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THE BELGIAN SHIP CANAL.

The ship canal from Ghent to Terneuzen was originally laid out with many bends, rendering navigation difficult; it had a depth of 14 feet 4 inches and a width of 98 feet 6 inches at the water level. The works which are at present in course of execution have especially for their object the deepening of the canal to 21 feet 3 inches, with a width of 55 feet 9 inches at the bottom and 103 feet 9 inches on the water line. The slopes have a uniform inclination of 1 to 3, and the towing paths on each side are placed 6 feet 6 inches above the water level, and are 32 feet 8 inches wide. In many instances also the course of the canal has been altered and straightened for the improvement of navigation; several important diversions have been made for this purpose. The excavation has been effected by hand, by dredging, and by the Couvreux excavator, figured as below in *Engineering*.

The earth excavated was carried to spoil, and in many cases was employed to form dikes inclosing large areas, which served as receptacles for the semi-liquid material excavated by the dredging machines with the long conductors; the Couvreux excavator used will be readily understood from the engraving. It had already done service on the Danube regulation works. The material with which it had to deal, however, was of a more difficult nature, being a fine sand charged with water and very adherent. The length of track laid for the excavator was about 3 miles along the side of the old canal, which had been previously lowered to the level of the water.

Preservation of Iron and Steel from Oxidation.

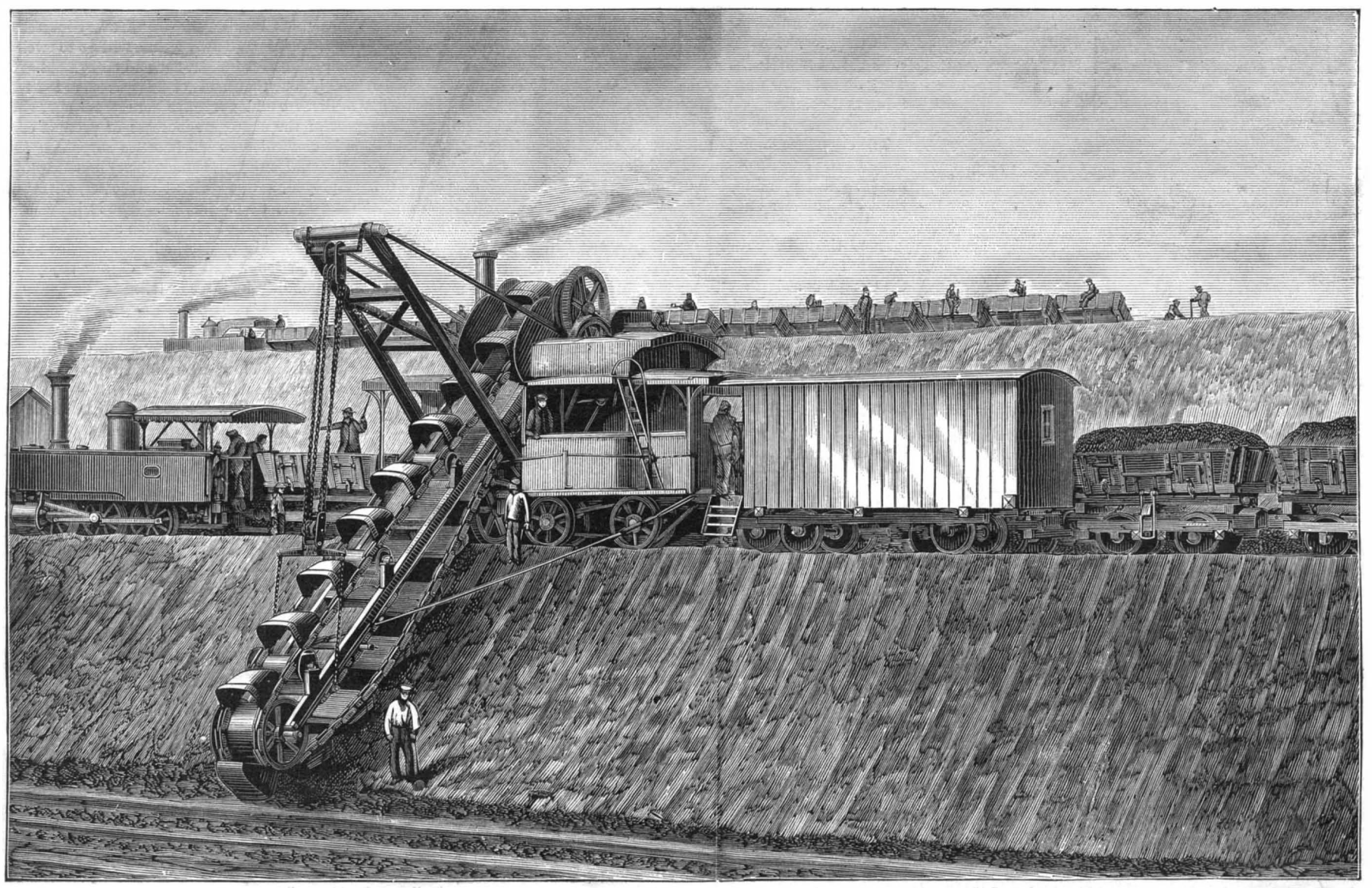
We are indebted to J. Pechar, Railway Director in Teplitz, Bohemia, for the first official report in English from the Paris International Exhibition which has come to hand. This volume contains the report on the coal and iron products in all countries of the world, and is valuable for its statistical and other information, giving, as it does, the places where the coal and minerals are found, and the quantities of each kind produced, for what it is used, and to what other countries it is exported. The able compiler of these statistics in the introduction of his report gives the following account of the means recommended by Professor Barff, of London, for preventing oxidation, which is being considerably used abroad. The writer says:

It is well known that the efficient preservation of iron against rusting is at present only provided for in cases where human life would be endangered by failure, as in the case of railway bridges and steamers. Thus, for example, at Mr. Cramer-Klett's ironworks at Nuremberg every piece of iron used for his bowstring bridges is dipped in oil heated to eight hundred degrees. The very great care which is at present taken in this matter may be judged from the current practice of most bridge and roofing manufacturers. Every piece of iron before being riveted in its place is cleaned from rust by being immersed in a solution of hydrochloric acid. The last traces of free acid having been cleared away, at first by quicklime and afterward by a copious ablution with hot water, the piece is immediately immersed in hot linseed oil, which protects every part of the surface from the action of the atmosphere. Afterward it is riveted and painted.

Notwithstanding all this, the painting requires continual and careful renewal. On the Britannia Bridge, near Bangor, the painter is permanently at work; yet, in spite of all this care and expense, rust cannot be entirely avoided. The age of iron railway bridges is still too short to enable us to draw conclusions as to the probabilities of accidents. Now, Professor Barff has discovered a process by which iron may be kept from rusting by being entirely coated with its own sesquioxide. A piece of iron exposed to the action of superheated steam, in a close chamber and under a certain pressure, becomes gradually covered by a skin of this black oxide, of a thickness depending upon the temperature of the steam and the duration of the experiment. For instance, exposure during five hours to steam superheated to five hundred degrees will produce a hermetical coating capable of resisting for a considerable time the application of emery paper and of preserving the iron from rust even in a humid atmosphere, if under shelter from the weather. If the temperature is raised to 1,200 degrees, and the time of exposure to six or seven hours, the skin of sesquioxide will resist every mechanical action, and the influence of any kind of weather. The sesquioxide being harder than the iron itself, and adhering to its surface even more firmly than the atoms of iron do to each other, there is an increased resistance not only to chemical but also to mechanical action. The surface is not altered by the process in any other respect, a plain forging retaining its roughness, a polished piece its smooth surface. If the skin is broken away oxidation takes place, but only just on the spot from which the oxide has been removed. If Professor Barff's experiments are borne out by practice, this invention may become of very great importance. It is within the bounds of probability that it may enable iron, by increasing its facility in competing with wood, to recover, at least for a considerable time, even more than the ground it has lost by the extraordinary extension of the use of steel. Iron is already being used for building purposes to a large extent; but oxidation once thoroughly prevented it will be able to take the place of wood and stone to a still greater degree. Iron roofing may be made quite as light as that of wood, and of greater strength, by a judicious arrangement and use of T iron.

Warning to Locomotive Engineers.

Drs. Charles M. Cresson and Robert E. Rogers, of this city, says the Philadelphia *Ledger*, well known as experts in chemistry and dynamics, were appointed by the Reading Railroad Company to inquire into and report upon the causes of the recent explosion of the boiler of the express locomotive "Gem," at Mahanoy City, by which five lives were lost. Their report, which is designed to cover the whole scope of a most careful investigation, is not yet made public, but they have arrived at the following specific conclusion, which we give in their own language: "We are, therefore, of the opinion that the explosion of the boiler of the locomotive 'Gem,' was produced by the projection of foam upon the heated crown bars of the furnace, caused by suddenly and widely opening the safety valve, at a time when the water had been permitted to get so low as to overheat the crown of the furnace." This is an important matter that should be carefully noted by locomotive and other engineers.



EXCAVATOR ON THE GHENT AND TERNEUZEN SHIP CANAL BELGIUM.

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No. 154,

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PROGRESS OF PETROLEUM.

The efforts of the great majority of the Western Pennsylvania petroleum producers to obtain relief from what they deem the oppressive acts of the Standard Oil Company and the unjust discriminations of the United Pipe Lines, and the various railroads traversing the oil regions, have attracted more than usual attention to the present condition of this industry and its possible future.

We would here explain that the Standard Oil Company originated in Cleveland, Ohio, about twelve years ago, and was incorporated under the laws of Ohio, with a nominal capital now, we are informed, of $3,000,000, which, however, very inadequately represents the financial strength of its members. It is now a combination of the most prominent refiners in the country, and has before been credited with manipulating the transportation lines to its own special advantage.

We can recall no instance of such serious hostility between parties whose interests are at the same time of such magnitude and so nearly identical; nor can we see what substantial, enduring benefit would accrue to the producers in the event of their victory in the struggle.

They charge that the Standard Oil Company has become the controlling power to fix prices and to determine the avenues by which the oil shall be transported eastward for home consumption and for foreign exportation; that the railway companies have given this company lower rates than other parties for transporting the oil; and that through the rates given to it by the railways the value of their property is destroyed.

The reply, in effect, is, Granting all this to be true, what does it amount to? Neither more nor less than that the managers of the Standard Oil Company, by combination of capital, by intelligence and shrewdness in the management of their operations, have built up a successful business, and that they have so extended it by the use of all practicable appliances, and by the purchase of the property of competitors, that they do practically control the prices of oil, both crude and refined, and that the uncombined capital of the other oil producers, lacking the power, the intelligence, and the business skill which combined capital can secure, cannot compete with the Standard Oil Company. Now, is there any great wrong or injustice in this?

When brains can command capital it is always more successful in business matters than any amount of brains without capital or capital without brains. This result is the natural working out of the same principle that is everywhere to be seen—some men are successful and others are not.

It is the essence of communism to drag down those who succeed to the level of the unsuccessful.

If men cannot compete with others in any business they must accept the fact, and try some other employment.

If, through superior intelligence and capital, the Standard Oil Company can control the oil business of Pennsylvania, then, according to the principles of common sense, it must be permitted to do so.

What right, then, has the oil producer to complain? Why, if all that is alleged is true, will they persist in sinking more wells, when, as they say, they are controlled by the Standard Oil Company? No one forces them to lose money by continuing in the business. Let them find other employment. They do not show that the Standard Oil Company does anything that combined capital on their part and equal business ability could not effect.

The cry of monoply in this case is altogether unfounded, those opposed to the Standard Oil Company having just as much right to do all that that company does, and, therefore, there can be no monoply, because they have no exclusive powers.

As to the railway companies, they can afford and have a right to transport the tonnage offered them by the Standard Oil Company at less cost, because it costs them less to do a regular and large business than an irregular and smaller one. They would simply be acting in accordance with business principles the orld wover.

These are the arguments, the statement of the position of a successful combination confident in its resources and of victory in the coming struggle. The justness, the correctness of the doctrines enunciated, and the wisdom of so doing at this crisis, we do not propose to criticise; but it is very safe to say that if the prosperity of the complainants depends upon relief in this direction they may as well cease producing.

There are too many of them for harmonious and concerted action against the powerful corporations they complain of; and if they should succeed in securing equal transportation facilities the prices would still be regulated by the monopolists, who carry more than four-fifths of the accumulated stock of the oil regions.

The proposed appeal to Congress to pass some law whereby each producer can compel railroad companies to carry his produce at regular rates, amounts to a confession of the desperate straits of the producers and of their weakness as well; and even if successful, which is most improbable, would not remedy the deplorable existing state of things.

Still lower rates would fail to give relief, with all the present avenues of trade filled to repletion and with an increasing output at the wells. Relief and permanent relief can be found only in the direction we have before indicated: in the general application of petroleum and its products to the manufacture of gas for illuminating and heating purposes, and its substitution for coal in the metallurgic and other prominent industries of the world.

THE LIMIT OF WORK.

In distributing the prizes to workmen at the Paris Exhibition, Louis Blanc, the leader of the French Republican Socialist party, quoted approvingly these words of Simonde de Sismondi:

"If the workman were his own master, when he had done in two hours with the aid of machinery what would have taken him twelve hours to do without it, he would stop at the end of the two."

