SCIENTIFIC AMERICAN

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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

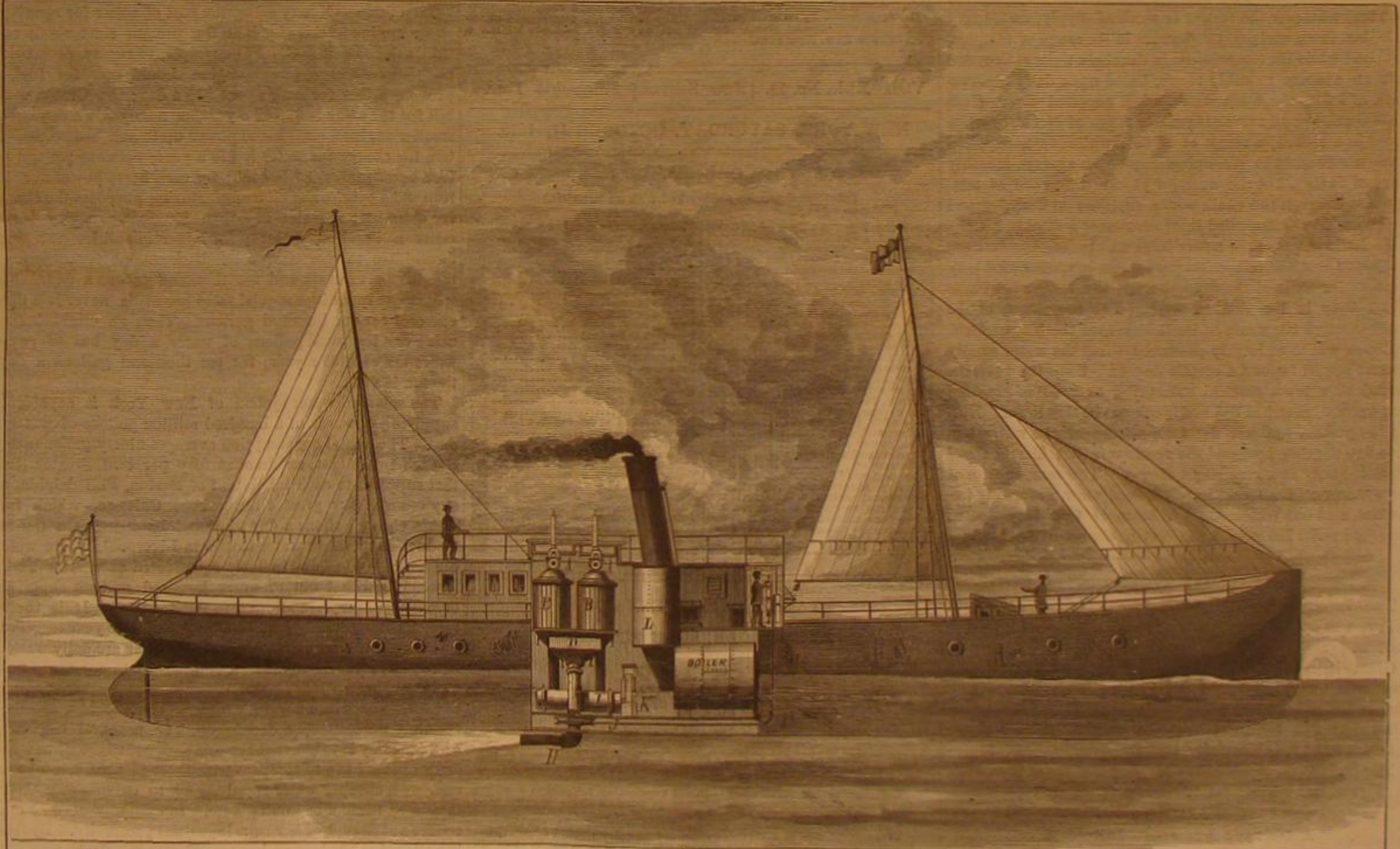


Fig. 2.

