observed flying about in the evening in the month of June, in the squares, avenues, and gardens with ailanto plants in the neighborhood of Paris, and even in Paris itself, a large moth, with wings variegated by longitudinal bands. In winter, there may be seen hanging to the leafless branches long cocoons, of a pretty pearly gray. These are the work of the caterpillar of *Attacus cynthia*, or ailanto silk worm, introduced into France by the Acclimatization Society, under the direction of M. Guérin-Méneville. The moth is now as much at home in France as in its native habitats, as robust, as large, and as well colored as in the north of India and China. No great welcome has hitherto been given to the new comer in France. The cocoon is not very rich in silk, it is strongly incrusted, and, on this account, presents difficulties in weaving, being regarded as good only for producing floss silk—a material of little value. Attempts have have been made to wind it; but the winding yields only the single thread of the cocoon—too fine to be used, and requiring special and expensive machinery. This question has now, however, been taken up and solved by M. le Doux. He has succeeded to some extent in separating the gum from the silk, permitting the threads to be drawn with great ease, and preserving to them, at the same time, sufficient natural glue to admit of the threads of several cocoons wound at the same time being, by the operation of twilling, twisted together and giving strands of raw silk, the only kind that can be utilized in weaving. Another chief point in the discovery of M. le Doux is that this production of raw silk is obtained with the same pans and the same hand processes as ordinary raw silk, so that no objection can now be raised on the score of expense. The specimens of silk produced are of a pretty blonde color, and make charming stuffs of *ecru* color. Moreover, both French and English dyers will know how to give the silk a variety of colors. The rearing of this new silk worm requires neither care nor expense. The wild moths look after themselves, and it only remains to collect the cocoons attached to the leaves or small branches. The ailanto tree of Japan, on which the worm feeds, is of rapid growth, and admirably adapted for covering waste spaces.—*London Times.*

The Kane Geyser Well.

BY CHAS. A. ASHBURNER, ASSISTANT SECOND GEOLOGICAL SURVEY OF PENNSYLVANIA.

The Kane Geyser or Spouting Water Well, which during the past year has attracted such general attention from the "sight-seeing" public, is no novelty to the oil man. The cause of the action has been so erroneously represented that a correct explanation seems to be demanded.

This well is situated in the valley of Wilson's Run, near the line of the Philadelphia and Erie Railroad, four miles southeast from Kane. It was drilled by Messrs. Gruhout and Taylor, in the spring of 1878, to a total depth of 2,000 feet. No petroleum was found in paying quantities and the casing was drawn and the hole abandoned, since which time it has been throwing periodically—10 to 15 minutes—a column of water and gas to heights varying from 100 to 150 feet.

During the operation of drilling fresh "water veins" were encountered down to a depth of 364 feet, which was the limit of the casing. At a depth of 1,415 feet a very heavy "gas vein" was struck. This gas was permitted a free escape during the time the drilling was continued to 2,000 feet.

When the well was abandoned, from failure to find oil, and the casing drawn, the fresh water flowed into the well and the conflict between the water and gas commenced, rendering the well an object of great interest. The water flows into the well on top of the gas, until the pressure of the confined gas becomes greater than the weight of the superincumbent water, when an expulsion takes place and a column of water and gas is thrown to a great height. This occurs at present at regular intervals of 13 minutes and the spouting continues for 1½ minutes. On July 31st Mr. Sheafer (aid McKean County) measured two columns, which went to heights respectively of 120 and 128 feet. On the evening of August 2 I measured four columns in succession, and the water was thrown to the following heights: 108, 132, 120, and 138 feet.

The columns are composed of mingled water and gas, the latter being readily ignited. After nightfall the spectacle is grand. The antagonistic elements of fire and water are so promiscuously blended, that each seems to be fighting for the mastery. At one moment the flame is almost entirely extinguished, only to burst forth at the next instant with increased energy and greater brilliancy.

During sunshine the sprays form an artificial rainbow, and in winter the columns became incased in huge transparent ice chimneys.

A number of wells in the oil regions have thrown water geysers similar to the Kane well, but none have ever attracted such attention.

As early as 1833 a salt well, drilled in the valley of the Ohio, threw columns of water and gas at intervals of ten to twelve hours to heights varying from 50 to 100 feet. This well is possibly the first of the "water and gas geyser wells."—*Stowell's Petroleum Reporter.*

FRENCH FAIENCE.

The illustration on this page represents elaborate examples of French faience. The covered dish is highly decorated, and the dessert plate shows a delicacy and refinement of treatment. The handle to the beer mug on the left, in its close

FRENCH FAIENCE.

imitation of nature, is in striking contrast with the decoration of the body of the mug. A capital design, simple yet effective, and thoroughly artistic, is seen on the unpretentious pitcher on the right of the group.

The Manufactures of the West.

After reviewing at length the conditions of the great agricultural prosperity of the West, in his instructive and suggestive paper before the Social Science Association at Saratoga, Mr. Robert P. Porter, of the Chicago *Inter-Ocean*, said:

These figures naturally suggest the inquiry, Is the West as promising a land to the manufacturer as I have already shown it is to the agriculturist? Will it attract both industries? This question has been answered in a general way by Mr. Leonard Courtney in a recent lecture. He believes that the law of distribution of labor depends upon the relative and not upon the absolute superiority of certain districts as settlements for labor. Thus, if a country were discovered where the agriculturist could work at double the advantage he had in his own country, while a manufacturer could only increase his productive energy there 50 per cent, the free course of industry would deliver the country over to agriculture, and would leave manufactures to their former seats. This was the movement at first in regard to the settlement of the nine States under consideration, and is now in the newer States, where the superiority of agricultural industry is maintained. Not so in Illinois, Indiana, Missouri, and Michigan, where manufacturing can be carried on cheaper, and labor paid better, in proportion to the cost of living, than in the Middle and Eastern States.

The West is growing more important every year in manufacturing; and in industries, where recent and reliable data can be obtained, the strides made within the past few years are surprising, and worthy of the most careful consideration of political economists. In 1878 the State of Illinois made as many more rails as the whole United States did in any one year prior to 1860. The four States of Illinois, Wisconsin, Indiana, and Kansas produced last year 266,783 tons of rails, upward of 30 per cent of all the rails produced in 1878 in the United States. Illinois and Indiana alone produced half a million tons of cut nails, over one-ninth of the total production of the country. The spring of the present year witnessed the starting of new nail manufactories at Omaha, Neb., and at Centralia, Ill. The total production of rolled iron of all kinds in the United States for 1878 was 1,555,576 tons; of this, Indiana, Illinois, Michigan, Wisconsin, Missouri, and Kansas produced 232,553, or about one-seventh. The ore in the iron regions of Michigan and Missouri is very rich and free from injurious ingredients, and is capable of being successfully employed for the manufacture of all varieties of iron and steel. Professor Newberry, one of the best authorities on the subject, has observed that in these two iron districts the inhabitants of the Valley of the Mississippi have a supply of remarkably rich and pure ores, which is not likely to be exhausted for some hundreds of years, and which, from the small amount of phosphorus which they contain, will be the chief dependence of the American people for the manufacture of steel.