M. Blanc had been discussing very eloquently, but also very fallaciously, the relations of machinery to labor. If men were properly united in the bonds of association, he said, if the solidarity of interests were realized, "the happy result of the application of mechanical power to industry would be equal production, with less of effort, for all. The discovery of an economic method would never have the lamentable consequence of robbing men of the work by which they live. Unfortunately, we are far from this ideal. Under the empire of that universal antagonism which is the very essence of the economic constitution of modern societies, and which too often only profits one man by ruining another, machinery has been employed to make the rule of the strong weigh more heavily on the weak. There is not a single mechanical invention which has not been a subject of anguish and a cause of distress to thousands of fathers of families from the moment it began to work."

If all this, and much else that M. Blanc alleges, were true, then the condition of all workingmen to-day should be in every way worse than that of their fathers, in anti-machinery days. But such is not the case. There never was a time when the laborer toiled less or enjoyed more than in these days of machinery; and the laborer's condition is best where the machinery is best and most used.

A hundred years ago the laborer toiled long, produced little, and enjoyed less. To-day, thanks to the victories of invention, machinery does the heaviest of the work; the workman's hours of labor are fewer than formerly; his wages are greater; and his earnings will buy vastly more, dollar for dollar, than in any previous age in the world's history.

What laborer of to-day would be satisfied with the remuneration, the food, the shelter, the clothing of the laboring classes of one hundred years ago? The wants of men, as well as their thoughts, are widened by the process of the suns. And in no section of society have the daily wants been more markedly increased, or the facilities for gratifying them either, than among those that live by labor.

"If the workman were his own master, when he had done in two hours with the aid of machinery what it would have taken him twelve hours to do without it, he would stop at the end of the two."

So says the thecretical socialist. The practical workman never has, nor, we believe, ever will, act so foolishly; certainly not until the limit of man's capacity to enjoy has been reached. When the united products of manual and mechanical effort fully satisfy the desires of all men, and leave no margin of want unfilled, then and then only will men be satisfied with the reduction of effort demanded by the socialists. Until then the larger part of every increase in production by mechanical improvements will go to swell the volume of good things for human use and enjoyment. Our machinery enables our thousands of busy workers to accomplish what millions could not have done years ago, and a very large part of the aggregate increase of product comes back to them in conveniences and luxuries surpassing those the wealthiest could enjoy were machinery not employed, or were it employed, as the socialist advocates, without increasing the aggregate of production. The laziness of the savage and the advantages of civilization are incompatible. The chief merit of machinery lies in its enabling us to multiply constantly the scope and variety of our enjoyments without a corresponding increase of toil.

IRIDESCENT GLASS.

Ornamental glassware in many styles, tinted with the glowing colors of the rainbow, is now making its appearance in the shop windows of Broadway and Fifth Avenue. This is one of those brilliant little achievements of science that delights the eye and pleases the imagination. To produce the colors, the glass, while in a heated state, is subjected to the vapor of chloride of tin. Shades of more or less depth or intensity are imparted by adding to the tin chloride a little nitrate of strontium or barium.

RAILS AND RAILWAY ACCIDENTS.—NEW YORK ACADEMY OF SCIENCES.

A meeting of the Section of Physics, New York Academy of Sciences, was held November 25, 1878. President J. S. Newberry in the chair. Numerous publications of learned societies were received and acknowledged. Professor Newberry read a letter from Professor Agassiz stating that sea lilies, which had hitherto been very rare—a single specimen bringing as much as fifty dollars—have been found in some numbers by dredging in the Gulf of Mexico. Their colors are white, pink, and yellow. Professor Newberry also exhibited specimens of garnet from California, lamellar quartz from North Carolina, sharks' teeth belonging to the eocene and miocene tertiary ages from the phosphate beds of South Carolina, and a number of shells.

Professor Thomas Egleston then addressed the Academy on the subject of "The Structure of Rails as Affecting Railway Accidents."

The destruction of rails is due to three causes. 1. De-

fects in the manufacture; 2. Improper mechanical or chemical composition; and 3. Physical changes.

A very large number of rails are annually made which should never be put in any track. Their defects are often imperceptible to the naked eye, but they very soon begin to break. Statistics show that the breakage from defects in making increase until they have been used 18 months; then it decreases to zero, and after that rails break from different causes. In France, breakage usually begins in December, reaches its maximum in January, and becomes normal in April. As a more intense cold would be necessary to explain such breakage than that which is felt in that climate, the cause must be sought in the stiffness and inelasticity of the frozen road bed. The impact of the locomotive is then apt to break the rail, very much on the same principle that is taken advantage of in breaking them up for the manufacture of smaller objects. A nick is made somewhere, and the workman then strikes a blow with a hammer at a point between the nick and the place where the rail is supported. This will sever the rail at the nicked place. Sometimes more than a second intervenes between the blow and the fracture. Now, whenever holes are punched in rails for the fish plates, flaws are apt to radiate from them; and if these flaws are not planed or filed out, they may cause the rail to break, just as the nicks above mentioned. Such rails have been known to last no longer than 18 months, and some have actually broken on the way from the manufacturer to their destination. There are establishments in this country and in Europe where they "doctor" such rails by filling up the flaws with a mixture of iron filings, sal ammoniac, and some adhesive substance. Beware of them; a poor cheap rail is dear at any price. The French government stipulates in its contracts for rails, that flaws shall be planed, drilled, or filed out; that the rails shall not be allowed to drop on the ground, but shall be carried by men and slid down. The Lyons railroad does not pay for its rails until 15,000 trains have passed over them.

By imperfect mechanical composition is meant imperfect union of the parts of rails. Steel heads are welded to the rest of the rail in a variety of ways, and this welding is necessarily imperfect. A number of sections of rails etched with acid plainly showed this want of homogeneity, as did likewise prints taken from the etched surfaces. Before such rails have lost weight appreciably, they are used up by the constant rolling they undergo. The advantage of a steel rail is its homogeneity, but a good iron rail, such as those made under the direction of the speaker, for the Reading Railroad Company, is likely to prove better than one of poor steel. The life of a steel rail is chiefly affected by the temperature at which it is rolled and annealed. It ought not to wear off more than 1 mm. for 20,000,000 tons of traffic, and is usually calculated to wear 10 mm. before it is taken up. In other words, it would last about 20 years on roads doing as much business as the New York Central. It is, however, unlikely that our steel rails will stand more than half this amount of traffic.

The effects of chemical composition are but little understood. Some of the purest irons have turned out utterly worthless. Apparently the absolute quantities of carbon, silicon, aluminum, phosphorus, etc., present are not of so much importance as their relative proportion. One specimen containing carbon 0·16, silicon 0·08, and phosphorus 0·012, could be bent double when cold, while another, containing carbon 0·58, silicon 0·56, and phosphorus 0·011 broke at once.

The physical tests for tensile and torsional strength, usually made on a portion cut out of the head of the rail, are not sufficient, because the flaws before spoken of exist mostly in the flange of the rail, and fracture usually begins there.

The effect of cold rolling and shocks that a rail is exposed to was shown by a piece of rail made by the Campbells, Sheffield, Eng., which had been worn 3 mm. by a traffic of 60,000,000 tons at Spuyten Duyvel. The head had been somewhat flattened, and the flange driven down into the foot to a certain extent. Under such usage an iron rail would have gone to pieces long ago.

Sometimes steel rails crumble all at once and pieces fall out of the head. This is probably due to some physical defects or to crystallization from shocks. The cause has not yet been definitely ascertained.

Mr. Collingwood stated that of a rail only a section of ⅜ square inch was pressed by the wheel of a locomotive, the effect being to cause this portion to act like a wedge, and thus to contribute to the disintegration of the rail. He also exhibited a hook which had been used to hoist stones of 10 to 12 tons, and then suddenly broke with a weight of only 6½ tons. It had been worn from a thickness of 2 inches to 1⅞. The pressure at the upper surface crowded the particles and caused them to act as wedges. Their fracture was crystalline, while that of the lower surface, which parted more slowly, was fibrous.

Professor Egleston asserted that there was no such thing as fibrous iron; what appeared so being simply crystalline with the ends drawn out. A sharp blow would cause this to fall off and show the crystalline structure beneath.

The discussion was continued by Professors Trowbridge, Egleston, and Newberry. C. F. K.

FORMATION OF IODIFORM.—All mixtures in which alcohol and iodine enter in combination with any alkali forming colorless solutions go in part to the formation of iodiform. Even chloroform and iodine, forming a colorless solution, give rise to the same product.—*L. Myers Connor.*

SANITARY SCIENCE IN THE UNITED STATES.

The following is an abstract of a paper on the Present and Future of Sanitary Science in the United States, read by Professor Albert R. Leeds, of the Stevens Institute of Technology, before the New York Academy of Sciences at their meeting, November 11th, 1878:

Sciences, such as the one under consideration, that have in them a side largely practical, are sure of a welcome in our midst. The study of the laws of public health grew into prominence in this country during the war, when the Sanitary Commission undertook to supervise the camps and hospitals. Sanitary associations were then formed in many States and smaller communities, and these have led to the establishment of State and city boards of health, clothed to a greater or less degree with executive functions. Every epidemic has been the cause of wider dissemination of sanitary knowledge by the daily press. The yellow fever plague, by which more than twelve thousand people have perished, has thoroughly aroused public interest. During its continuance the papers were full of homilies on private and public hygiene, the people everywhere sent aid and sympathy to the afflicted, and a lady offered to defray the expenses of a scientific commission of sanitary experts to inquire into the cause and prevention of the scourge. The proper execution of sanitary laws depends on the free and intelligent co-operation of individuals much more than on the influence of a strong central authority. A general health department at Washington could not legislate pure air, pure water, and pure food into use throughout the nation. The people themselves, in each community, must be educated to demand these requisites of health and to secure them in their own way.

I. *Vital Statistics.*—The first "Bill of Mortality" in New York city extended from November 1st, 1801, to January 1st, 1803. In it people are said to have died of "flux," "hives," "putrid fever," "breaking out," "stoppage," "fits," of "rash," and, by way of contrast, of "lingering illness." This rude beginning gradually led to the organization of the Metropolitan Board of Health, whose first report was made in 1866. Their second report showed a decrease of 3,152 deaths, mainly in districts where the greatest amount of sanitary work had been done. Valuable illustrations of the relation between damp houses and consumption were obtained by constructing maps of certain wards, on which every death from phthisis for several years was noted opposite each house. It was found that the disease was most fatal in the lowest levels, in rainy seasons, and in crowded localities.

The registration of marriages continued so defective that a writer on the subject declares it would be impossible for a large portion of the adult native population of the United States to prove by any legal document that they have a right to the name they bear, or that their parents were ever married. The mortality returns of 1871 were probably nearly perfect, and their very accuracy told against New York city, whose death rate was 28·6 per thousand, while St. Louis reported 17, Rochester 16, Buffalo 14, and Jersey City 7 per thousand. To secure accuracy in the returns of marriages and births, etc., more stringent legislation will be necessary.

In New Jersey the State Sanitary Association has conclusively shown the utter worthlessness of the State vital statistics. They memorialized the legislature, and caused the passage of a law which gives to New Jersey one of the best systems of registration yet devised. It owes its excellence to the following features, which should be universally copied:

1. *Burial Permits* are issued only after registry has been made by a properly qualified person; and

2. The returns are made to an *expert*, who collates them and deduces practical lessons from them.

II. *Registration of Disease.*—A large class of diseases may be prevented from becoming epidemic if their existence is known in time. For this purpose the boards of health should be invested with power and provided with means to investigate, reform, and, if necessary, to punish delinquency. Yet in the face of so practical a requirement little more is annually appropriated for the Board of Health of New Jersey than for the pay of two policemen.

III. *State Sanitary Legislation.*—The agitation for sanitary reform caused by the yellow fever should not be allowed to die out with the pressure of the calamity that aroused it. It should continue until every State that has been the seat of yellow fever, year after year, has as efficient a health code as Massachusetts and Michigan. The necessity of educating the people before it is possible to secure the requisite legislation will cause a considerable period of time to elapse before all the States have laws in accordance with modern knowledge. Probably no community takes the trouble to protect itself until it has actually suffered. To the distress of London the world owes the report of the Royal Commissions on water supply and the pollution of rivers, still the best repertory of the best knowledge on the subject. The manufactories of England have made it necessary for the government to take cognizance of aerial impurities. Similarly in this country the pollution of the Passaic has caused inquiries to be set on foot in the same direction.*

An attempt was made to deprive the inhabitants of New York of their public parks, and to occupy them with buildings devoted to military and other purposes; but the people had already been sufficiently educated up to an appreciation of their sanitary value not to permit it. Dr. Seguin eloquently advocated the improvement of the parks, to make them not only pleasure grounds, but places of æsthetical and practical out-door education of the public school children.

IV. *Ventilation.*—It would be a great step in the interests of sanitary science if builders, vestrymen, and school or hospital trustees could be persuaded that their offices did not make them temporary authorities on ventilation, and that they had best intrust this matter to specialists who have fought their way into successful practice.

It appears that both the system of ventilation by aspiration and that by propulsion have had great successes and great failures. Many authorities have declared in favor of mechanical ventilation, yet in most institutions where fans had been introduced they are now standing still. In Roosevelt Hospital, New York, they ran their fan backwards for months and then stopped it.

V. *Physical Education.*—Instruction in hygiene and physical exercise as a part of the college curriculum was first successfully accomplished at Amherst College, and has now had a trial of nearly twenty years. The importance attached to it is shown by the fact that only distinguished members of the medical profession are appointed as professors, and that they have the same rank as the rest of the faculty. Their first duty is to know the physical condition of every student and to see that the laws of health are not violated. In case of sickness, the students are given certificates to excuse them from attendance and are put in the way of obtaining suitable treatment. The records kept are of great interest. All the classes are required to attend the gymnastic exercises four times a week. For a full account see Professor Hitchcock's report on Hygiene at Amherst College to the American Public Health Association. The excellent results of this feature—it can no longer be regarded as an experiment—recommend its introduction in all our colleges and public schools.