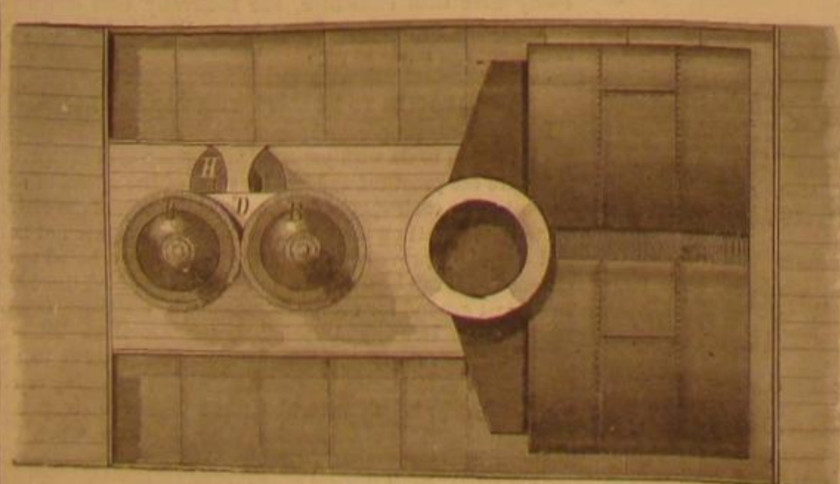
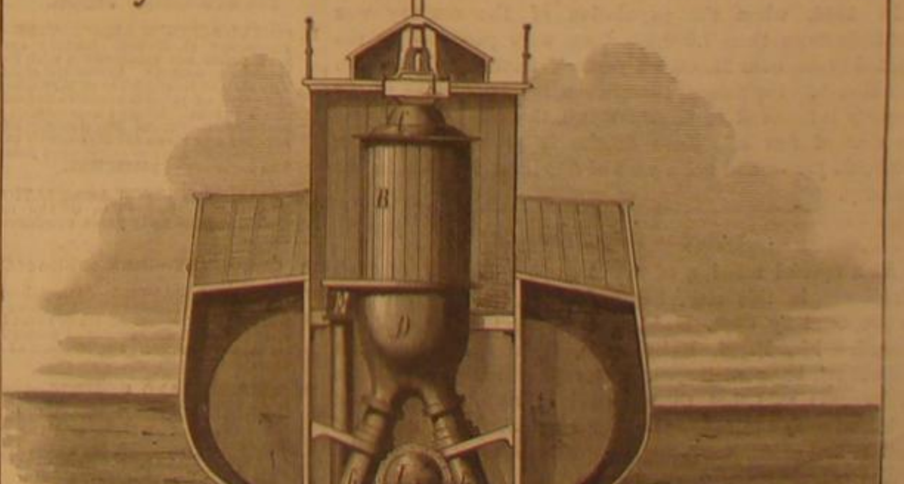


Fig. 3.



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.

Great Britain has 800 industrial exhibits and 513 of fine arts. Germany has 691 entries, and Austria 170. France has 350 industrial exhibits and 168 of fine arts. Belgium has 236 industrial exhibits and 50 of paintings America has 150 industrial exhibits.

The State Department at Washington announces that thirty or more of our leading manufacturing firms are represented.

A Decayed American Industry.

Before the advent of cheap cotton the production and manufacture of flax were important industries in this country.

In 1810, when the population of the country was but little more than 7,000,000, there were produced in the United States over 21,000,000 yards of flaxen cloth made in families. At the present time, when the population of the country is believed to be 50,000,000, the total annual production of flax and linen fabrics is probably not over 5,000,000 yards, and not a yard of fine linen is made in the country.

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.

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NEW YORK, SATURDAY, OCTOBER 11, 1879.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 197.
For the Week ending October 11, 1879.

Price 10 cents. For sale by all newsdealers.

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 6¼ 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 certainly 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	1,239,400	817,770	200	2,057,370
Corn, bush	1,075,450	45,850	....	1,121,300
Oats, bush	28,900	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 Ryffelhom, 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.