To Chicago and Milwaukee, and other points on the shores of the great lakes, the ore of the Lake Superior iron regions is floated cheaply, and is manufactured where disembarked, or is distributed through the interior of Illinois and neighboring States, to be brought in still closer proximity to the coal. Already, as will be presently shown, an immense iron rail industry, second only to Pennsylvania, has grown up, based on the relations which have been briefly indicated between the ore and coal. The increase of population on the shores of these lakes within the past quarter century is without parallel in history, and twenty-five years more will witness a greater growth. The demand for iron will be greater than ever before, and will be met by the Western instead of the Eastern markets. This demand, according to Professor Newberry, must be furnished from three points or lines of manufacture: First, near the mines, where a limited quantity of iron will be produced from charcoal, and coke or coal brought as return freight; second, along the shores of the lakes, where the ore is transhipped and meets the coal from the interior, as in Chicago; third, in the vicinity of the coal mines, to which the ore is brought overland by rail, as at Springfield and at Joliet. Neither of these points or lines can monopolize the iron manufacture, since return freights must be furnished to empty coal cars, as well as empty ore vessels. The preponderance of the lake shores or the interior will be determined mainly by the point to which economy of fuel can be carried in our iron manufacture. With keen foresight and enterprise the West, and especially Illinois, has taken the newest and now most profitable branch of the iron trade—the manufacture of steel rails. The Bessemer process was introduced into the United States about ten years ago. From a volume published by the State of Pennsylvania, entitled "Iron-Making in Pennsylvania," page 58, I learn that the first Bessemer steel rails ever rolled in the United States were rolled at the North Chicago Rolling Mill on the 24th day of May, 1865.

In the manufacture of Bessemer steel rails Cook County, Ill., has already distanced Allegheny County Pa. Last year that great center of the iron trade, according to William P. Shinn, Esq., manufactured 72,246 tons of Bessemer steel rails. Chicago, during the same time, turned out 123,000 tons, and if the neighboring county of Will is counted in, the amount is increased to 178,000 tons, or 33,608 tons more than twice the entire production of Allegheny County. Last year the State of Illinois produced nearly one-third of all the Bessemer steel rails produced in the United States. In this way have Western industries multiplied until, in the absence of reliable data, it would be difficult to even approximate the aggregate production in branches of trade where no care is taken to collect statistics. A few years ago all our best furniture came from Boston. Said a leading Chicago furniture dealer to me the other day, "Not one dollar's worth is now bought east of Grand Rapids."

There is but one conclusion from these facts: That the labor of the country is gradually congregating where it can be most efficiently employed, and that manufacturing interests are bound to develop in and around the great iron and coal districts of the West, and near the vast lumber regions of the North; second, that the further the agriculturist pushes West, where his labor will be more liberally rewarded, the more important will become the manufacturing industries of the West.

Progress of the Petroleum Business.

The production of crude petroleum in the Pennsylvania oil fields for the first eight months of 1879 was 12,386,497 barrels, against 9,810,327 barrels for the same time in 1878, making an increase of 2,576,170 barrels, which is equal to about 26 per cent. So says *Stowell's Reporter.*

The number of producing wells in the Pennsylvania oil fields on the 31st of August, 1879, was 11,585, against 9,884 for the same time in 1878, making an increase of 1,701, which is equal to about 11 per cent.

The total production for August was 1,869,052 barrels.

THE BANEFUL EFFECTS OF ABSINTHE.

Dr. B. W. Richardson, in an article on "Chloral and other Narcotics," in the current number of the *Contemporary Review*, touches on the subject of absinthe, and points out the deleterious effects following the habit of using it as an exhilarant—a habit which, originally confined to the French, has become more or less prevalent among other European nations, and to a certain extent among Americans. He says: Absinthe, as it is made in France, whence it is exported, is a mixture of essence of wormwood (*Absinthium*), sweet-flag, anise seed, angelica root, and alcohol. It is colored green with the leaves or the juice of the smallage, spinach, or nettles. It is commonly adulterated. M. Derheims found it adulterated with sulphate of copper (or blue vitriol), which substance is added to give it the required greenish color or tint, as well as to afford a slight causticity, which, to depraved tastes, is considered the right thing to taste and swallow.

M. Stanislas Martin stated that he found chloride of antimony, commonly called butter of antimony, as another adulteration used also to give the color. Chevalier doubts this latter adulteration, but that with sulphate of copper is not disputed. The proportion of essence of wormwood to the alcohol is 5 drachms of the essence to 100 quarts of alcohol. The action of absinthe on those who become habituated to its use is most deleterious. The bitterness increases the craving or desire, and the confirmed *habitué* is soon unable to take food until he is duly primed for it by the deadly provocative. On the nervous system the influence of the absinthium essence is different from the action of the alcohol. The absinthium acts rather after the manner of nicotine; but it is slower in taking effect than the alcohol which accompanies it into the organism. There is, therefore, felt by the drinker, first, the exciting relaxing influence of the alcohol, and afterward the constringing suppressing influence of the secondary and more slowly acting poison. The sufferer, for he must be so called, is left cold, tremulous, unsteady of movement, and nauseated. If his dose be large, these phenomena are exaggerated, and the voluntary muscles, bereft of the control of the will, are thrown into epileptiform convulsions, attended with unconsciousness and with an oblivion to all surrounding objects, which I have known to last for six or seven hours.

In the worst examples of poisoning from absinthe the person becomes a confirmed epileptic. In addition to these general indications of evil there are certain local indications not less severe, not less dangerous. The effect which the absinthe exerts in a direct way on the stomach would alone be sufficiently pernicious. It controls for mischief the natural power of the stomach to secrete healthy digestive fluid. It interferes with the solvent power of that fluid itself, so that, taken in what is considered to be a moderate quantity, one or two wine-glassfuls in the course of the day, it soon establishes in the victim subjected to it a permanent dyspepsia. The appetite is so perverted that all desire for food is quenched until the desire is feebly whipped up by another draught of the destroyer. In a word, a more consummate devil of destruction could not be concocted by the finest skill of science devoted to the worst of purposes than is concocted in this destructive agent, absinthe. It is doubly lethal, and ought to be put down peremptorily in all places where it is sold. Dr. Richardson believes that the sale of the article should be under legal control, and that no person ought to be able to get it in any form at all without signing a book and going through all the necessary formality for the purchase of a poison.