VI. *Health Resorts.*—The number of people who leave the cities in the summer to visit the seashore, the mountains, and the country is annually increasing. A healthful village is often changed to a center of pestilence merely by such an influx of strangers, the ordinary means of removing offal, etc., being no longer adequate. The town of Bethlehem, N. H., became so popular by reason of its pure air that several thousand hay fever patients sought relief there in 1877. The consequence was insufficient drainage; but as the inhabitants understood their interests, this defect was at once remedied.

The sea shore of New Jersey from Sandy Hook to Cape May is becoming an almost continuous city, and harbors a multitude of visitors every summer. Those whose interest it is to retain this patronage cannot have it too strongly impressed upon them to preserve their healthfulness by introducing cemented cisterns, by causing garbage to be removed daily, and by encouraging local boards of health.

VII. *Illuminating Gas* not only withdraws from the air of our rooms a considerable amount of oxygen, but fills them with noxious products of combustion. All this may be avoided in the future by the introduction of the electric light.

VIII. *Sanitary Surveys.*—Dr. Bowditch has shown that a thousand deaths from consumption in Massachusetts are due to a wet and retentive soil, and this fact alone will show the importance of sanitary surveys of the country, such as that made of Staten Island by Professors Newberry and Trowbridge, who determined the influence of the surface soil, of the underlying rock, its porosity, its bedding and its joints, upon the drainage and upon the local climate and health. A similar survey of Hudson county, New Jersey, has been recently made by L. B. Heard, C.E.

IX. *Composition of the Atmosphere.*—The English government has been obliged to appoint the celebrated Dr. Angus Smith to examine the effects of atmospheric contamination. In Philadelphia there is scarcely a house front that is not disfigured by the stain of magnesia and lime salts, caused by acid vapors in the atmosphere.

A discussion followed, which was introduced by Mr. Collingwood, who remarked that the problem of the sewage of cities was still far from being solved. Though the recent experiments in England on utilizing sewage for agricultural purposes by filtration and otherwise were reported to be successful, we had only dodged the question in this country. Our sewage is still emptied into rivers to poison the water of cities further down their course. When the country becomes more thickly settled, this will answer no longer.

It was also stated that while gas in large chandeliers could be made an effective means of ventilation, there was another objection to its use in the fact that the soil of the city was everywhere impregnated with it from leaky mains, thus causing poisonous exhalations and an insufferable odor whenever the ground was opened. Attention was also called to the evil effects of the system of tenement houses, which led to an unfavorable comparison of the health and morality of New York with those of cities like Philadelphia and Cleveland, that abound in small homes.

Dr. Minor attributed disease to what Richardson calls "ultra-microscopic molecular aggregates," which always exist in the air, but take hold of us only when our vitality is reduced to a certain point. It has been shown that decay is absolutely impossible in vessels from which they are excluded. But for them the earth would now be heaped with the undecomposed remains of animals and vegetables. According to this view, the future efforts of sanitary science must be simply in the direction of learning how to protect ourselves against the "ultra-microscopic molecular aggregates." C. F. K.

* See Report to Board of Public Works of Jersey City, by Professors Wurtz and Leeds; also, Analyt. Beiträge aus dem Laboratorium des Stevens Institute of Technology, by Professor Leeds, in *Zeitschr. fur Anal. Chem.* 1878.

Felling Trees by Electricity.

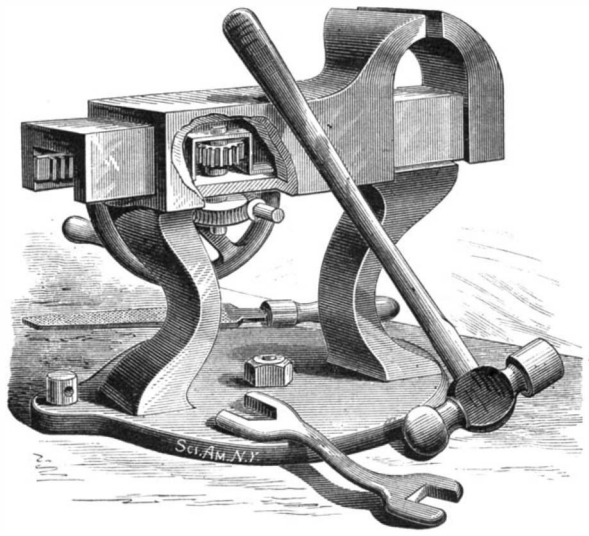
Some years ago a Doctor Robinson of this city obtained a patent through the agency of the SCIENTIFIC AMERICAN for Felling Trees by Electricity. Subsequently a description of the invention was published in this paper, soon after which the newspapers in this country and Europe teemed with the account of a gentleman in India having contrived an apparatus for felling trees in the same manner. Since these several years have elapsed we have heard nothing of the gentleman from India till a few days ago our papers have taken up the subject anew, and annexed is the account they give of the inventor's progress in developing his discovery.

The electric fluid in the form of lightning oftentimes proves itself a very efficient wood cutter, and it has occurred to some ingenious gentleman in India that artificial electricity may be so applied and controlled as to cut down trees a good deal faster than the clumsy ax or that American notion the chain saw. The two ends of the copper wires of a galvanic battery are connected with platinum wire, which of course instantly becomes red hot, and while in that state it is gently seesawed across the trunk of the trees to be felled. When arrangements were made for the experiment, it turned out that the thickness of the thickest platinum wire that could be got was only that of crochet cotton. It was at once seen that such a wire would be consumed before the tree was half severed from its trunk. However, the attempt was made. The burning wire performed its task very well as long as it lasted, but, as anticipated, the wire continually broke, and at length there was no wire left. There can be little doubt that, with a stronger battery and a thicker wire, the experiment would have been entirely successful. As it was, the tree was sawn one fifth through.

AN IMPROVED VISE.

The novel vise shown in the engraving was recently patented by Mr. William Starkey, of Pittsburg, Pa.

The fixed jaw is supported by two standards from the base piece, and has a square boxing or tube for receiving the slide of the movable jaw. This slide is hollow, and contains a rack which is engaged by a pinion on the short vertical



STARKEY'S VISE.

shaft, which is supported by the fixed jaw. At the lower end of the vertical shaft there is a worm wheel, that is engaged by a worm on the horizontal shaft on which is placed the hand wheel. By turning the hand wheel the vertical shaft is rotated and the movable jaw is drawn against the object to be clamped by the vise.

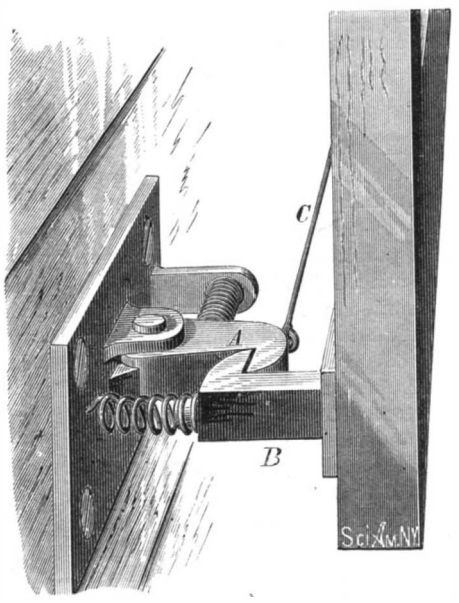
Culinary Uses for Leaves.

A writer in the London *Iron Trade Exchange*, calling attention to a neglected source of culinary flavors, says:

"With the exception of sweet and bitter herbs, grown chiefly for the purpose, and parsley, which is neither bitter nor sweet, but the most popular of all flavoring plants, comparatively few other leaves are used. Perhaps I ought also to except the sweet bay, which is popular in rice and other puddings, and certainly imparts one of the most pleasant and exquisite flavors; but, on the other hand, what a waste there is of the flavoring properties of peach, almond, and laurel leaves, so richly charged with the essence of bitter almonds, so much used in most kitchens! Of course such leaves must be used with caution, but so must the spirit as well. An infusion of these could readily be made, either green or dry, and a tea or table spoonful of the flavoring liquid used. One of the most useful and harmless of all leaves for flavoring is that of the common syringa. When cucumbers are scarce, these are a perfect substitute in salads or anything in which that flavor is desired. The taste is not only like that of cucumbers, but identical—a curious instance of the correlation of flavors in widely different families. Again, the young leaves of cucumbers have a striking likeness in the way of flavor to that of the fruit. The same may be affirmed of carrot tops, while in most gardens there is a prodigious waste of celery flavor in the sacrifice of the external leaves and their partially blanched footstalks. Scores of celery are cut up into soup, when the outsides would flavor it equally well or better. The young leaves of gooseberries added to bottled fruit give a fresher flavor and a greener color to pies and tarts. The leaves of the flowering currant give a sort of intermediate flavor between black currants and red. Orange, citron, and lemon leaves impart a flavoring equal to that of the fruit and rind combined, and somewhat different from both. A few leaves added to pies, or boiled in the milk used to bake with rice, or formed into crusts or paste impart an admirable and almost inimitable bouquet. In short, leaves are not half so much used for seasoning purposes as they might be."

NEW SHUTTER FASTENER.

We give herewith an engraving of a new shutter fastener, recently patented by Mr. P. F. Fernandez, of San Juan, Porto Rico, West Indies. This fastener is designed for hold-



IMPROVED SHUTTER FASTENER.

ing doors or window shutters in position when open, to prevent them from closing or swinging in the wind.

To the wall is secured a plate to which is pivoted the spring-acted hook, A, and upon the shutter in the proper position for engaging the hook, A, there is a rigid hook, B. A coil spring is attached to the plate that supports the hook, A, and when the shutter is open is engaged by a boss formed on the end of the hook, B. By this means the hook, B, is pressed forward into close contact with hook, A, thereby preventing all jarring and rattling.

The hook, A, is provided with an eye for receiving the cord, C, which extends to the window casing and is within easy reach, so that when it is desired to close the shutter the hook, A, may be readily disengaged from the hook, B, by simply pulling the cord.

Further information may be obtained by addressing the inventor as above.

AN IMPROVED GARDEN SPRINKLER.

A novel garden sprinkler, which may be carried on the back, is shown in the accompanying engraving. The cylindrical vessel has a removable cover, and contains a perforated plunger which is operated by a hand lever from without. The cylindrical vessel is provided with shoulder straps, and it has two sprinkling nozzles connected with it by flexible tubes.

This sprinkler is especially designed for applying insect-destroying poison to plants. The operator, as he goes

HODEL & STAUBER'S GARDEN SPRINKLER.

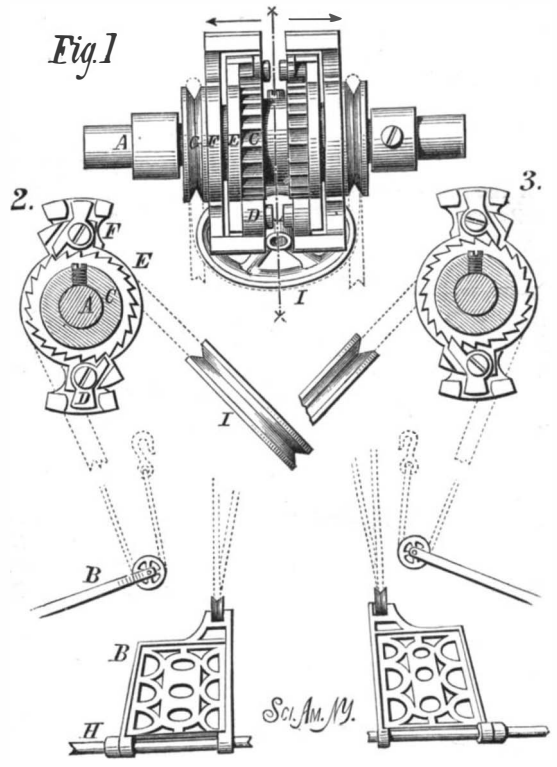
through the field or garden, takes one nozzle in each hand and distributes the liquid upon the plants. From time to time the liquid will be agitated by moving the perforated plunger.

This invention was recently patented by Adolf Hodel, of Jefferson, and F. A. Stauber, of Chicago, Ill.

A NEW FOOT POWER.

In our issue of November 9 we illustrated and described a sewing machine having W. F. Lane's improved foot power applied. We give herewith views of the foot power in detail, Fig. 1 being a side elevation, and Figs. 2 and 3 sectional views. The device is designed for application to any light machinery that can be propelled by foot power. A is the shaft to which motion is to be imparted by the treadles, B, the latter being pivoted to oscillate on the shaft, H. Two ratchet wheels, C, are secured to the shaft, A, and are each worked by pawls, D, which are pivoted to a carrier, E, which turns loosely on the shaft. The pawls are in the form of an elbow lever, and the movement of their tooth ends is limited by lugs or shoulders on the carrier, E. The outer ends of the pawls are received between lugs that project from the plate, F, which turns loosely on the shaft, A, and has attached to it the rope pulley, G. When the plate, F, is turned in one direction the pawls are raised and ride loosely over the teeth, but when the plate turns in the other direction the pawls engage the ratchet teeth and carry them and also the shaft, A. A guide pulley, I, is pivoted below the shaft, A, with its axis at right angles to the shaft.