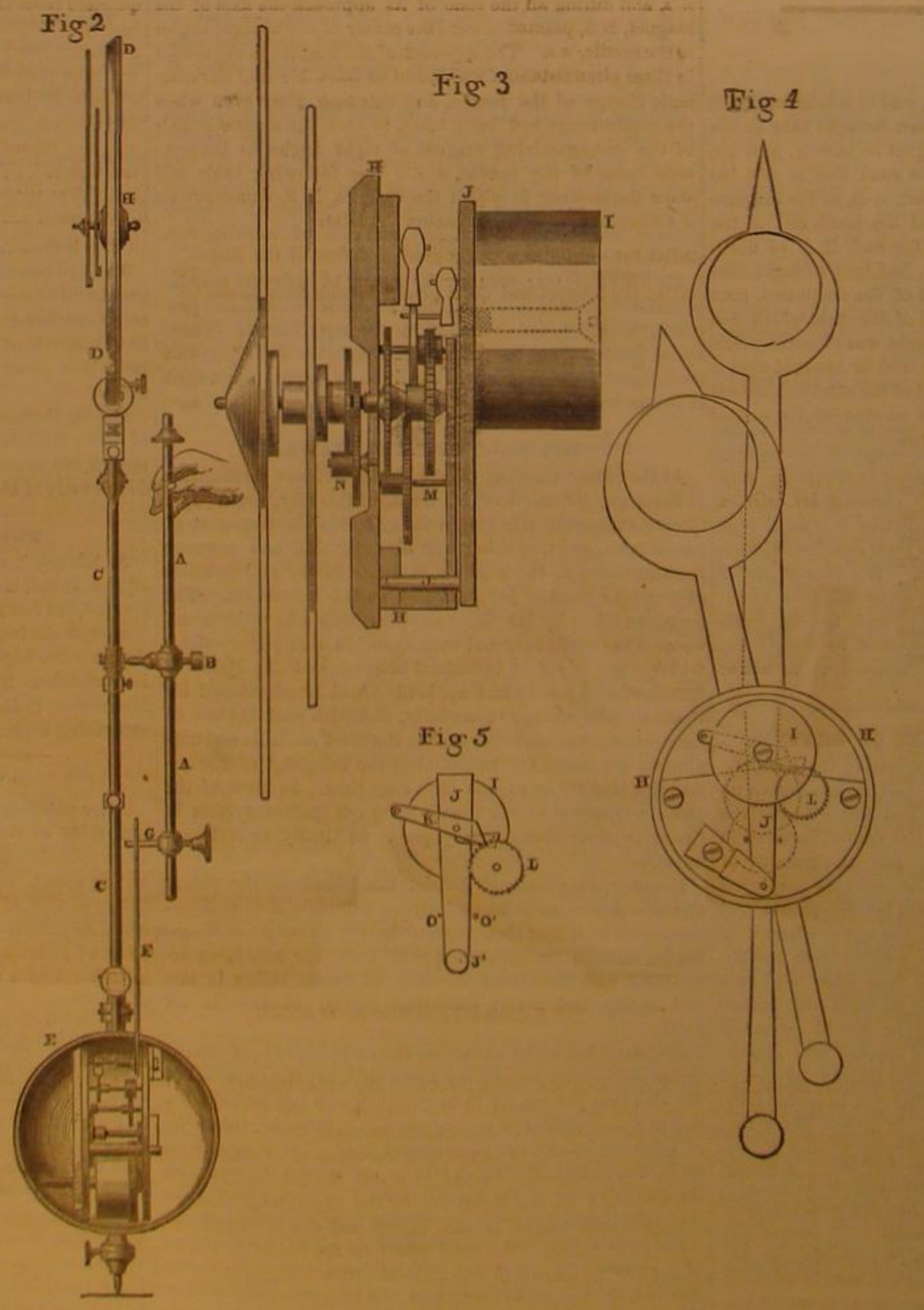
ROSSET'S CLOCK.