To Keep a Wet Plate without Stains during a Long Exposure.

Every photographer is familiar with the risks of stains from partial drying of the plate when a long time elapses between exciting and developing the plate. Here is a method whose extreme simplicity will entitle it at least to a trial, and one trial will prove its utility. The plan is simply to flood the plate with a few drachms of distilled water previous to exposure; the water is then poured from the plate to a developing glass, and must on no account be thrown away, for in this appears to lie the secret of success. After exposure, the plate is again flooded with the same water that was previously used, and which, after thoroughly moistening the film, is again returned to the developing glass, and mixed with the required quantity of developer, and the development proceeded with as usual. Plates so treated will give pictures as clear and free from markings as if only exposed in the camera for a few seconds. Try this before you believe it.

Silvering Mirrors.

An improvement in silvering mirrors, by which excellent results are obtained, and which at the same time spares the workmen the danger of exposure to the effect of mercurial vapors, has just been accorded a prize of 2,500 francs by the French Academy. The inventor is M. Lenoir, and his procedure is substantially as follows: The glass is first silvered by means of tartaric acid and ammoniacal nitrate of silver, and then exposed to the action of a weak solution of double cyanide of mercury and potassium. When the mercurial solution has spread uniformly over the surface, fine zinc dust is powdered over it, which promptly reduces the quicksilver, and permits it to form a white and brilliant silver amalgam, adhering strongly to the glass, and which is affirmed to be free from the yellowish tint of ordinary silvered glass, and not easily affected by sulphurous emanations.

New Copying Processes.

Herewith are further details of this process, heretofore noticed by us:

Take one part by weight of gelatine (glue does just as well), let it swell in two parts of water, melt, and add four parts of (common) glycerine with a few drops of carbolic acid, and sufficient whiting or white lead to make the whole milky. Pour the mixture into a shallow tin or zinc dish; it will be ready for use in about twelve hours.

A correspondent of the *English Mechanic* says: I have not been successful with the ink prescribed—1 violet methylated aniline (Hoffman's purple ?), 7 distilled water, and 1 alcohol—so I have bought it at the most extravagant price of 1*s.* per ½ ounce bottle; but acetic rosaniline, boiled down in alcohol till it does not run in writing, forms a capital red ink. The purple ink is dosed with oil of almonds, I suppose, to mask its real composition.

To use the process, write on any kind of paper with the ink, taking care that the writing is thick enough to show a green luster on drying. When dry, place it, face downward, on the jelly, rub it gently to bring it well in contact, and leave for one or two minutes; then peel it off. It will leave a large portion of the ink neatly transferred to the jelly; then place the paper to be printed on the writing, and pass the hand over; bring it well into contact as before, peel it off, and it will bring away a perfect copy of the original. In this way sixty to eighty copies may be made; by using a thick pen and plenty of ink, one hundred good prints may be taken. If the original still shows a green luster, another transfer may be made. When exhausted, wash off the ink from the jelly with a sponge and cold water; the ink need not be entirely removed, since it does no harm if too faint to print and the composition is worn away by washing; a layer a quarter inch thick would give five thousand copies at least, if not twice that number. If the jelly is injured, it may easily be melted down over a spirit lamp or in an oven. After melting, and in the first instance after making, the surface should be washed with cold water.

Improved Tanning Process.

Dr. Chr. Heinzerling, of Frankfurt a. M., Germany, has invented and patented a new and improved tanning process, which produces better and more durable leather, and is from 20 to 25 per cent less expensive than the old methods. The greatest advantage that it possesses over the old methods is that it requires but 3 to 5 days instead of as many months.

The raw hides are unhaired and swelled in the ordinary manner, and are then placed into a solution of sour bichromate of potassa, or sour chromate of soda, or sour chromate of magnesia and alum, or sulphate of alumina and salt. They remain in this solution for a few days, according to the thickness and quality of the hides and the concentration of the solution.

Instead of placing the hides directly into one of the above solutions, they can be first submitted to the action of a solution containing about 10 per cent of alum and some small pieces of zinc. By the action of the alum and the zinc, amorphous alumina (clay) is deposited upon the fibers of the hide and prevents an injurious action of the strong solutions. If the hides have been in the above solutions of soda or alum for a certain time, a few per cent of ferrocyanide or ferricyanide of potassa are added, which will prove to be very effective for the leather to be used for the uppers of shoes.

They are then placed into a solution of chloride of barium or acetate of lead, or soap, for a few days, to fix the tanning substances. They are then dried and treated in the ordinary manner with fat, or paraffine, or naphtha dissolved in benzine and similar substances, to which a small quantity of thymol or carbolic acid should be added.—*Deutsche Industrie Zeitung.*

Lightning Rods.

In an interesting article in the *Building World*, it is stated that there is in Carinthia a church which was so often struck by lightning that at length it became the custom to close it during the summer months. This continued until, in 1778, the church was rebuilt and provided with a suitable lightning conductor, since which time the building has been struck but few times and has suffered but little damage. It was at one time held that the best way to protect a building was to repel the lightning from it, and as glass is one of the best non-conductors, a thick glass ball was placed upon the top of the spire of Christ Church, Doncaster, England, but in 1836 lightning struck the church, shattering the ball and seriously damaging the spire. The carrying out of a theory which in this case proved so disastrous has had a happier result in the Houses of Parliament, London, where Sir W. Snow Harris, who was charged with protecting the building, carried the flat copper bands which were used for lightning conductors behind the plastering of the walls; and Faraday caused a spiral channel, following the course of the stairs from top to bottom, to be cut in the granite of the lighthouse on Plymouth breakwater, in which was laid a massive copper lightning rod. One of the best instances of what may be called natural protection is afforded by the London Monument. This column, some two hundred feet high, is crowned by a bronze flame, which typifies the great fire of London; this flame is in contact with the bars of the iron cage in which it was found necessary to inclose the balcony at the top, to prevent persons from throwing themselves over, and the bars in their turn connect with the rail of the balcony and the hand-rail of the staircase which descends to the ground. It is useless to try to insulate the vane spindle or finial upon a tower or spire by using glass rings; it is better to make this rod the upper part of the lightning conductor. The earth end of a lightning conductor should be carried to continually damp earth or running water, but not to a stone-lined well or cistern.

Effects of Pressure on Various Substances.