The motion from the alternately-oscillated treadles, B, is transmitted to the pulleys, G, by means of a rope (shown in dotted lines), both ends of which are fastened by hooks to some fixed point. This rope runs from one of the hooks down under a pulley pivoted in the toe of one of the treadles, thence around one of the pulleys, G, thence around the pulley, I, over the other pulley, G, and downward around the pulley in the other treadle, and upward to the second fixed hook. The depression of one of the treadles causes the



LANE'S FOOT POWER.

shaft to rotate, and also lifts the other treadle into position to be operated.

For further information address Wm. F. Lane, Elgin, Ill.

New Inventions.

Mr. Samuel Heaton, of Cedar Rapids, Iowa, has patented an improved Iron Fence Post, which is particularly adapted for wire fences. It is formed of a slotted iron bar, constituting the post proper, and a triangular brace, which is so connected with said bar that it may be easily adjusted at different angles, corresponding to the undulation or unevenness of the ground surface where the post is used.

Mr. Thomas S. Alexander, of Meriden, Conn., has patented an improved Drawer Pull, which is neat, strong, and durable, and is less expensive than when made in the usual way.

An improved Earth Scraper has been patented by Mr. Benjamin Slusser, of Sidney, Ohio. This is an improvement in that class of earth scrapers which are arranged to revolve for the purpose of dumping the load, and during the intervals, or while being filled, are locked in rigid position.

An improvement in Wagon Bodies has been patented by Mr. James H. Paschal, of Camden, Ark. This invention consists, essentially, in a frame provided with spurs projecting therefrom for engagement with the bales to prevent them from slipping, and the combination therewith of removable extension side and end pieces, for enabling the wagon to be used for other purposes when not employed for hauling cotton bales; there is an extension of the frame forming a feed trough for the horses employed to draw the vehicle.

An improved Scraper has been patented by Mr. George Eiteman, of Round Grove, Ill. This is a double-ended scraper hung at its center on a rod connected to the handle arms, whereby either end of the scraper may be used. It has catches to prevent the scraper from revolving backward, and spring actuated dogs on the handle frame to retain the scraper in position and prevent it from turning over until released.

AMATEUR MECHANICS.

For amusement, exercise, and profit we commend, to those who are mechanically inclined, the practice of working with tools of the smaller sort, either in wood or other of the softer materials, or in metals, glass, or stone. This practice renders the hands dexterous, the muscles strong, and the head clear, with the further advantage of producing something for either ornament or use. Of course a bench with a vise and a few wood working and iron working tools will be required; but the most expensive as well as the most essential tool is a lathe. With this tool, not only turning in wood, metal, ivory, rubber, etc., can be accomplished, but it may also be used for screw-thread cutting, gear cutting, drilling metals, boring wood, spinning metals, milling, sawing metal and wood, grinding, polishing, moulding, shaping, and other purposes. A first class plain lathe of small size cannot be purchased for less than $50 or $60, and one of inferior quality will cost $20 to $30.

While the purchase of a lathe is recommended there may be many who would prefer to make one. A lathe that will do admirably and which may be easily made is shown in the accompanying engravings, Fig. 1 representing in perspective the lathe complete; Fig. 2 is a perspective view of the lathe without the table; Fig. 3 is a vertical longitudinal section of the lathe, showing the manner of securing the head and tail stocks to the bars which form the bed or shears.

In making this lathe one pattern only will be required for the two standards of the head stock, and the support of the ends of the bars. The lower part of the tail stock is made in two parts, so that they may be clamped tightly together on the shears by means of the bolt that passes through both parts, and is provided with a nut having a lever handle. The rest support is also made in two parts, clamped together on the ways in a similar way.

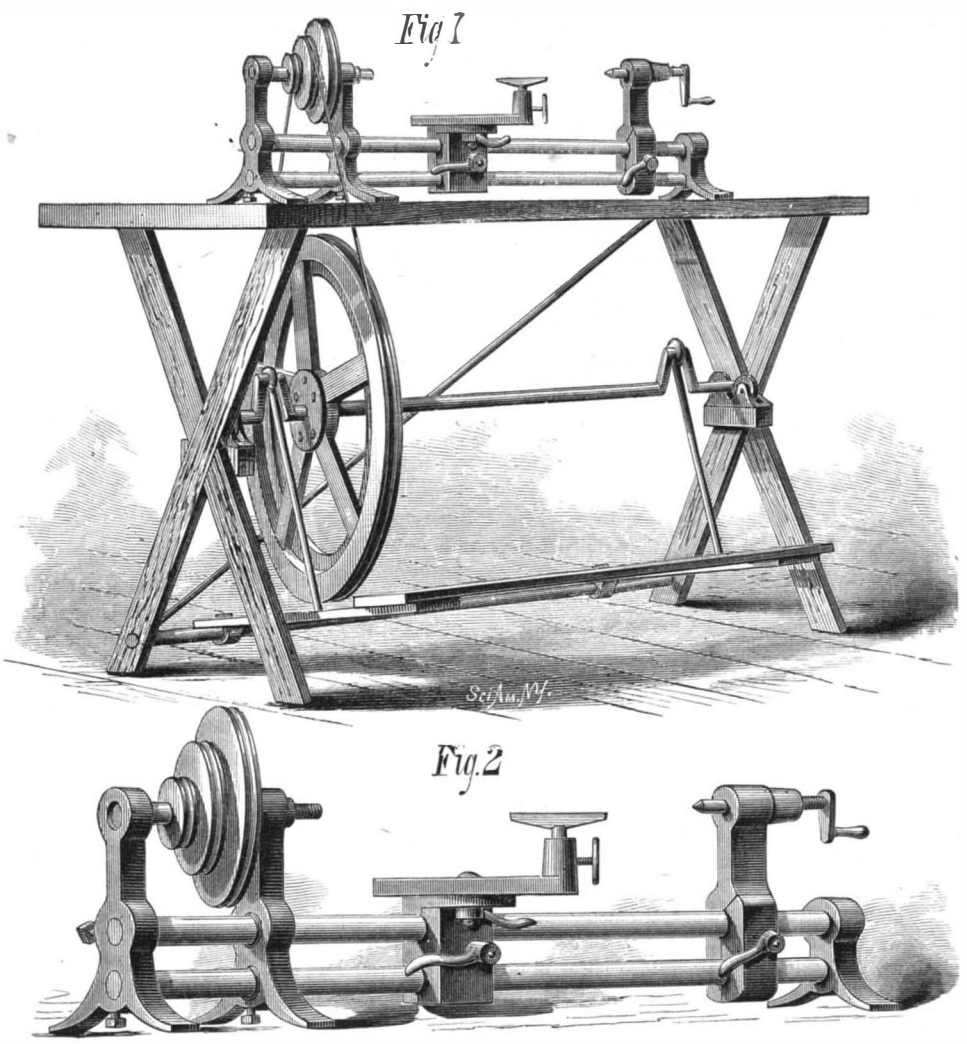
The patterns may be easily sawed from 1¼ inch pine. The holes that receive the round bars should be chambered to receive Babbitt metal, used in making the fit around the bars forming the shears, around the head and tail spindles, and around the shank of the tool rest. The smallest diameter of the holes that receive the round bars should be a little less than that of the bars, so that the several pieces that are placed on the bars may be fitted to hold them in place while the Babbitt metal is poured in.

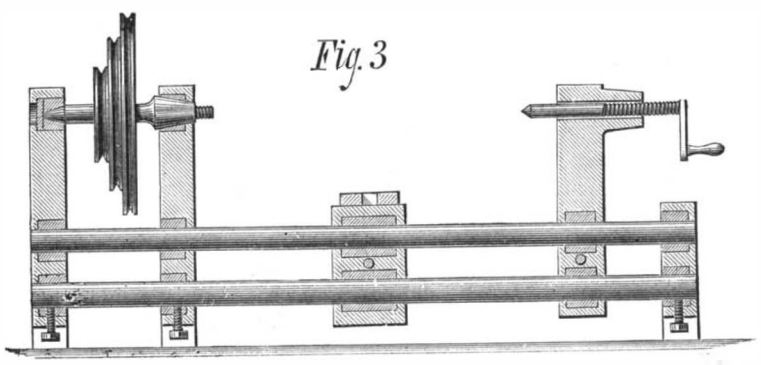
The dimensions of the lathe are as follows:

Length of round bars forming shears, 24 inches; diameter of bars, 1 inch; distance from the upper side of upper bar to center of spindle, 3 inches; between bars, ¾ inch; between standards that support the live spindle, 3½ inches; size of standard above shears, ¾x1¼ inch; diameter of head and tail spindles, ¾ inch; diameter of pulleys, 5 inches, 3½ inches, and 2 inches; width of base of standards, 5 inches; height of standards, 7 inches.

The live spindle should be enlarged at the face plate end, and tapered at both ends, as indicated in the engraving.

The pulleys, which are of hard wood, are made of three pieces glued together, bored, and driven on the spindle, secured by a pin passing through both it and the spindle, and turned off.





LATHES FOR AMATEUR MECHANICS.

The bars forming the shears may be either cold rolled iron or round machinery steel; they will require no labor except perhaps squaring up at the ends. The castings having been fitted to the bars, and provided with set screws for clamping them, the two standards that support the live spindle and the support for the opposite end of the bars are put in position, when the bars are made truly parallel, and a little clay or putty is placed around each bar and over the annular cavity that surrounds it, and is formed into a spout or lip at the upper side to facilitate the pouring of Babbitt metal. The metal must be quite hot when poured, so that it will run sharp and fill the cavity. To guard against a possible difficulty in removing the castings from the bars it might be well to cover the side of the bar next the screw with a thin piece of paper. The pieces of the tail stock and tool rest support are fitted to the bars by means of Babbitt metal, the metal being poured first in one half and then in the other. The bolts which clamp the two parts of the rest support and tail stock together are provided with lever handles. After fitting the parts to the two bars by means of Babbitt metal, the tail spindle, which is threaded for half its length, is placed in the tail stock parallel with the bars and Babbitted. A binding screw is provided for clamping the tail spindle, and the spindle is drilled at one end to receive the center, and has at the other end a crank for operating it.

A steel or bronze button is placed in the hole in the standard that supports the smaller end of the live spindle, and the spindle is supported in its working position and Babbitted.

The thread on the spindle should be rather coarse, so that wooden or type metal face plates and chucks may be used.

The table shown in Fig. 1 is simple and inexpensive. It consists of two pairs of crossed legs halved together and secured to a plank top. A small rod passes through the rear legs near their lower ends, and also through a piece of gas pipe placed between the legs. A diagonal brace is secured to the top near one end, and is fastened to the lower end of the rear leg at the other end of the table.

A block is secured to each pair of legs for supporting a pair of ordinary grindstone rollers, which form a bearing for the balance wheel shaft. This shaft has formed in it two cranks, and it carries an ordinary balance wheel, to the side of which is secured by means of hook bolts a grooved wooden rim for receiving the driving belt. The cranks are connected, by means of hooks of ordinary round iron, with a treadle that is pivoted on the gas pipe at the rear of the table. The shaft will work tolerably well, even if it is not turned. The cranks must have half round grooves filed in them to receive the treadle hooks. The size of the different diameters of the drive wheel may be found by turning the larger one first and the smaller ones afterward, using the belt to determine when the proper size is reached. The wooden rim may be turned off in position by using a pointed tool.

The lathe above described, although very easily made and inexpensive, will be found to serve an excellent purpose for hand work, and if the holes, instead of being Babbitted, are bored, and if the bars forming the shears are turned, the lathe may be converted into a kind of engine lathe by placing a feeding screw between the bars, and putting a small tool post in the rest support.

M.

Machine Shop Economy.

In times like the present, when even with good management our best machine shops are enabled to exhibit but small margins of profit, and shops with indifferent management exhibit margins on the wrong side, it is a question of paramount importance what kind of economy should be pursued in order to maintain a successful business. The directors of long established machinery enterprises differ widely upon some methods of conducting business, and while one gains success by pursuing a certain plan, another, with perhaps as much ability, cannot pursue the same with satisfactory results.

While in the main there are many different plans upon which successful machinery establishments are conducted, there are some underlying principles that must be observed to avoid meeting with difficulties. The rate of wages paid is certainly a large element of shop economy, but there are so many other elements that should be considered before wages are reached, that we often find proprietors, who pay their workmen at a comparatively high rate, doing a more prosperous business than their competitors who have reduced wages to the lowest possible scale. Many machine shop owners, not having mastered the various economies of management, as soon as profits begin to shorten, pounce directly upon the wages paid to their workmen, and pare them down so as to make up for the deficiency elsewhere. They don't seem to realize that there are important elements of economical management other than closely watching the wages of labor and the cost of material. It is sometimes necessary to reduce the rate of wages, but what a different effect it has upon the men in different shops! In one shop you scarcely hear a murmur—no angry meetings—no threats of a strike—no growling at the head of the establishment. The intelligent workmen understand the reasons for the reduction without a wordy explanation, and accept it, feeling confident that it has not been unjustly made. In another shop it causes ill feeling, angry protests, and perhaps a disastrous strike. The owner often charges his trouble to the character of his workmen. Let him review his course, and see if the great cause is not in his own management. Mechanics are keen and observing. If the business is poorly managed they are not slow to mark it, and when a cut is made in wages can generally cipher out the cause. It is good economy to keep a systematic record of the cost of everything. This record will be found very valuable in making estimates, much more so than guess work. It is not good economy to keep using worn-out tools when any work of consequence is to be performed. The extra cost of labor and spoiled pieces would soon pay for new tools. It is not good economy to keep discharging capable workmen for petty causes, and employing new hands to take their places. It is poor economy to use slow-cutting grindstones to accomplish work that fast cutting emery wheels are suited for. It is questionable economy to employ lathes, planers, and drills to perform work of any extent that a milling machine will do better in less time and at much less expense.