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. 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 $C_{116}H_{241}N_4O_{22}P$. 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 $C_{160}H_{308}N_5PO_{35}$—an alteration from Liebreich's, in all probability owing to the extreme care and the improved methods employed in these late investigations.

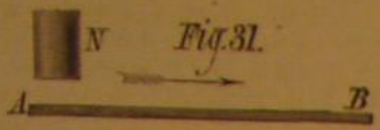


ROSSET'S MYSTERIOUS CLOCK.

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

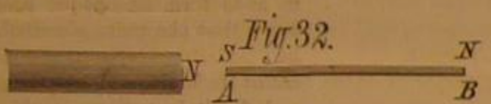
BY ALFRED M. MAYER.

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.



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.



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.

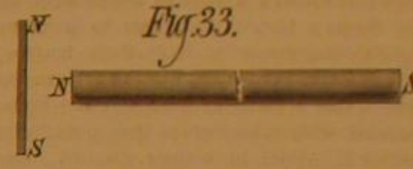
The manner of experimenting was as follows: The needle was magnetized by stroking it repeatedly with the end of the magnet. It was then placed pointing toward the center of the magnetometer needle and at right angles to the magnetic meridian. In this position the needle produced a certain angular deflection 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.

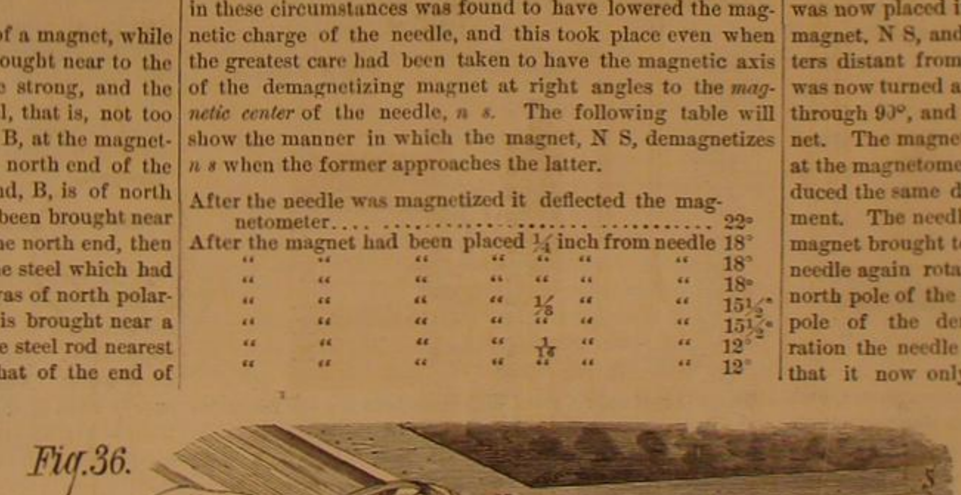
In another series of experiments the needle had its magnetic charge lowered from 61° to 35° deflection on the magnetometer.

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.



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 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.



DEMAGNETIZING A WATCH.

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 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.

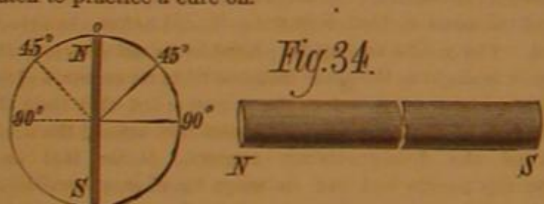


Fig. 34.

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.

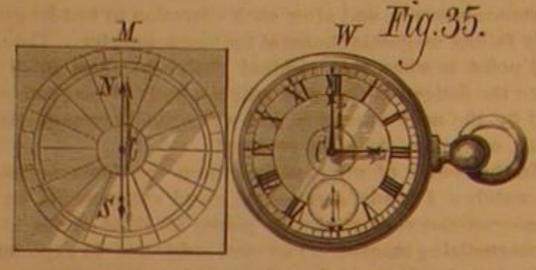


Fig. 35.

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.