It is stated that a member of the Belgian Academy of Science, Mr. Spring, has made some experiments on the effect of pressure on powdered substances. He is said to have subjected, amongst other things, a quantity of powdered poplar wood to a pressure of twenty thousand atmospheres (about 280 tons per square inch). The result was a block having greater hardness than the natural poplar wood, and having a specific gravity of 1·328, while the natural wood has a specific gravity of only 0·389.

There must be an error here in the statement of the pressure. Twenty thousand atmospheres would be 300,000 lb., or only 150 tons per square inch.

We understand that Mr. Edison has lately made some interesting experiments with high pressures. Among other things we are told that he has subjected alumina (clay) to a pressure of 80,000 lb. per square inch (40 tons), the result being the production of a substance so hard and sharp that it cuts glass.

The Fires of St. Elmo.

An interesting example of the fires of St. Elmo was seen recently in the Jura above St. Cergues. The sky was dark and stormy. The air was thick with clouds, out of which darted at intervals bright flashes of lightning. At length one of these clouds, seeming to break loose from the mountains between Nyon and the Dole, advanced in the direction of a storm which had, meanwhile, broken out over Morges. The sun was hidden and the country covered with thick darkness. At this moment the pine forest round St. Cergues was suddenly illuminated, and shone with a light bearing a striking resemblance to the phosphorescence of the sea as seen in the tropics. The light disappeared with every clap of thunder, but only to reappear with increased intensity until the subsidence of the tempest. M. Raoul Pictet, who was one of the witnesses of the phenomenon, thus explains it in the last number of the *Archives des Sciences Physiques et Naturelles:* Before the appearance of this fire of St. Elmo, which covered the whole of the forest, it had rained several minutes during the first part of the storm. The rain had converted the trees into conductors of electricity. Then, when the cloud, strongly charged with the electric fluid, passed over this multitude of points, the discharges were sufficiently vivid to give rise to the luminous appearance. The effect was produced by the action of the electricity of the atmosphere on the electricity of the earth, an effect which, on the occasion in question, was considerably increased by the height of the locality, the proximity of a storm cloud, and the action of the rain, which turned all the trees of the forest into conductors.

The Power of Guns.

Herr Krupp contends that if we wish to know the real power of a gun we must observe how much power we get for a given weight in the gun itself. Thus, he has issued a table showing that for every kilogramme of weight in his great breechloader, weighing a total of 72,000 kilogrammes, or nearly 71 tons, there is a power put forth equal to very nearly 140 meter kilogrammes—that is to say, the force displayed by the projectile would lift the entire gun 140 meters high, seeing that every kilogramme of weight would be raised to that height. In fact, we may say that the real measure of the power of a gun is the height to which the gun itself would be raised by the power which is imparted to the projectile when the gun is fired. Krupp, with his great breechloader, gives to a projectile of 777 kilogrammes a velocity of 502 meters per second. This force would lift more than 10,000 tons a meter high, which is the same as raising the gun itself to a height of 140 meters, or 458 feet. The same test may be applied to other guns. Thus we find, according to the results given by Herr Krupp, that the energy of the shot fired by the Fraser 80 ton gun would raise the gun itself to the height of 121 meters, or 397 feet. So also the Armstrong gun of 100 tons develops an energy sufficient to raise that gun to an elevation of 125 meters, or 415 feet. The power of modern artillery is well illustrated by the fact that the shot flies on its way with a force sufficient to raise the gun itself to an altitude equal to that of the gilt cross on the top of St. Paul's Cathedral. Krupp himself lays claim to a power sufficient to make his steel breechloader of 70 tons soar at least 50 feet above the topmost point.

American Cottons for India.

During the first half of September, one of the largest firms of agents in Lancashire, England, took more orders for American cotton cloth for India than they received during the same period for all the English firms which they represent. This significant statement, by the Blackburn correspondent of the London *Standard*, indicates that there is a basis of truth in the assertions of English cotton millers, who have closed or who threaten to close their mills, when they say that they can buy cotton cloths cheaper than they can make them.

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.

The best results are obtained by the Imp. Eureka Turbine Wheel and Barber's Pat. Pulverizing Mills. Send for descriptive pamphlets to Barber & Son, Allentown, Pa.

A firm in Scotland, representing a New York Leather Belting House, are anxious to obtain another representation for American goods. Address B. J. H., P. O. Box 2701 New York.

Agents wanted To sell State Rights for a small Household Article. John A. Worley, Cleveland, O.

For Sale Cheap.—No. 1 Weymouth Lathe, 5 ft.; one C B. Rogers Rod Machine; one do. Saw Table; all nearly new. E. Gould & Eberhardt, Newark, N. J

Wanted—Employment with some opportunity for study or drawing in daylight. Mechanical tastes, considerable experience with machinery; American; single; 36 no bad habits. R. B. Fenn, Medina, O

Buy Calvin Carr's Cornice Machines. 44 Center St., N.Y.

Linen Hose, Rubber Hose, Steam Hose; all sizes. Greene, Tweed & Co., 18 Park Place, New York.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery. Send for descriptive catalogue to Rowley & Hermance, Williamsport, Pa.

Repairs to Corliss Engines a specialty. L. B. Flanders Machine Works, Philadelphia, Pa.

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions Profitable business for a man with small capital. Send stamp for 80 page illustrated catalogue. McAllister, Manufacturing Optician, 49 Nassau St., New York.

Great Inducements.—It will pay you to send for our Standard Subscription List. All leading periodicals furnished. Wm. H. Schutte & Co., 174 Pearl St., New York.

Blake's Belt Studs. The strongest, cheapest, and best fastening for all belts. Greene, Tweed & Co., New York.

Microscopes, Optical Instrm'ts, etc. G. S. Woolman, 116 Fulton St., N. Y.

S. A. Woods' 27 in. Single Lag Bed Surfacer for sale by A. M. Quinby & Co., Wilmington, Del.

Philadelphia Hydraulic Works, Philadelphia. Pumps and Hydraulic Presses.

Book on Making and Working Batteries, Electrotyping Plating, etc., 25 cts. T. Ray, Box 356, Ipswich, Mass.

For Sale.—Agricultural Engine, 8 horse power, cheap. S. J. Benedict, East Randolph, N. Y.

The United States Capitol at Washington, the Metropolitan Elevated Railroad of New York, and many of the largest and finest structures in this country, are painted with H. W Johns' Asbestos Liquid Paints, which are rapidly taking the place of all others for the better class of dwellings, on account of their superior richness of color and durability, which render them the most beautiful as well as the most economical paints in the world. H. W Johns M'f'g Co., 87 Maiden Lane, New York, are the sole manufacturers.

For Sale.—48 in. x 12 ft. Planer, in good order, price $700. E. P. Bullard, 14 Dey St., New York.