It is decidedly bad economy to employ engines and boilers that waste fuel and are troublesome to keep in good running condition. It is mistaken economy to buy inferior tools, machines, and shop supplies, because they are low priced.

It is very defective economy to fit the parts of machines together by trial instead of making them by aid of correct drawings and standard tools for accurate measurement. It is faulty economy to practice borrowing and lending working tools.

The idea that economy consists in withholding every expense not absolutely demanded is erroneous. An extra outlay in one or another direction often assures the saving as well as the making of money. Wise economy looks to the future as well as the present, and requires that all work sent out from a shop should be of the best and most reliable character.—*American Machinist.*

The Reward of Invention.

Capital and Labor publishes the substance of a letter from Mr. Henry Bessemer with reference to the refusal of the English Government, or of its ambassador in Paris, to allow the Grand Cross of the Legion of Honor to be accepted by its countrymen, and in his letter Mr. Bessemer furnishes some autobiographic particulars which cannot fail to be of interest. He tells us that at the age of eighteen he came to London from a small country village, knowing no one, and himself unknown; but his studious habits and his love of invention soon gained for him a footing, and in two years he was pursuing a method of his own invention for taking copies from antique and modern bassi-rilievi in a manner that enabled him to stamp them on a cardboard, thus producing thousands of embossed copies of the highest works of art, at a small cost. The facility for making a permanent die, even from a thin paper original, capable of producing a thousand copies, would have opened a wide door

to successful fraud if the process had been known to unscrupulous persons; for by its means, Mr. Bessemer states, there is not a government stamp, or the paper seal of a corporate body, that every common office clerk could not forge in a few minutes at the office of his employer or at his own home. The production of a die from a common paper stamp is the work of only ten minutes; the materials cost less than one penny. No sort of technical skill is necessary, and a common copying press or letter stamp yields most successful copies. There is no need for the would-be forger to associate himself with a skillful die sinker, capable of making a good imitation in steel of the original, for the merest tyro could make an absolute copy on the first attempt. The public knowledge of such a means of forging would, at that time, have shattered the whole system of the British Stamp Office, had a knowledge of the method been allowed to escape. The secret has, however, been carefully guarded to this day.

During the time that Mr. Bessemer was engaged in studying this question he was informed that the government were themselves cognizant of the fact that they were losers to a great amount annually by the transfer of stamps from old and useless deeds to new skins of parchment, thus making the stamps do duty a second or third time, to the serious loss of the revenue. One official in high position said that he believed they were defrauded in this way to the extent of probably £100,000 per annum. To fully appreciate the importance of this fact, and realize the facility afforded for this species of fraud by the system then in use, it must be understood that the ordinary impressed or embossed stamp, such as is employed on all bills of exchange, if impressed directly on a skin of parchment, would be entirely obliterated by exposing the deed for a few months to a damp atmosphere. The deed would thus appear as if unstamped, and therefore invalid. To prevent this it has been the practice as far back as the reign of Queen Anne to gum a small piece of blue paper on to the parchment; and for still greater security a strip of metal foil is passed through it, and another small piece of paper with the printed initials of the Sovereign is gummed over the loose ends of the foil at the back. The stamp is then impressed on the blue paper, which, unlike parchment, is incapable of losing the impression by exposure to a damp atmosphere. But, practically, it has been found that a little piece of moistened blotting paper applied for a whole night so softens the gum that the two pieces of paper and the slip of foil can be removed from the old deed most easily, and be applied to a new skin of parchment, and thus be made to do duty a second or third time. Thus the expensive stamps on thousands of old deeds of partnership, leases, and other old documents, when no longer of value, offer a rich harvest to those who are dishonest enough to use them. A knowledge of these facts led Mr. Bessemer to fully appreciate the importance of any system of stamps that would effectually prevent so great a loss; nor did he for one moment doubt but that government would amply reward success. After some months of study and experiment, which he cheerfully undertook (although it interfered considerably with the pursuit of regular business, inasmuch as it was necessary to carry on the experiments with the strictest secrecy, and to do all the work himself during the night after his people had left work), he succeeded in making a stamp that satisfied all the necessary conditions. It was impossible to remove it from one deed and transfer it to another. No amount of damp, or even saturation with water, could obliterate it, and it was impossible to take any impression from it capable of producing a duplicate.

Mr. Bessemer says that he knew nothing of patents or patent law in those days; and adds that if he had for a moment thought it necessary to make any preliminary conditions with government he would have at once scouted the idea as utterly unworthy, thinking his interests absolutely secure. In this full confidence he sought an interview with the then chief of the Stamp Office, Sir Charles Presley, and showed him by numerous proofs how easily all his stamps could be forged, and also the mode of prevention. He was greatly astonished, and at a later interview he suggested that the principle of the invention should be worked out fully. This Mr. Bessemer was only too anxious to do; and some five or six weeks later called again with a newly designed stamp, which greatly pleased him. The design was circular, about 2½ inches in diameter, and consisted of the Garter with the motto in capital letters surmounted by a crown. Within the Garter was a shield with the words "five pounds." The space between the shield and the Garter was filled with network in imitation of lace. The die had been executed in steel, which pierced the parchment with more than 400 holes, each one of the necessary form to produce its special portion of the design. Since that period perforated paper of this kind has been largely employed for valentines and other ornamental purposes, but was previously unknown. It was at once obvious that the transfer of such a stamp was impossible. It was equally clear that dampness could not obliterate it; nor was it possible to take any impression from it capable of perforating another skin of parchment.

This design gave great satisfaction, and everything went on smoothly; Sir Charles consulted Lord Althorp, and the Stamp Office authorities determined to adopt it. Mr. Bessemer was then asked if, instead of receiving a sum of money from the Treasury, he would be satisfied with the position of Superintendent of Stamps, at some £600 or £800 per annum. This was all that he then desired, rejoicing over the prospect, for he was at that time engaged to be married, and his future position in life seemed assured. An incident now occurred that reads almost like romance. A few days after affairs had assumed this satisfactory position, he called on the young lady to whom he was then engaged (now Mrs. Bessemer), and showed her the pretty piece of network which constituted the new parchment stamp, explaining how it could never be removed from the parchment and used again, and mentioning the fact that old deeds with stamps on them dated as far back as the reign of Queen Anne could be fraudulently used. She at once said, "Yes, I understand this; but surely, if all stamps had a date put upon them, they could not at a future time be used again without detection?" This was indeed a new light, and greatly startled the inventor, who at once said that steel dies used for this purpose could have but one date engraved upon them. But after a little consideration he saw that movable dates were by no means impossible, and that this could easily be effected by drilling three holes of about a quarter of an inch in diameter in the steel die, and fitting into each of these openings a steel plug or type with sunk figures engraved on their ends, giving on one the date of the month, on the next the month of the year, and on the third circular steel type the last two figures of the year. This plan would be most simple and efficient, would take less time and money to inaugurate than the more elaborate plan that had been devised; but while pleased and proud at the clever and simple suggestion of the young lady, her future husband saw also that all his more elaborate system of piercing dies, the result of months of study, and the toil of many a weary and lonely night, was shattered to pieces by it. He feared to disturb the decision that Sir Charles Presley had come to, as to the adoption of the perforated stamp, but, with a strong conviction of the advantages of the new plan, felt in honor bound not to suppress it, whatever might be the result. Thus it was that he soon found himself again closeted with Sir Charles at Somerset House, discussing the new scheme, which he much preferred, because, as he said, all the old dies, old presses, and old workmen could be employed, and there would be but little change in the office—so little, in fact, that no new superintendent of stamps was required, which the then unknown art of making and using piercing dies would have rendered absolutely necessary. After due consideration the first plan was definitely abandoned by the office in favor of the dated stamps, with which every one is now familiar. In six or eight weeks from this time an Act of Parliament was passed calling in the private stock of stamps dispersed throughout the country, and authorizing the issue of the new dated ones.

Thus was inaugurated a system that has been in operation some forty-five years, successfully preventing that source of fraud from which the revenue had so severely suffered. If anything like Sir Charles Presley's estimate of £100,000 per annum was correct, this saving must now amount to some millions sterling; but whatever the varying amount might have been, it is certain that so important and long established a system as that in use at the Stamp Office would never have been voluntarily broken up by its own officials, except under the strongest conviction that the losses were very great, and that the new order of things would prove an effectual barrier to future fraud. During all the bustle of this great change no steps had been taken to install the inventor in the office. Lord Althorp had resigned, and no one seemed to have authority to do anything. All sorts of half promises and excuses followed each other, with long delays between, and Mr. Bessemer gradually saw the whole thing sliding out of his grasp. Instead of holding fast to the first plan, which they could not have executed without his aid and special knowledge, he had, in all the trustfulness of youthful inexperience, shown them another plan, so simple that they could put it in operation without any assistance. He had no patent to fall back upon, and could not go to law, even if he wished to do so, for he was reminded, when pressing for mere money out of pocket, that he had done all the work voluntarily. Wearied and disgusted, he at last ceased to waste time in calling at the Stamp Office, and he felt that nothing but increased exertions could make up for the loss of some nine months of toil and expenditure. Thus, sad and dispirited, and with a burning sense of injustice overpowering all other feelings, he went from the Stamp Office, too proud to ask as a favor that which was indubitably his just right, and he adds, "Up to this hour I have never received one shilling or any kind of acknowledgment whatever from the British Government." It is notorious, adds the editor, that some of the most renowned and invaluable inventions of recent years, especially those connected with the navy, have narrowly escaped rejection by permanent but ignorant officials; and that the authors of the inventions have had to submit to delay, loss, annoyance, and contumely before their processes could be tried, even after their success had been officially demonstrated. Perhaps it is not now so much a question of money, for it is to be hoped that Mr. Bessemer is reaping the due reward of ingenuity and skill in other fields of invention. But even his discoveries in steel making, if they have very properly enriched himself, have, in an infinitely larger degree, added to the wealth of the country, and have given employment to many thousands. Such a man is a public benefactor, and eminently deserves recognition by the state, especially by way of atonement for former neglect and injustice. Military men receive titular honors and a pecuniary reward for slaying a crowd of savages and burning their huts, while the men who have helped to make England what she is, commercially and industrially, are in most cases left to their fate, which may chance to be pecuniary ruin.

Oil Notes.

PENNSYLVANIA.

The total production of crude petroleum for the first three quarters of 1878 was 11,126,037 barrels, against 8,436,867 barrels for the same time in 1877; increase in 1878, 1,689,170 barrels.

The total number of drilling wells completed for the first three quarters of 1878 were 2,333, against 2,659 for the same time in 1877; decrease in 1878, 366.

The daily average production of the new wells completed for the first three quarters of 1878 was 13 2-10 barrels, against 14 2-10 for the same time in 1877; decrease in 1878, 1 barrel.

The total number of dry holes developed in the first three quarters of 1878 were 280, against 476 for the same time in 1877; decrease in 1878, 196.

The total amount of crude petroleum held in the producing regions of Pennsylvania, at the close of the third quarter of 1878, was 4,599,362 barrels, against 2,503,657 at the same time in 1877; increase in 1878, 2,095,705 barrels.

The amount of crude petroleum represented by outstanding certificates on the last day of September was 1,705,853 barrels, against 1,317,484 barrels on the last day of October, a reduction during October of 158,127 barrels.

Mr. J. M. Guffey has purchased of Marcus Hulings an undivided half interest in the celebrated Kinzua Creek property (Bradford district). The purchased portion contains 6,400 acres, on which there is a well that was struck in June last, and since that time has been doing from 16 to 18 barrels, and has never been torpedoed. Mr. Guffey looks upon this as one of the best prospective oil territories in the country.

D. W. C. Carroll & Co., of Pittsburg, have kept from 45 to 75 men employed, since June, in the oil regions, building iron tanks, nearly all of which are located in the Bradford district.

WEST VIRGINIA.

The Wheeling *Intelligencer* says: As noticed in our Moundsville letter this morning, extensive preparations have been made to bore for oil on the opposite side of the river at the Union Coal Works shaft. The machinery was brought down from Pittsburg on Tuesday, and is now being put in position by contractors, who have engaged to go down 1,200 feet. It will be recollected that for a long time past oil has been found in the coal shaft, and the company who are putting down the well feel confident that plenty of it exists deeper down. Some parties look forward to the development of the fact that Moundsville is situated in an important oil break, and that oil in abundance will be found on both sides of the river. The progress of the well will be looked forward to with much interest by the people of that vicinity.

MASSACHUSETTS.

The Maverick Oil Works at East Boston have recently made some very extensive additions and improvements, lengthening their wharf and making a variety of alterations in their buildings. They will shortly complete a new cooper shop, wherein, it is probable, they will construct all the tin cans required by the demands of their business.

OHIO.

The oil excitement has broken out afresh in West Mecca, Warren county, Ohio. Oil men, heavily backed with capital, have recently come in from Pennsylvania, and are making things lively in that locality. Eight new wells have been put in operation during the past week. This district is the same where the principal excitement prevailed 18 years ago.

JAPAN.