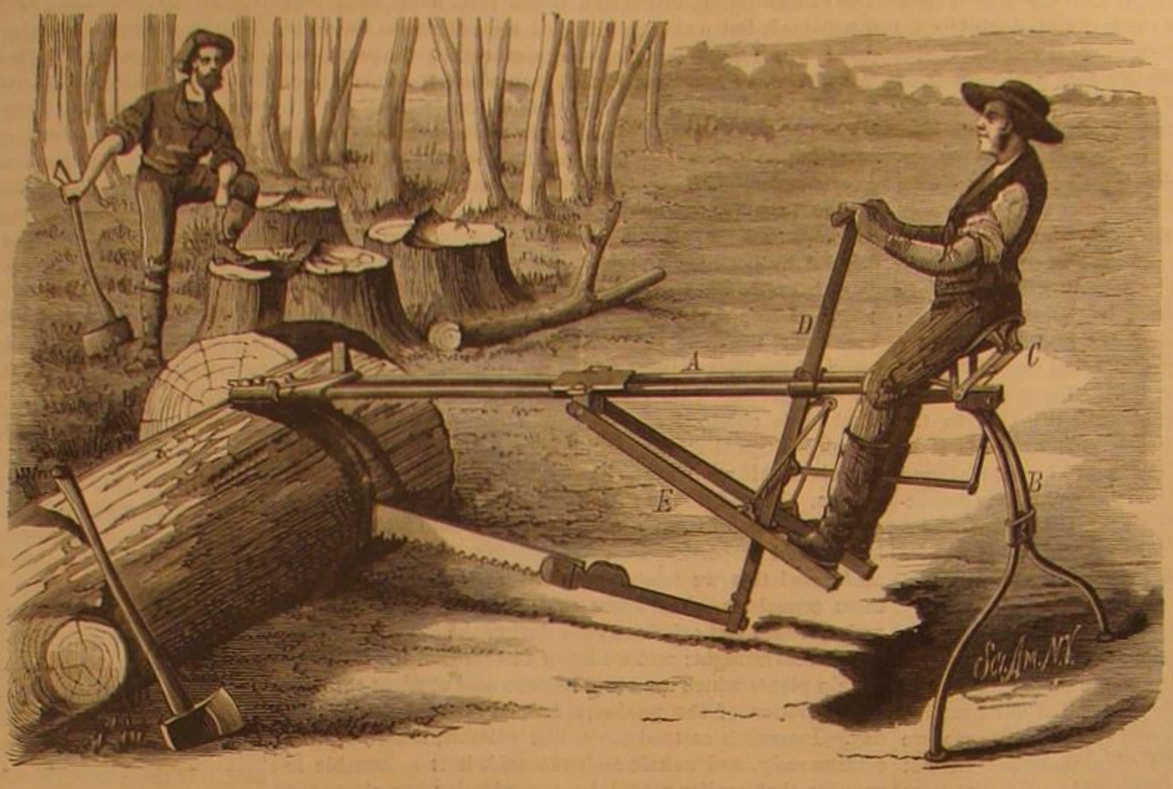
A PRE-HISTORIC CLAMBAKE.—In excavating for the Jacksonville (Fla.) water works, recently, there was found, twenty-eight feet below the surface, an ancient clambake. In a bed about six feet by four in area, the clam and oyster shells, many with gaping mouths, were arranged as for a modern clambake, intermixed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