Patent For Sale.—Solid Die Rivet Making Machine. G. A. Gray, Johnston Building, Cincinnati O.

Nickel Plating.—Sole manufacturers cast nickel anodes pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Steam Excavators. J Souther & Co., 12 P.O. Sq. Boston.

The Secret Key to Health.—The Science of Life, or Self-Preservation. 300 pages. Price, only $1 Contains fifty valuable prescriptions, either one of which is worth more than ten times the price of the book. Illustrated sample sent on receipt of 6 cents for postage. Address Dr. W. H. Parker, 4 Bulfinch St., Boston, Mass.

The Baker Blower runs the largest sand blast in the world. Wilbraham Bros., 2313 Frankford Ave., Phila., Pa.

Magnets, Insulated Wire, etc. Catalogue free. Goodnow & Wightman, 175 Washington St., Boston, Mass.

Forsaith & Co., Manchester, N. H., & 213 Center St., N. Y. Bolt Forging Machines. Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery Send stamp for illus. cat. State just what you want.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

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

H. Prentiss & Co., 14 Dey St., New York, Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

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

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

Eclipse Portable Engine. See illustrated adv., p. 189.

Bradley's cushioned helve hammers. See illus. ad. p. 206.

$300 Vertical Engine, 25 H. P. See illus. adv., p. 221.

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

Eagle Anvils, 9 cents per pound. Fully warranted.

Brass or Iron Gears; Models. G. B. Grant, Boston.

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

Band Saws a specialty. F. H. Clement, Rochester, N.Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N Y.

Automatic Machines for grinding quick and accurate, Planer, Paper, Leather, and other long knives. The best Solid Emery Wheels and Portable Chuck Jaws. Made by American Twist Drill Co., Woonsocket, R. I., U.S.A.

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

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

A well equipped Machine Shop desire to manufacture special machinery. Address T H. Muller, care of P. O. Box 533, New York.

The New Economizer, the only Agricultural Engine with return flue boiler in use. See adv. of Porter Mfg. Co., page 206.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

Sawyer's Own Book, Illustrated. Over 100 pages of valuable information. How to straighten saws, etc. Sent free by mail to any part of the world. Send your full address to Emerson, Smith & Co., Beaver Falls, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 30.

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

Vertical and Horizontal Engines M'f'd by Nadig & Bro., Allentown, Pa.

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

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

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

Machines for cutting and threading wrought iron pipe a specialty. D. Saunders' Sons, Yonkers, N. Y.

Steam Engines, Automatic and Slide Valve; also Boilers. Woodbury, Booth & Pryor, Rochester, N. Y. See illustrated advertisement, page 29.

NEW BOOKS AND PUBLICATIONS.

ANWENDUNGEN DER MECHANISCHEN WÄRME-THEORIE AUF KOSMOLOGISCHE PROBLEME. Professor August Ritter, Ph.D. Hannover: Carl Rumpler, 1879. (The Applications of the "Theory of the Mechanical Equivalents of Heat" to Cosmological Problems.)

The object of the author is to deduce from the laws of the "Theory of the mechanical equivalents of heat," the properties of a heavenly body, floating in space and acted upon only by its gravity, the whole mass of the body being in a gaseous aggregate state. He also discusses the question: How would the present condition of the existing heavenly bodies harmonize with a gaseous aggregate state of the same; Also, the unstable equilibrium of the atmosphere, the temperature of an assumed atmosphere in the interior of the earth, the gaseous heavenly bodies, the relation of the mechanical action of gravity to the quantity of heat produced, the changes of the sun, the annual diminution of its radius, and numerous similar hypothetical subjects, are carefully and attentively discussed in six dissertations. These dissertations appeared in "Wiedemann's Annalen der Physik und Chemie;" the author has had them published as a separate work in order to induce others to interest themselves in these subjects and to examine and develop them. The author is Professor of Mechanics at the Technical High School at Aachen (Aix la Chapelle), and has a high standing in the scientific world.

THE MAGAZINE OF ART.

The Magazine of Art for September (Cassell, Petter, Galpin & Co., 596 Broadway, New York) is an unusually fine number. Lovers of art will appreciate the excellent illustrations and valuable information which this beautiful periodical supplies.

FORESTS AND FORESTRY. By S. V. Dorrien. New York. Paper, pp. 46.

This is a letter addressed to Verplanck Colvin, Esq., Superintendent of the Adirondack Surveys, on the importance of forests and their management in Germany, with a short review of the historical development of forestry.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

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

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

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

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

(1) J. W. C. asks how to measure a building or rooms to heat them with steam. A. According to Haswell, one square foot of plate or pipe surface will heat from 40 to 100 cubic feet of inclosed space to 75° in a latitude where the temperature ranges from —10°. As a general rule 1 square foot of heating surface will heat 100 cubic feet in an inner room, and 75 in an exposed room.

(2) R. C asks for the rules for heating of buildings by steam and hot water; or quote the best authority. A. See reply to J. W. C. on this page, also consult "Box on Heat."

(3) H. B. asks: 1. Which slides of a vertical and which of a horizontal engine wear the fastest, also the reason, practically? A. It depends upon which way the engine runs. A moment's observation should satisfy you which slide receives the most pressure. 2. Why do locomotive cylinders wear most at the ends? A. Do they wear most at the ends? If so they wear differently from all other steam cylinders. 3. Where can I obtain information about cycloids? A. In any good geometrical work. 4. What is the best works on locomotives for a young mechanic to study? A. "Forney's Catechism of the Locomotive" and "Clark on Locomotives." 5. What course of draughting would you advise a young mechanic to go through? A. If without a teacher, study MacCord's drawing in SCIENTIFIC AMERICAN SUPPLEMENT.

(4) C. B. writes: 1. I have had a practical optician experimenting the "new camera lucida," as described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158, and he can make nothing of it. Please give me the address where they may be had. A. As some of the draughtsmen in this office have made cameras from the directions given in the SUPPLEMENT, we conclude that you have not followed directions carefully. The address of the inventor of this form of camera lucida is given in the article referred to. 2. Also, is there a way to cast under pressure, and how? A. Pour your metal into the mould through a tube and leave a column of metal standing in the tube. If the metal melts at a high temperature the tube should be lined with clay or moulding sand. 3. What is the composition of oreide, that watch cases are formed of sometimes, and in what proportions are the metals mixed? A. Oreide: copper, 73; zinc, 12·3; manganese, 4·4; cream of tartar, 6·5; sal ammoniac, 2·5, quicklime, 1·3.