The Tokio *Times* states that the principal feature of American trade with Japan is the petroleum exports from New York. The enterprise was inaugurated only eight years ago; but the business has so increased that while only 200 cases of kerosene, valued at $600, were exported in 1870, in 1877 366,639 cases were sent to Yokohama, and 128,158 cases to Hiogo, whither none had before been carried direct. The value of these consignments was over $1,000,000.

Several refineries are in operation in Japan, making kerosene from native petroleum.

RUSSIA.

The recent reports concerning the discovery of oil near the shores of the Caspian Sea seem to be fully confirmed. From one of the wells a stream, free from gas and froth, is forced to a height of 75 feet, yielding at the rate of 10,000 barrels a day. It is reported that companies are forming at Odessa, Novo-Tcherkask, Astrakhan, and other cities, for the purpose of obtaining oil. Two large manufacturing concerns, who have their headquarters in New York city, recently received orders for considerable quantities of oil-line pipes, steam pumps, engines, boilers, and other apparatus, to be shipped immediately for St. Petersburg, Russia.

ITALY.

The oil wells of Italy comprise about 5, with a capacity of about 30 barrels per day, of a thick substance of 14 gravity. They are pumped by hand, which, though primitive, is cheaper than steam, for both men and women are employed, the former receiving as compensation for a day's work 1 lira, equal to 20 cents; and the women 60 centessimi, equal to 12 cents of our money. The wells are located in a deep valley, and the oil carried up on the backs of donkeys to a

refinery, where it is treated, and yields from 2 to 5 per cent of burning oil.

PERU.

It is proposed to build a pipe line from the refinery on the estates of Henry Meiggs to the shipping port, a distance of about 7 miles. It is stated that oil can be produced at this point for less than 1 cent a gallon, and as the fields have produced from time immemorial, there is no prospect of their early exhaustion.

ONTARIO.

The oil refinery at St. Thomas, Ont., is running day and night; 494 barrels of crude petroleum were brought from Ptrolia for it in one week recently.—*Stowell's Petroleum Reporter*.

Railway Notes.

THE new track laid in this country during the year ending September 10, 1878, was 1,160 miles. During the six preceding years the number of miles of track laid was: In 1872, 4,498; 1873, 2,455; 1874, 1,066; 1875, 702; 1876, 1,467; 1877, 1,176.

THE statement made in the recent Narrow Gauge Convention, that standard gauge freight cars weigh ten tons and carry ten tons, is indignantly disputed by users of the latter. One gentleman, having much to do with freight cars, says that the modern freight cars weigh from 17,000 to 18,000 lbs., commonly carry (and that on long hauls) 28,000 lbs., are guaranteed to carry 30,000 lbs., while he has seen them show on the scales 30,000 and 32,000 lbs. of load, and in one case 35,000 lbs. The general tendency for some years has been to increase loads without increasing, but in many cases decreasing, weights of cars; and it seems quite likely that 30,000 lbs. will soon be the standard load. The tank cars used for carrying petroleum have an average capacity—and they are almost always run full—of 30,000 lbs. The Standard Oil Company, which has some 3,000 of such cars, carried on four-wheeled trucks with the Master Car Builders' standard axle, has run them with such loads for years, and only recently had its first case of a broken axle, manifestly due to a defect in the iron.

INTERESTING observations have been made recently on the Cologne-Minden Road, Prussia, on the rusting of iron rails. A pile of rails of odd lengths were laid on sleepers over a bed of gravel early in 1870, and remained undisturbed until the fall of 1877, there being no use for them. It was then found that they were covered with a layer of rust 0·12 inch thick, which had to be removed by striking the rail with a hammer. The cleaned rail weighed only 398·2 lbs., while its original weight was 419·1 lbs., showing that 5 per cent of the rail had been destroyed by rust, which covered the rail quite uniformly. This confirms the observation often made, that rails stacked away are much more liable to rust than those laid down in a track.

ACCORDING to *Le Fer*, at a meeting of directors of the German railroads held at Constance, the following information was furnished in regard to the relative value of the different methods of injecting ties:

1. Railroad from Hanover and Cologne to Minden. Pine ties injected with chloride of zinc; after 21 years the proportion of ties renewed was 21 per cent. Beech ties injected with creasote; after 22 years, 46 per cent. Oak ties injected with chloride of zinc; after 17 years, 20·7 per cent. Oak ties not injected; after 17 years, 49 per cent. The conditions were very favorable for experiment; the road bed was good, and permitted of easy desiccation. The unrenewed ties showed, on cutting, that they were in a condition of perfect health.

2. Railroad "Kaiser-Ferdinands-Nord." Oak ties not injected; after 12 years the proportion renewed was 74·48 per cent. Oak ties injected with chloride of zinc; after 7 years, 3·29 per cent. Oak ties injected with creasote; after 6 years, 0·09 per cent. Pine ties injected with chloride of zinc; after 17 years, 4·46 per cent.

THE annual official reports of the railroads of India place the length of railways there at 7,551½ miles, of which 492½ miles were completed during the year 1877, and 223 miles since the close of the year. There are 806½ miles of double track; 5,912¾ miles are constructed on the 5 foot 6 inch gauge, and 1,638¾ on narrower gauges. The capital outlay on the State lines amounted to £3,122,051, and on the guaranteed lines to £1,374,882, bringing the total capital expenditure, up to the end of October, as regards the State, and to the end of March last, as regards the guaranteed lines, to £113,144,541. The expenditure up to the end of the year may be taken in round numbers at £13,344,500. The revenue from all the open lines was £6,232,888, of which £6,091,532 were earned by the guaranteed lines, with a capital of £95,482,941, and £141,356 were earned by the State lines, on a capital expenditure of £17,661,600. The net receipts from the guaranteed lines exceeded the amount advanced for guaranteed interest by £1,454,591; the year previous there was a deficit of £216,517.

A FRENCH engineer named Duponchel has made a report on the project of a railroad across the Desert of Sahara. The projected railway would run from Algiers to Timbuctoo, a distance of 2,500 kilometers. M. Duponchel stated that the principal portion of the line would rest during nearly its whole extent on layers of sand, and toward the end on primitive volcanic rocks, granite, gneiss, etc. No mountainous obstructions would have to be encountered. The average heat does not appear to exceed 23° or 24° C. (73 2-5° or 75 1-5° Fah.), but account must be taken of the great variations which occur in the 24 hours. For instance, occasionally, a very cold night succeeds a temperature of 40° C. (104° Fah.) in the day time. The great difficulty to be overcome would be the want of water, which is not to be procured in that region. M. Duponchel calculates that for three trains daily the amount of water required would be 4,000 cubic meters, and that the engineering science of the day is quite sufficient to supply even a much greater quantity at the requisite points.

THE government of Costa Rica has advertised for tenders for building bridges on the second Atlantic Division of its railroad. There will be needed 194 bridges. The bridges will vary in length from 3 feet to 1,044 feet, and will be built for a track of 3 foot 3½ inch gauge. They will be of sufficient strength to stand a strain of 2,240 lbs. to the lineal foot, in addition to the weight of the usual freight carried.

THE WERDERMANN ELECTRIC LIGHT.

It has been looked upon as essential that a certain distance should separate the ends of the carbon electrodes used in

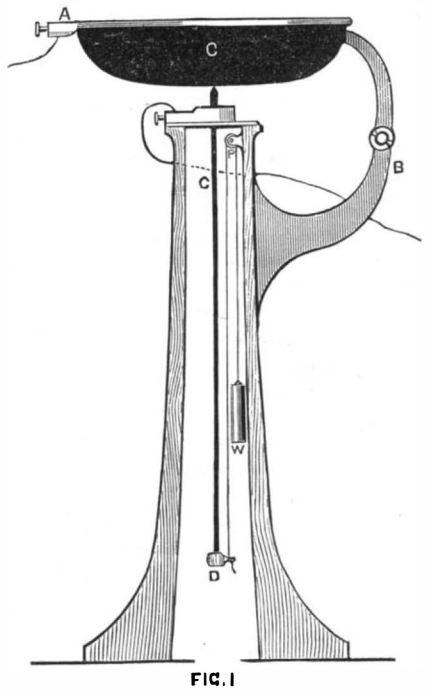


FIG. 1

THE WERDERMANN LAMP.

electric lamps. Every one has accepted this as an axiom. Mr. Werdermann's skepticism has, however, caused him to doubt the axiom, and the result is that he has discarded the electric arc space, and by placing his electrodes in actual contact, has produced a lamp which provides the means of dividing the electric current, and promises to give almost any number of lights from a single machine. Mr. Werdermann's inventions, says the *Engineering*, are secured by patents considerably in advance of those of Mr. Edison, and may in their chief points be explained as follows:

In place of two electrodes of similar form and dimensions, one electrode consists of a large bun-shaped disk of carbon placed with the rounded face downward. The other carbon is a fine rod of carbon of about ⅛ or 5-32 inch in diameter. The upper end of this is pointed and maintained in contact

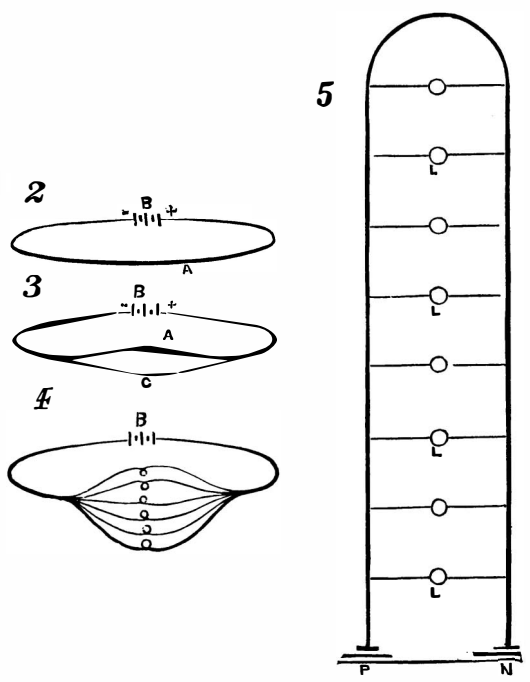


DIAGRAM OF CURRENT.

with the center of the lower surface of the disk. This rod is supported by means of a spring collar, which also forms the circuit connection. This is within about ¾ in. of the top of the carbon, so that the ¾ in. becomes incandescent, and the contact between the two carbons being only a point, a small electric arc is produced between the two carbons, while the electricity is at the same time passed on through the carbon disk, and the connections there attached to the next lamp.

Referring to our diagrams, in Fig. 1 the upper carbon is shown at C, and the rod carbon at *c*. The former is supported by means of an adjustable jointed bracket, B, attached to the wood stand. The rod carbon is guided by the spring collar on the top of the stand, and to which the connection is made, and is supported by the fine cord running over the pulley, P. This cord is attached to the clasp, D, at the bottom of the rod, and to the balance weight, W, by which the rod is maintained in constant, practical, though not absolute contact with the disk. Round the upper part of the disk is a metal band, A, to which the circuit wire is attached, and the current thus passed on to the next lamps.

At a recent trial of this lamp, the current was derived from a small Gramme electro-plating machine, requiring only 2 horse power to put it in full work. It may therefore be assumed that this was about the limit of the power at work to produce the light. At the commencement of the proceedings two lights were maintained, each stated to be equal to 320 sperm candles. At this rate the two lights would be equal to 640 candles, or 40 full power gas lights, each consuming 5 cubic feet of 16 candle gas per hour. Such gas lights, it may be observed, are not often seen, except in the argand form. The two lights burned with extreme steadiness, there being no undulation or flickering whatever, although there was no glass globe to tone down any variations of luster. The lights were perfectly bare and unprotected, and the place where the trial was made was a workshop of moderate size.

Later in the evening one light was exhibited outside the building, in an open thoroughfare, and the same perfect steadiness was observable. After the two lights had been burning for a time they were extinguished, and the current was sent through a row of ten lamps. The light per lamp was of course reduced, but there was the remarkable fact that ten lights were maintained by a comparatively weak machine, driven by an engine exerting the power of only two horses.

The light of each of these ten lamps was stated to be that of 40 candles, making, therefore, a total of 400. A reduction of light, consequent on the further division of the current, is thus apparent; but for this loss there may be ample compensation in the superior economy of a distributed light as compared with one that is concentrated. In the case of the ten lamps, the light is equal to that of 25 full power gas lights, consuming altogether 125 cubic feet of gas per hour. The extremely small arc due to the peculiar arrangement of the carbons in the Werdermann light has the advantage of offering the least possible resistance to the passage of the current.

This resistance increases much more rapidly than is represented by increase of distance between the carbon points. Hence the electric power with Werdermann's lamp is economized to the utmost in this respect, and it becomes possible—as in the recent experiment—to make use of an electric current large in quantity but of low intensity. The tension being small, there is the less difficulty with regard to insulation. If one lamp or more should be accidentally extinguished, the rest will continue to burn. The whole of the lamps can also be extinguished and relit by merely stopping the current and then sending it on again. No nice and troublesome adjustment with reference to the length of the electric arc is requisite, and simple contact between the point of the rod and the surface of the disk is sufficient for the manifestation of the light.

In respect to duration, a carbon rod 5-32 in. in diameter, and a yard long, obtained from Paris, costs a franc. This, placed in a large lamp, having an estimated lighting power of 320 candles, will last from 12 to 15 hours. The smaller lamps take a carbon of ⅛ in. diameter.