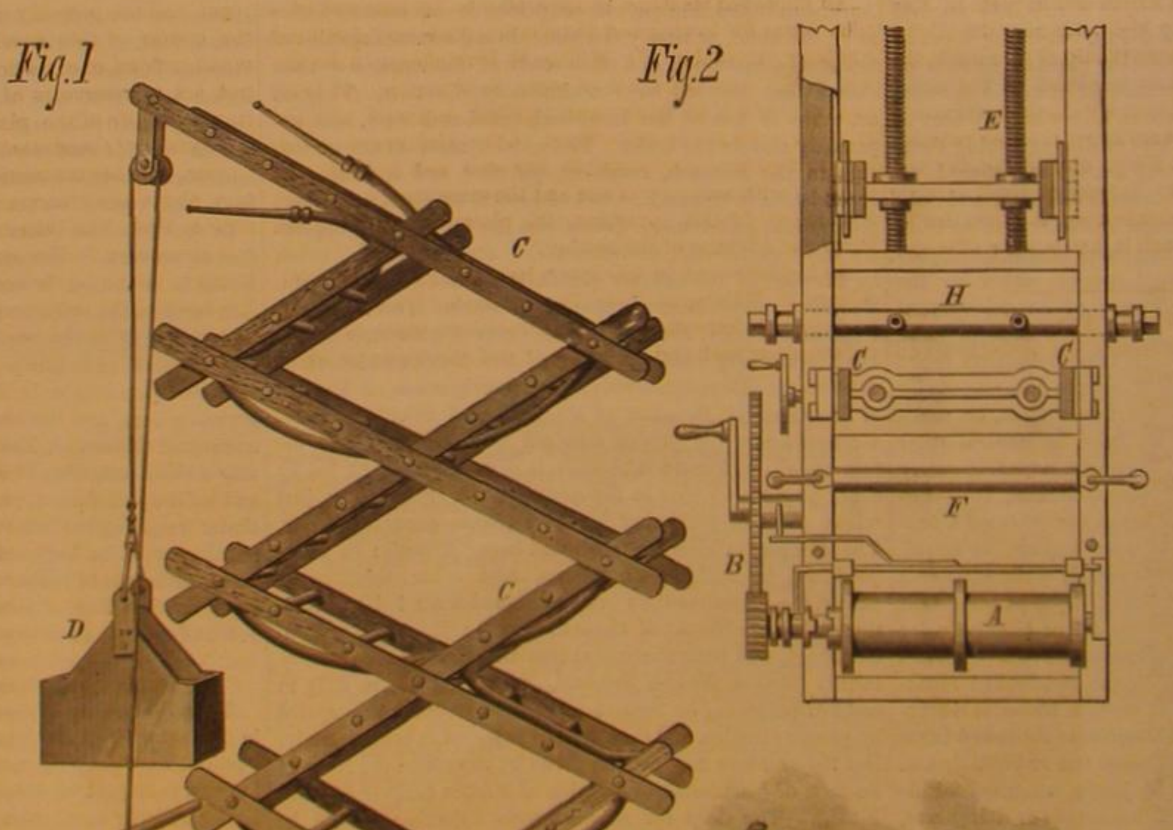
The main frame is mounted upon wheels and supports two screws, E, and the lazytongs, B. The screws, E, are provided with miter wheels, which are driven by miter wheels on a shaft at the end of the main frame. On the ends of this shaft there are fly wheels, G, provided with cranks set diametrically opposite 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 lazytongs is provided with spring-bearing pieces, F, which check the downward motion of the ladder and assist in starting it upward.

This fire escape, as will be seen, is capable of being raised to any height within the limits of the capacity of the machine, and it may be inclined at different angles to bring it into position for use under varying conditions.

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.