(5) M. & L. ask: 1. Is the electric light more injurious to the eyes than the ordinary coal oil lamp? A. The light is not injurious, but to view the source of light is. 2. Is the electric light, described in SUPPLEMENT, No. 149, sufficient to light a room, 7 feet x 10 feet x 11 feet? A. The electric light referred to is designed merely for experimental purposes and not for continued use. 3. Will it answer to make the battery jars of the ordinary household bowls? A. Yes. 4. Are the zincs of the ordinary thickness as that used by the tinsmiths? A. No; the zinc must be at least ⅛ inch thick, and it should be thicker. 5. Are the carbon holders made of brass? A. Yes.

(6) P. S. writes: 1. I have some cotton covered copper wire; would it not be best to varnish it, to make the cotton stick to the wire better? A. Yes. 2. How many feet is 1 lb. No. 24 wire? A. About 800 feet. 3. Are the coils for an electric bell and an electro-magnetic machine wound opposite to each other, that is, one right and the other left handed? A. They may be wound in opposite directions, or in the same direction, provided they are connected so that the current traverses them in opposite directions. 4. Is it best to wind the wire directly on the soft iron core, or on a thin wooden spool? A. Wind on the core after wrapping it with paper. 5. How are spools wound to give shocks, and with what No. wire? A. See SCIENTIFIC AMERICAN, Vol. 39, p. 203 (14). 6. Is a Leclanche battery for an electricity machine good to give shocks? A. It will answer for temporary use, but is not suited for long continued use, as it quickly polarizes. You should use some form of constant battery. 7. What does cotton covered copper wire No. 24 cost a pound? A. $1.10. 8. Where are the ends of the wire from the coils of an electro-magnetic machine fastened? A. To the commutator cylinder. 9. Is it best to put a strip of paper under each layer of wire in the coils? A. Yes.

(7) H. N. C. asks: How many cells of the gravity battery will be necessary to heat a piece of platinum sufficiently to light the gas with? A. About 25.

(8) H. M. P writes: In the plan of the induction coil in No. 162, SCIENTIFIC AMERICAN SUPPLEMENT, the secondary coil seems to be wound in two sections. Is it necessary? Would it not be as well to wind it right across, and put a layer of shellac and thin paper between each layer? A. Many coils have been made in the manner proposed by you, but the plan given in the SUPPLEMENT is cheaper, and the coil made in that way is less liable to injury by internal discharges.

(9) O. E. P. writes: 1. I wish to transfer upon black painted work a large number of ornaments, borders, etc., in gold bronze, and propose to have them engraved and then printed and bronzed on paper, somewhat like the transfer ornaments used on carriage work. What preparation shall I use on the press in printing? Will the gold size usually used by printers answer? A. As we understand you, the printer's gold size will answer. 2. What kind of paper should be used? A. Use a heavily sized lithographic transfer paper.

(10) M. J. W. asks: Can animal fat be thoroughly incorporated with common clay? And can the whole be aerated? A. If we understand you, no.

(11) H. S. asks: What substance is put in safes to make them fireproof? A. The composition of 19 different fillings is given on p. 218 (17), Vol. 40 of SCIENTIFIC AMERICAN.

(12) "Reader" asks how to write or engrave in relief on zinc plates, for printing, as is done by zincographers. A. Use good lithographic ink, and etch with very dilute sulphuric or nitric acid.

(13) H. C. H. asks: Has there ever been a book of instruction published on lithography or photo-lithography or both; if so, where can they be obtained? A. Consult Vogel's "Chemistry of Light and Photography." See advertising columns for address of booksellers.

(14) S. E. T.—The wheel question, "How many times does a wheel revolve on its own axis in traveling once around the periphery of a fixed wheel, both wheels being of the same diameter?" was so fully discussed a few years ago in the SCIENTIFIC AMERICAN, that we cannot again revive it. Many columns, for several weeks, were devoted to the discussion. The lunar motion argument which you now suggest was then presented. A pamphlet of over a hundred pages, called "The Wheel," was printed, containing the discussion. By a little perseverance and care in observation you can probably satisfy yourself by trial with a pair of wheels, that the moving wheel makes one revolution on its own axis and one revolution around the axis of the fixed wheel.

(15) W. F. asks: Is there a company making hydrogen gas out of water, on a large paying scale; if so, what is the process? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 42, p. 654, Lowe Gas Process.

(16) E. B. T. C. asks: What medicine or combination will relieve me from the fatty substance, commonly called "black heads," which accumulates in the face? A. A very moderate diet and frequent bathing are among the best remedies.

(17) G. W. M. asks for the best varnish or preparation for the iron cover of a cistern to preserve it from rusting. A harmless substance is desired, as some slight portion of the rain water that falls on the flat cover is liable to enter the cistern. The water is used for domestic purposes. A. You may use genuine asphaltum varnish.

(18) E. J. S. desires information in regard to boring cylinder with boring bar, with the cylinder clamped on the carriage and the centers set out of line. Will the hole bored be round or oblong? A. Oblong or elliptical.

(19) G. W. L. writes: 1. I have a clock of the old kind, generally denominated "grandfather's clock," with a good walnut case, which is painted red. What process shall I take to remove red paint? I am desirous of having it painted with some other paint. I would therefore like to remove old paint without injury to the case. A. Warm the paint with a hot shovel held near it, or with the flame of an alcohol lamp, then remove the paint with a wide scraper. 2. I am running an engine 14x20, 120 revolutions per minute; the opening to admit steam to steam chest is 4 inches x 1¼ inches: is there area enough to feed cylinder of the above named size? A. It is about one half as large as it should be. 3. What should be the size of openings or induction ports of cylinder 14x20, making 120 revolutions per minute? A. About 9 inches x 1¼ inch. 4. Should like to know what examination a man must go through to be hired as railroad engineer, that is, to run locomotive? A. We do not know the character of the examination required on railroads; it is probably different on different roads.

(20) B. C. C. writes: Our engine started to cut in the steam chest, so that we had to put in a false face. This face is just large enough to hold all the parts; and then lead was run in at each end of the face to make it steam tight. Every six months the cylinder has to be taken off and the lead run in again to keep the face steam tight. Is there anything better than lead that will do to put in its place that will answer the purpose and will not have to be renewed, as it is a great deal of trouble to take off the cylinder every time it needs fixing? A. Type metal would be much better than lead. Use Babbitt metal if you cannot procure type metal.

(21) "Subscriber" asks: What is the ratio of iron and lime (as a flux) to the silica in the ore, and upon what does such ratio depend? Also, what is the simplest and best work published on lead smelting, and the reduction of argentiferous lead ores? A. The iron desulphurizes the galena, and the lime appropriates the silica which would otherwise combine with the lead. 100 lb. galena (clear) requires about 23 lb. iron (or its equivalent in iron ore), and the quartz sand in the neighborhood of equal parts of limestone. Consult parts 4 and 5, Percy's "Metallurgy." Your ore will be noticed under "minerals."