Mr. Werdermann endeavors to make the resistance of the external portion of the circuit equal to the internal resistance, in order to obtain the greatest effect. It is well known that the best results are obtained when the internal and external resistances are equal. The method adopted is that known to electricians as the divided arc, and will easily be understood from Fig. 2. Let B represent the source of the electric current, and A a copper wire connected to the positive and negative poles of the source as in the diagram. The wire, A, has a certain resistance. Suppose, now, we arrange for the current to pass as in the diagram, Fig. 3. By the insertion of the new wire, C, we have lessened the total external resistance and increased the current, as will be seen by reference to Ohm's law. $C = \frac{E}{R+r}$ where C = current; E = electromotive force; R = resistance external; r = resistance internal. The fraction $\frac{E}{R+r}$ increases as its denominator is lessened.

The current passes along the two branches in equal quantities if the resistances of the wires are equal, but inversely as the resistances if they are unequal. Thus, if the branch, A, has a resistance, 9, and C has a resistance, 1, 9-10 of the current will pass through C, and 1-10 through A. Similarly, for any number of branches the current will divide itself according to the resistances. If, then, we have a number of branches, as indicated in Fig. 4, the current will divide itself equally among the branches when the resistances of the branches are equal. This is the arrangement adopted by Mr. Werdermann, as will be seen from the annexed diagram, Fig. 5, in which N and P represent the negative and positive poles of the machine, and L L the electric lamps.

When any one lamp is put out the inventor arranges that an equivalent resistance shall be put into the circuit, so that as a whole the circuit is unaltered, and the other lamps unaffected.

CASSON'S SAW BENCH.

We give herewith a perspective view of a circular saw bench made by Messrs. Oliver & Co. (Limited), of Chesterfield, England, which we take from *Engineering*. The chief features in this machine are that it is fitted with Mr. John Casson's patent feed gear and apparatus for steadying the saws. This feeding arrangement has now been in use some years, and has been fitted to a very large number of circular saw benches. This being the case, and the arrangement being very clearly shown by our engraving, it will be unnecessary for us to describe it in detail here.

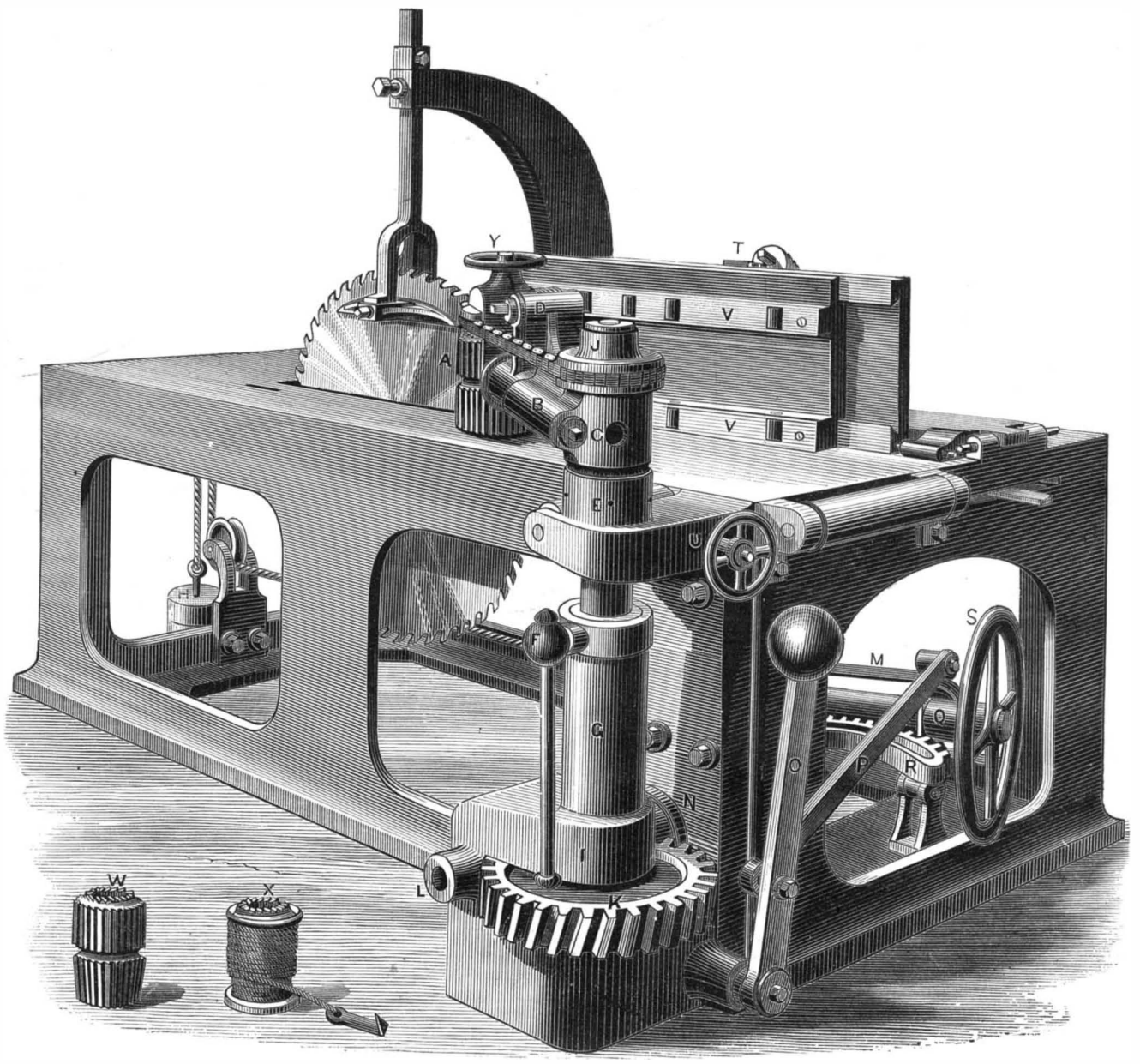
The saw-steadying apparatus, with which the saw bench we illustrate is fitted, is a novel arrangement, recently patented by Mr. Casson; in the present case it is applied to two saws.

The steadying arrangement consists of accurately fitted sliding jaws mounted on the arms of a forked support, so that they can be moved and adjusted only by fine threaded screws, the jaws having their surfaces next the saws, accurately parallel with the plane of the collar of the saw spindle; these jaws, A, are fixed when the adjusting screws are at rest, and they are faced with strips of greenheart or other suitable timber, secured by countersunk screw bolts, these faces forming a perfectly true guide for the saw blades.

For a single saw the guides just described would suffice; but for two or more saws the outside guides must be supplemented by others between the saw blades.

It will be noticed that the support, F, carrying the guiding jaws, has a square stem sliding through the head of a suitable standard, and it can be readily fixed at any desired height by means of the set screw.

The arrangement we have been describing is well carried out, and there can be no doubt that it will do good service, and enable thin saws to be efficiently used with a heavy feed. We have received very satisfactory reports of its performance.



SAW BENCH WITH SAW-STEADYING APPARATUS.

A Bait for Inventors.

I will give $200 for a machine that will bale hay in the field. Rake and press combined would be preferable, but would not object to its taking the hay in the windrow. The machine must be expeditious, executing as fast as a mower is able to cut. Must have sufficient power to make a bale suitable for commercial uses; shape of the bale immaterial; a round one preferred. Must be of light draught; one team is generally all that is available for any machine on the farm. These, with the other qualifications demanded of every machine, simplicity, durability, easy to manage, etc. If such an invention could be produced it would make a revolution in the hay field almost equal to that which the mower has made.

What an awkward, ungainly spectacle a man presents, struggling at one end of a six foot pole, with a ten pound lock of hay at the other end, endeavoring with all his might and main to elevate it 12 or 15 feet on top of a load! It is an insult to human intelligence. A load of loose hay is an uncertain quantity. You are never sure of getting it into the barn. Top heavy, one sided, too wide or too high for the doors; and even with the best of luck, a good percentage has drizzled in the wake of the wagon over the lot to the barn. A 100 or 200 lb. bale, with an inclined plane, or a pulley on side or aft of a good strong rack, and all this barbarism has succumbed to civilization.

At the barn comes a worse servitude. (I don't mean the horse fork; that is a grand lift to civilization. I hope to modify it shortly to throw bales.) There a man struggles with sheer desperation to press by his own avoirdupois 20 tons of hay into a place that won't hold 10. Tramp, tramp, tramp, leg-weary, panting like an overheated dog, every fiber of his clothing saturated with perspiration, a subject worthy of a better immortality than the Greek slave. O Edison! don't fritter away your genius on sounding brass and tinkling cymbal. Elevate the laborer. Liberate our overworked people. Make us a chariot to press our hay.—*Edmund Adams, North Manlius, N. Y., to the New York Tribune.*

A Silver Mill in the Clouds.

The largest and most complete silver mill ever constructed, says the San Francisco *Stock Report*, has recently been built by Messrs. Rankin, Brayton & Co., of the Pacific Iron Works of that city, for the Cerro de Pasco Mining Company, of Peru, and shipped for Callao, the port of destination. This enormous mill consists of 80 stamps, 900 lbs. each, 44 five foot amalgamating pans, 22 nine foot settlers, and all the accessories of a first-class modern mill. It is to be erected upon the above named mines, which are situated in the heart of the Andes, some 150 miles east of the city of Lima, at an elevation of more than 14,000 feet. To admit of mule transportation a portion of the way up this tremendous ascent, the mill had to be made in sections, no piece weighing more than 500 lbs. Some idea of the magnitude of this work may be inferred from the fact that the mill, as thus constructed, consisted of more than 17,000 pieces, and weighed upward of 600 tons. This enormous amount of machinery was constructed by the above firm and put on board a ship 50 days from date of contract.

The Cerro de Pasco mines have been the richest and most famous in the world's history. They have been worked by the old arastra process for the past 200 years, and have produced, according to the most authentic records, more than $500,000,000. With such improved machinery the product of these mines will undoubtedly attract the attention of the world, and so reflect great credit upon the capacity, ingenuity, and skill of our mechanical establishments.

Poultices.

The common practice in making poultices of mixing the linseed meal with hot water, and applying them directly to the skin, is quite wrong, because, if we do not wish to burn the patient, we must wait until a great portion of the heat has been lost. The proper method is to take a flannel bag (the size of the poultice required), to fill this with the linseed poultice as hot as it can possibly be made, and to put between this and the skin a second piece of flannel, so that there shall be at least two thicknesses of flannel between the skin and the poultice itself. Above the poultice should be placed more flannel, or a piece of cotton wool, to prevent it from getting cold. By this method we are able to apply the linseed meal boiling hot, without burning the patient, and the heat, gradually diffusing through the flannel, affords a grateful sense of relief which cannot be obtained by other means. There are few ways in which such marked relief is given to abdominal pain as by the application of a poultice in this manner.—*Dr. T. Lauder Brunton, in Brain.*

New Mechanical Inventions.

Mr. Joseph Adams, of Washington, D. C., has patented an improved Gas Regulator, designed either to cut off the gas entirely or to let on a larger amount of gas than its automatic action would ordinarily permit, or to allow the regulator to operate with an automatic action, as usual.

Mr. Jean A. Hitter, Jr., of St. Martinsville, La., has patented an improved Type Writer, of simple and compact construction, that may be readily used for printing on paper and for other purposes, being small enough to be carried conveniently in the pocket, if desired, and readily operated with little practice.

Messrs. Edwin N. Boynton, Geo. M. Coburn, and Thos. F. Carver, of Worcester, Mass., have patented an improved Hand Drilling Machine, by which a fast or slow motion can be readily obtained, at the will of the operator, the slower motion being especially advantageous in drilling large holes, as more power is obtained, and the holes are drilled with greater ease.

Mr. Reuben R. James, of rising Sun, Ind., has devised an improved Adding Machine of simple and comparatively inexpensive construction. The chief feature of the machine is a series of toothed revolving counting wheels, which are inscribed on their peripheries with the nine digits and cipher, and mounted loosely on a common axis, and each having four lateral inclines or cams, which cause, at the proper time, a weighted pawl lever to engage the next counting wheel on the left, so as to carry ten when the numbers added on the wheel on the right exceed ten. The adding is effected by successively drawing down to a stop on the finger board the teeth of the counting wheels which are opposite the numbers to be added, and the numerical result will be seen on the wheels in a series of slots or apertures in the case of the machine.

Mr. Jacob Croft, of Scipio, Utah Ter., has devised an improved Turbine Water Wheel, which is constructed to prevent back pressure by the water against the casing as it escapes from the buckets. Sand and other substances in the water are prevented from entering around the shaft and cutting or wearing it.

An improvement in Sweeping Machines has been patented by Mr. Isaac A. Chomel, of Brooklyn, N. Y. This invention relates to apparatus for sweeping up and collecting dirt, dust, and other refuse from floors, carpets, streets, and other places. The dust box is to be rolled over the floor and the brush revolved by a winch. The speed of the brush is independent of the motion of the machine along the floor.

Mr. D. A. Ferris, of Tioga Center, N. Y., has patented an improved Implement for Forcing Flooring Planks together when laying floors. It is simple, convenient, and powerful.

Effect of Quinine on the Hearing.

It is a well known fact to medical men that there exists a great prejudice among a large number of people against taking quinine, the idea being very prevalent that a prolonged use of it not only affects the hearing, but (to use the common expression) that it "gets into the bones." As regards the former belief, Dr. Roosa, of New York, has recently been collecting and examining the evidence as far as possible, and has come to the conclusion that in some cases

there really is a permanent nervous affection of the ear produced which justifies the opinion held by the laity. Hitherto physicians have generally disbelieved this, and ascribed the notion to prejudice.