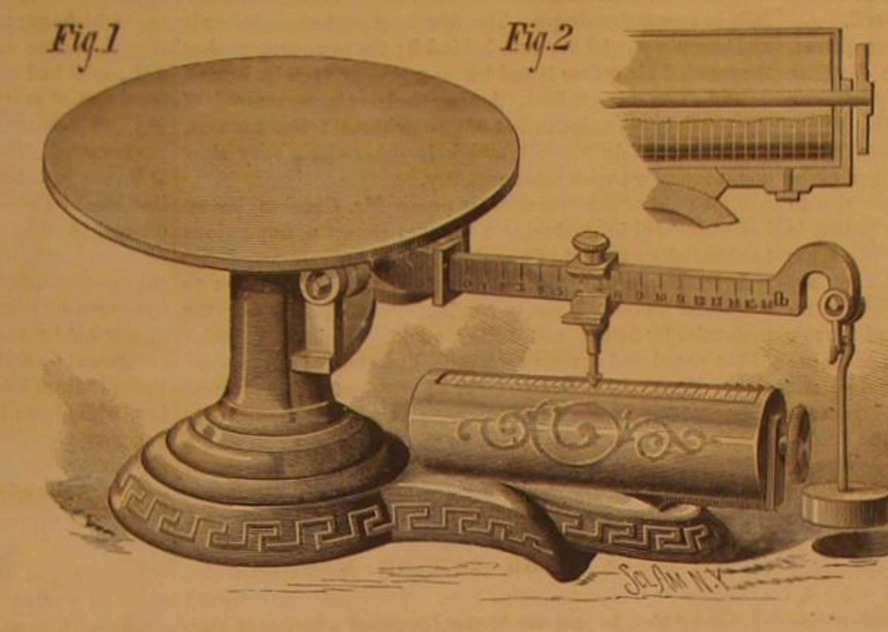
Mr. Benjamin N. Shelley, of Anderson, Ind., has invented a combined implement for domestic and other purposes, which presents in a single device and compact form, the functions of a hammer, screw driver, corkscrew, can opener, ice pick, glass cutter and breaker, stove lifter, tack drawer, saw set, knife 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.



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.

THE OTOCYON.—(*Otocyon Caffer.*)

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.

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 diœcious 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 Cloëz 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.

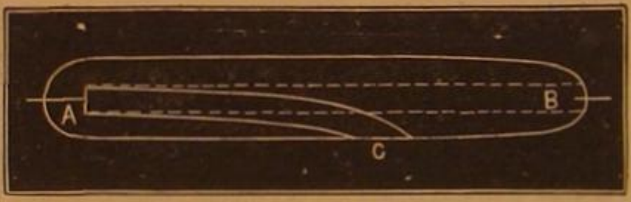
Dr. William Crookes, F.R.S., brought some of the results of his recent researches on the action of molecules in high vacua before the British Association at the recent Sheffield meeting. One experiment showed that light seems not to travel always in straight lines. Mr. Crookes has been enabled to carry 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 *écru* 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 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.

FRENCH FAIENCE.

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 1s. 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's, 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., 2318 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.

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 532, 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 WÄRMETHEORIE 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 photolithography 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 get 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.

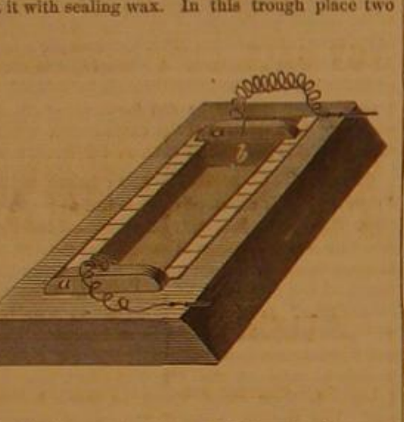
(27) H. G. A. asks: Can you give me a rule by which I can calculate the velocity of steam at different pressures through pipes of different sizes, and how much to deduct for friction on straight pipes and angles of 90°? A. A formula for the flow of steam and gases, which is generally accepted as correct, 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 2½ 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 ⅜ 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 3⅛ inches diameter, how large should the ports and exhaust be? A. Steam ports ⅜ inch x 2⅜ 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 2⅜ 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.]

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Kerosene wicks, E. W. Holbrook 7,669
Medical compounds for the cure of lung and throat diseases, E. H. Carpenter 7,676
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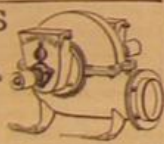

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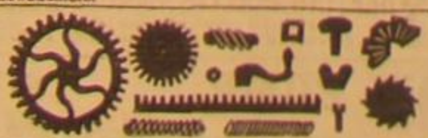
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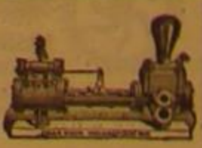

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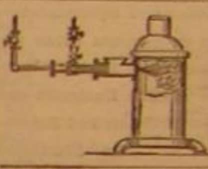

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