(22) J. S. T. writes: 1. I am experimenting with a new propeller. The model is 6 inches in diameter, and I would like to make models of the best that are in use to work against it. Please give the proportions. A. You should learn how to draw a propeller by studying "MacCord's Mechanical Drawing," in the SCIENTIFIC AMERICAN SUPPLEMENT; you will then be able to draw all the different forms. 2. If there is any treatise on the subject you would advise me to peruse, please state where I can find it. A. There is no one work published that would meet your wants; information on the subject is scattered through various books and periodicals.

(23) H. A. W. asks: 1. Would the easily made chromic acid batteries do for magnetizing a rat-tail file? A. Yes. 2. How many cells would it take to destroy life? A. With a suitable induction coil, 18 or 20 cells. 3. Where can I get the carbon pencils? A. From dealers in electrical supplies who advertise in our columns. 4. What size wire do I need for covering the file and how much? A. Use about 50 feet of No. 16 cotton covered wire.

(24) A. G. S. asks how to make the preparation that is put on cards which turn a different color when there is a change of weather. It is of a pale blue color when fair weather, but in damp and rainy weather turns a pale pink. A. Use a dilute solution of chloride of cobalt in soft water.

(25) A. J. H. asks (1) how to find the area of a piston. A. Multiply the square of the diameter by the decimal 0·7854; all engineers' pocket books have tables giving the area of circles. 2. The way to find the travel of piston in feet per minute? A. Multiply the number of revolutions per minute by twice the length of stroke.

(26) S. L. J. asks for the best recipe for making a strong quick drying paste or preparation of which flour is the base, similar to that used on envelopes or postage stamps. A. The mucilage is prepared from gum dextrine (British gum), 2 parts; water, 5 parts; acetic acid, 1 part; dissolve by aid of heat. Strain, and add 1 part 80 per cent alcohol.

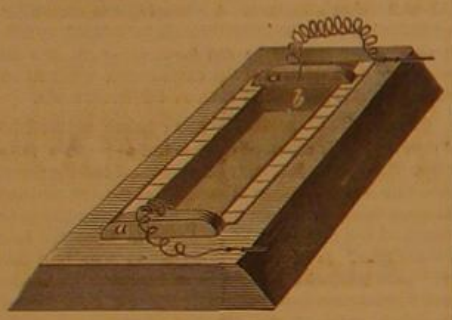
(27) H. G. A. asks: Can you give me a rule by which I can calculate the velocity of steam at different pressures through pipes of different sizes, and how much to deduct for friction on straight pipes and angles of 90°? A. A formula for the flow of steam and gases, which is generally accepted as correct, is still wanted. You can find rules and formulæ in Clark's Manual for Engineers," page 893 and onward.

(28) H. von S. asks: 1. Where and by whom are steam engines manufactured to burn petroleum oils in place of coal or wood? A. We know of no one who makes boilers specially for petroleum, though there are many boilers in the oil regions in which oil is used as a substitute for other fuel. 2. What would be a suitable size of such engine to give a boat, 30 feet long by 8 feet beam, a speed of 10 miles an hour? A. The engine for such a boat should be about 6 inch cylinder by 8 inches stroke, with tubular boiler about 40 inches diameter by 5 feet high.

(29) W. R. J writes: There is a blast furnace located about 1,200 feet from a water power. It has been proposed to convey the power by wire ropes to the blowing machinery located at the furnace. I suggest that the machinery be located at the power and the air conveyed to the furnace. The furnace will require about 1,300 cubic feet of air per minute, at an average pressure of 2¼ lb. per square inch. I propose to use a 15 inch pipe. Which plan do you think best, and what would be the loss in friction through the pipe? A. Locate your blast machinery near the power, and convey the air in a large pipe; the pipe, if large, will be a substitute for a receiver or reservoir.

(30) W. W. S. asks (1) if it is necessary that the "air chamber" (that is, any part of it) in a force pump should be higher than the discharge snout. A. Yes, to prevent the air passing away with the water. 2. When an air chamber is used, does any of the water pass into it and by so doing compress the air? A. Yes, sufficient to compress the air to the pressure required for delivery of the water. 3. Should an air chamber be perfectly air tight? A. Yes. 4. What are the advantages to be derived from using an air chamber? A. More uniform delivery of water and relief to the valves

(31) G. M. asks how to determine the conducting power of liquids. A. To measure the resistance of liquids make a wooden trough, 4 or 5 inches long, and cement it with sealing wax. In this trough place two



movable blocks, *a a*, the edges of which, extending over the sides, will serve as indices to the scale. To each of these blocks is attached a platina plate, soldered to a spiral copper wire, the ends of which are fastened to the trough. The liquid is placed in the trough, and the plates placed at any convenient distance from each other. After observing the galvanometer placed in the same circuit with this apparatus, a rheostat is substituted for the liquid and adjusted until the same deflection is produced. Since Ohm's law holds good for liquids as well as solids, the resistance of a stratum of liquid can be calculated from the length, breadth, and thickness when the resistance for the unit of section and length is known.

(32) B. H. L. asks: 1. Is civil engineering a good, profitable, and healthy business? A. Yes, in ordinary times. 2. How and where is the preparation best obtained? A. At educational institutions where it is especially taught. 3. Is civil engineering as good a business as mechanical engineering, and where do you get the best preparation for a mechanical engineer? A. The difference will depend entirely on circumstances. For mechanical engineering, in a technical school and workshop.

(33) M. A. D. writes: Suppose I have a furnace and boiler for making steam to run a large air pump. I have this pump to force air into a large iron drum. I then use this compressed air to run an engine. What per cent of the steam power can I get out of the air engine? A. Probably from 30 to 55 per cent of the power expended, and by an exceptionally good arrangement, perhaps somewhat more.

(34) W. C. B. asks: Would a circular steam boiler, 10 inches in diameter by 12 inches long, with wrought iron sides 3-32 of an inch thick, and cast iron heads 5-16 of an inch thick, with 5 one inch flues, be perfectly safe at 50 lb. pressure? A. Yes, with the exception of the heads; if they are to be cast iron, make them ⅝ inch thick at least.

(35) G. H. B. asks: What will be the mean velocity of a stream of water running through a pipe 2½ feet diam., 1 mile long, grade of 1½ inch to 100 feet, and a mean head of 2 feet? A. Formulas given differ very much, but the average result is about 3·8 feet per second.

(36) G. T. asks if there is such a place on the American coast, north, south, east, or west, as Eddystone Lighthouse, or North and South Edisto, or Edisto Island? A. Edisto Island, in the southern part of South Carolina, is at the mouth of the Edisto River, and is formed by two tidal streams called North Edisto River and South Edisto River. Edisto Island post village is on Edisto Island.

(37) W. M. B. asks if a locomotive engine, same cylinder and same pressure of steam, is as effective as a stationary engine, and if not, why not? A. No, because the valve arrangement will not permit the working of the steam expansively to the same degree of efficiency.

(38) F. L. writes I am troubled with salt in my boilers coming from the lower levels of the mine. I understand in ocean steamship practice, zinc is put in the boilers. What action has it on the salt? Is it used as a plain metal or a compound, and how, and in what quantity? A. Zinc is more electropositive than iron, and in virtue of this property it in a measure protects the boiler plates from corrosion. It is usually employed in the form of plates or scrap (spelter) in quantities of 5 or 10 lbs.

(39) F. R. R. asks: 1. Will the power or polarity of a permanent magnet be affected by constant use on an electro-magnet, to be attracted and repelled, and liable to be left in either position for a length of time? A. If the electro-magnet is strong, and the like poles of the two magnets are in contact with or near each other for a time, the polarity of the permanent magnet would be neutralized or reversed. 2. If an electro-magnet is more than twice as strong, as a permanent magnet, or *vice versa*, would not the attraction of the strong magnet for the metal of the other overcome the repelling force of its corresponding pole and attract instead of repel it? A. Yes. 3. Would it not be the same if both were permanent magnets, or both electro-magnets? A. Yes.

(40) W. A. A. writes: 1. I want to make an engine, 3½ inches stroke and 3½ inches diameter, how large should the ports and exhaust be? A. Steam ports ¾ inch x 2¼ inch. 2. How large a boiler and of what size copper should it be made of, so that it would stand 150 lb? A. Exhaust ports ⅝ inch x 2¾ inch. The size of the boiler about 30 square feet heating surface, but will depend upon the speed of the engine and thickness of metal upon the design of the boiler. 3. How large a boat would be best adapted for this engine? A. It would probably drive a good model boat, 21 feet in length, at a fair speed.

(41) W. H. G. asks: 1. If two or more small cubes of Indiarubber are clamped together in a certain machine, would the pressure cause all of the pieces of rubber to be equally reduced in the direction of the pressure, or would some of the pieces yield more than the others? A. As we understand you, if the cubes were taken from the same piece of rubber the elasticity would be about the same in all of the pieces. 2. How long would the elastic nature of rubber continue if subjected to such pressure at intervals, and where the degree of force applied sometimes varied? A. Your question will not admit of a definite reply; from one to five years, depending upon the conditions of strain, wear, and exposure. 3. In what way can rubber be made to resist the hurtful effect of linseed and other oils? A. If the rubber is to be subjected to varying compression, we know of no practical means of protecting it.

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

C. P. T.—No. 1 (quartzose), gold, 1 3-10 dwt.; silver, 255-100 oz; value $4.13 per ton. No. 2, gold, 1 3-5 dwt.; silver, 6 68-100 oz.; value per ton, $8.97. The others contain nothing.—J. S. R.—1. Pyrrhotine (magnetic pyrites, iron sulphide). 2. Zincite (red oxide of zinc). 3 and 4. Magnetite (magnetic iron ore).—R. H.—Quartz and magnetite an excellent iron ore.—J. W. C.—It is mica scales, of little value.—W. E. K.—Fossiliferous limestone.—J. D. M.—Chrysolite (olivine) in basalt.—H. W. T.—Lime carbonate. We do not exchange specimens.—N. P. W.—They are impure hematites (iron ores). No. 1 contains much sulphur, and No. 2 manganese and probably titanium.—W. S. H.—Iron pyrite (sulphide of iron) —G. P.—It is graphite (plumbago). If found in sufficient quantities, of some value.—L. L. R. & B.—Fragments of quartz, valueless.

COMMUNICATIONS RECEIVED.

On Ellipses; also, on Preserving Cider. By A. C.
On the Magnetic Needle. By G. W. M.
On Boiler Explosions. By J. P. H.
Death in What We Eat. By T. B. M.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

September 9, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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English Patents Issued to Americans.

From August 9 to September 2, inclusive.

Book stand, F. G. Johnson, Brooklyn, N. Y.
Buckles, W. J. Carnes, Gonzales, Texas.
Compound for protecting goods, D. W. Lamb, N. Y. city.
Grain elevator, J. B. Stoner, Toledo, Ohio.
Guns, W. B. Farwell *et al.*, Brooklyn, N. Y.
Horseshoe machinery, J. R. Williams *et al.*, Johnstown, Pa.
Knitting machine, B. F. Shaw, Lowell, Mass.
Machine guns, D. C. Farrington, Lowell, Mass.
Mills for grinding corn, etc., A. L. & E. Lister, Newark, N. J.
Mowing machine, P. Mast *et al.*, Springfield, Ohio.
Puddling furnace, J. Luhens, Conshohocken, Pa.
Pressure regulator, G. Ross, Troy, N. Y.
Railway signaling apparatus, W. Robinson, Boston, Mass.
Sewing machines, Wilson Sewing Machine Company, Chicago, Ill.
Spinning machinery, J. Abbott, Philadelphia, Pa.
Telephone, S. H. Short, Franklin Co., Ohio.
Water supplying apparatus, N. W. Green, Springfield, Mass.
Wheels, manufacture of, C. Bried, Newark, N. J.

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.

BOOKS
ON
Heat, Steam, the Steam Engine,
BOILERS, ETC.

Armstrong. The Construction and Management of Steam Boilers. With an Appendix by R. Mallet. Ill. 12mo, $0.75
Baker. The Mathematical Theory of the Steam Engine. Illustrated. 12mo, $0.75
Burgh. Practical Rules for the Proportions of Modern Engines and Boilers for Land and Marine Purposes. 12mo, $1.50
Bourne. Recent Improvements in the Steam Engine. Illustrated. 12mo, $1.50
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Clark. Fuel: Its Combustion and Economy. Illustrated by 144 engravings. 12mo, $2.25
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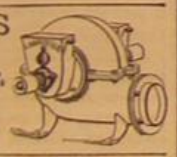

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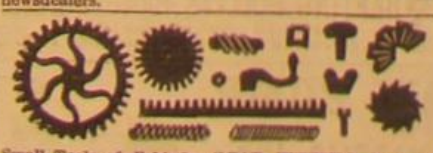
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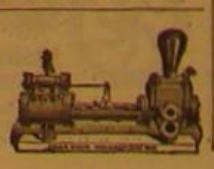

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