The Microphone as a Thief Catcher.

The microphone as a thief catcher has proved very useful to an English resident in India, who found his store of oil rapidly and mysteriously diminishing. He fixed a microphone to the oil cans, carried the wire up to his bedroom, and, after the house had been closed for the night, sat up to await the result. Very shortly he heard the clinking of bottles, followed by the gurgling sound of liquid being poured out, and running downstairs he caught his bearer in the act of filling small bottles with oil for easy conveyance from the premises.

The Tallest Tree in the World.

The tallest accurately measured *Sequoia* standing in the Calaveras Grove, near Stockton, California, measures 325 feet, and there is no positive evidence that any trees of this genus ever exceeded that height. Of late years, explorations in Gippsland, Victoria, have brought to light some marvelous specimens of *Eucalyptus*, and the State Surveyor of Forests measured a fallen tree on the banks of the Watts River, and found it to be 435 feet from the roots to the top of the trunk. The crest of this tree was broken off, but the trunk at the fracture was 9 feet in circumference, and the height of the tree when growing was estimated to have been more than 500 feet. This tree, however, was dead, though there is no doubt that it was far loftier than the tallest *Sequoia*. Near Fernshaw, in the Daudenong district, Victoria, there has recently been discovered a specimen of the "Almond Leaf Gum" (*Eucalyptus amygdalesia*), measuring 380 feet from the ground to the first branch, and 450 feet to the topmost wing. This tree would overtop the tallest living *Sequoia* by 125 feet. Its girth is 80 feet, which is less than that of many Sequoias, but as far as height is concerned it must be considered the tallest living tree in the world.

THE ARGONAUT, OR PAPER NAUTILUS.

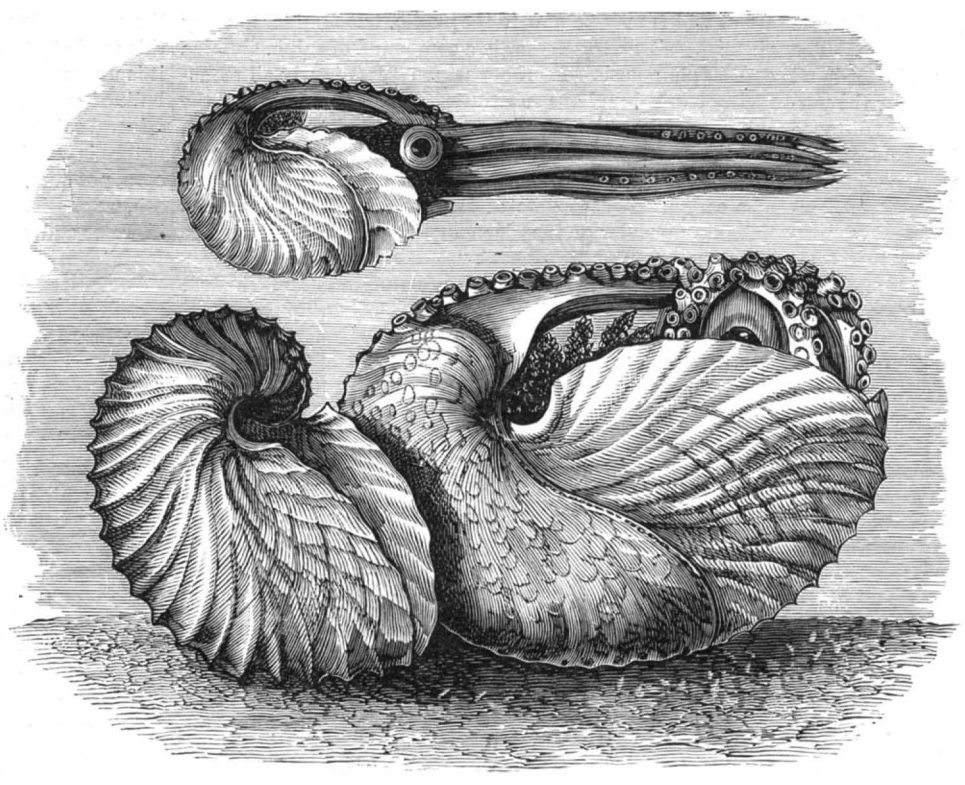
This mollusk received the first title in allusion to the pretty fable which was formerly narrated of its sailing powers, and the latter title is given on account of the extreme thinness and fragility of the shell. It is remarkable that the shell of the argonaut is, during the life of its owner, elastic and yielding, almost as if it were made of thin horn.

The two arms of the argonaut are greatly dilated at their extremities; and it was formerly asserted, and generally believed, that the creature was accustomed to employ these arms as sails, raising them high above the shell, and allowing itself to be driven over the surface by the breeze, while it directed its course by the remaining arms, which were suffered to hang over the edge of the shell into the water and acted like so many oars. In consequence of this belief the creature was named the argonaut, in allusion to the old classical fable of the ship Argo and her golden freight.

The animal, or "poulp," as it is technically called, is a lovely creature despite its unattractive form. It is a mass of silver with a cloud of spots of the most beautiful rose color, and a fine dotting of the same, which heighten its beauty. A large membrane, which is the expanded velation of the arms, covers all. It has been definitely proved that the use of the expanded arms which cover the exterior of the shell is to build up its delicate texture, and to repair damages, the substance being secreted by these arms, and by their broad expansions moulded into shape. The larger figure in the engraving represents the argonaut while thus within its shell.

While crawling the creature turns itself so as to rest on its head, withdraws its body as far as possible into its shell, and, using its arms like legs, creeps slowly but securely along the ground, sometimes affixing its disks to stones or projecting points of rocks for the purpose of hauling itself along. When, however, it wishes to attain greater speed, and to pass through the waters, it makes use of a totally different principle.

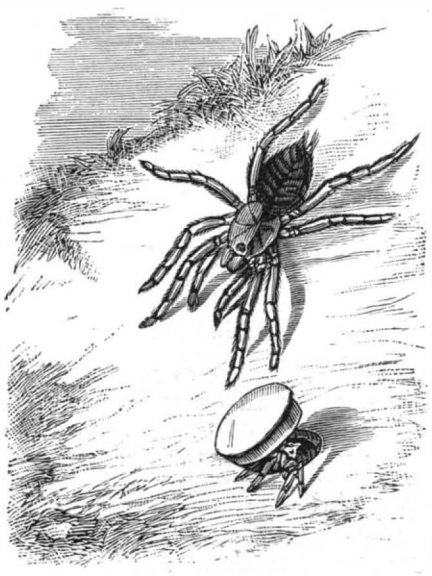
Respiration is achieved by the passage of water over double gills or branchiæ; the water, after it has completed its purpose, being ejected through a moderately long tube, technically called a siphon. The orifice of the siphon is directed toward the head of the animal, and it is by means of this simple apparatus that progression is effected. When the creature desires to dart rapidly through the water, it gathers its six arms into a straight line, so as to afford little resistance to the water, keeps its velated arms stretched tightly over the shell, and then, by violently ejecting the water from the siphon, drives itself by reaction in the opposite direction. The uppermost figure shows the argonaut in the act of swimming.



ARGONAUT, OR PAPER NAUTILUS.

THE TRAP DOOR SPIDER OF JAMAICA.

This spider digs a burrow in the earth and lines it with a silken web. The burrow is closed by a trap door, having a hinge that permits it to be opened and closed with admirable accuracy. The door is circular, and is made of alternate layers of earth and web, and is hinged to the lining of the tube that leads to the burrow by a band of the same silken secretion. The door exactly fits the entrance to the burrow, and when closed, so precisely corresponds with the surrounding earth that it can hardly be distinguished, even when its position is known. It is a strange sight to see the earth open, a little lid raised, some hairy legs protrude, and gradually the whole form of the spider show itself.



TRAP DOOR SPIDER.

The mode in which these spiders procure food seems to be by hunting at night, and in some cases by catching insects that are entangled in the threads that the creature spins by the side of its house.

In the day time they are very chary of opening the door of their domicile, and if the trap be raised from the outside, they run to the spot, hitch the claws of their fore feet in the silken webbing of the door, and those of the hind feet in the lining of the burrow, and so resist with all their might. The strength of the spider is wonderfully great in proportion to its size.

To Make a Hole in Glass.

New Remedies describes the following easy method of making a hole in plate glass: Make a circle of clay or cement rather larger than the intended hole; pour some kerosene into the cell thus made, ignite it, place the plate upon a moderately hard support, and with a stick rather smaller than the hole required, and a hammer, strike a rather smart blow. This will leave a rough-edged hole, which may be smoothed with a file. Cold water is said to answer even better than a blow.

The Preservation of Eggs.

As science advances, the processes proposed for the preservation of organic substances are being brought to greater and greater perfection. No subject perhaps in this connection has received greater attention, and been the subject of more processes, patent and otherwise, than that of the preservation of eggs. In fact this is a question of considerable importance, not only from a culinary, but also from an industrial standpoint—that of the manufacture of albumen for photographic purposes. In the *Moniteur de la Photographie* Dr. Phipson calls attention to a new process, which may be briefly stated as follows:

On taking the eggs from the nest they are covered over, by means of a bit of wool, with butter in which has been dissolved 2 or 3 per cent of salicylic acid. Each egg, after receiving this coat, is placed in a box filled with very fine and absolutely dry saw dust. If care be taken that the eggs do not touch each other, and that they be perfectly covered with the saw dust, they will keep fresh for several months—perhaps for more than a year. Dr. Phipson states that he has experimented with this process for two years, with most excellent results. So much for the preservation of the entire egg; but there is also a process for the preservation of the albumen of the egg for photographic uses, due to M. Berg. In this process, the white, separated from the yolk, is evaporated in zinc pans or porcelain cups, at a temperature of 45° C. The solidified albumen thus obtained is pulverized by means of a mill. The yolk, by means of machinery, is whipped up into a light mass, and then spread out on zinc plates and evaporated to dryness at a temperature of 80°, and finally powdered. The powders thus obtained keep for a long time. The white of eggs, so prepared, is used for the purposes to which albumen is applied in the industrial arts, while the powdered yolks are used for domestic purposes.

Characteristics of American Sheep Husbandry.

Dr. Hayes, in his recent address before the National Agricultural Congress, remarking that a very inadequate idea is given of a nation's resources by the number of sheep raised—the character of the animals being of the first consideration—proceeds to show some of the characteristics of American sheep husbandry. He states that the sheep of the United States consist, first, of what are called native sheep; second, descendants from improved English races; third, the Mexican sheep found in Texas, New Mexico, Colorado, and California; fourth, the merino sheep, and crosses of that breed with the three preceding races. The merinos constitute the principal and characteristic race of the United States; and this is the most important fact in the enumeration of our resources for sheep husbandry and the wool manufacture. England has no merinos, except in her colonies; Russia has but 12,000,000 merinos; France, but 9,000,000. The merinos and grades in the United States exceed 25,000,000. Merino wool is for clothing what wheat is for food; it is the chief material for cloth at the present day, the coarsest as well as the finest. While the softest, it is the strongest of all fibers. From its fulling and spinning qualities, it is the best adhesive for the cheap fabrics—coarser wool, cotton, or shoddy; the mixture of merino wool increasing indefinitely the material for cheap clothing. An abundance of merino wool is the greatest boon the world has received from the animal kingdom in the last century. It is, in fact, in its extended culture the product of the last century. A century ago all the merinos in the world, confined exclusively to Spain, did not number 1,000,000. 1765 marks the epoch of the first exportation of the merinos to Saxony; 1786, to France; 1833, to Australia; 1802, the introduction of the first merino sheep to this country; and to Gen. Humphreys, of Connecticut, and to the introduction to his farm of twenty-one rams and seventy ewes, may be directly traced the most celebrated breeds of the American merino; producing individuals actually sold for $5,000 each, others for $2,000 to $3,000, and one for which $10,000 was refused. The fiber of the merino sheep is not the only excellence of the animal; when properly bred, this race has a hardiness surpassing all other high-bred races. The "yolk," provided by nature to assist in the growth of the wool, abounding in this race more than in any other, causes the tips of the fleece to be cemented, and to become impenetrable to rains and snows. A lighter pasture suffices for their maintenance than would support the mutton races. This race is fitted, above all others, for the remote pastoral lands and for culture on a large scale.

Our breeders, in aiming to increase the weight of their fleece, have developed the length of the staple, and have unconsciously created a merino combing wool—a wool in special demand through modern improvements in machinery and changes in the fashion of goods. Mr. Ferneau, an eminent Belgian wool manufacturer, who has thoroughly studied our wool resources and manufactures, says that three quarters of the American wool is "combing wool," and will be ultimately employed for this purpose. The bulk of American merino wools is of strong, sound, and healthy staple, having few weak spots in them. Those from the other States of the West are free from burrs. Those from California have

this defect in a high degree. They are admirably fitted for blankets, flannels, and fancy cassimeres, and the great bulk of our card wool manufactures. They are so excellent, as a whole, that M. Ferneau says they are too valuable to be used for clothing purposes. They supply nine tenths of all the card or clothing wool consumed in American mills.

THE PROGRESS OF SCIENCE IN MEXICO.

Mexico, the land of so many and such frequent revolutions, and the scene of such intestinal commotions and bitter strife through the whole period of her existence, from the Spanish conquest up to within a few years, is at present happily in a state of comparative peace and quiet; the laws are less disregarded, brigandage is gradually disappearing, more attention is being paid to the protection of life and property, and public education is in a prosperous condition. No greater evidence of this felicitous state of affairs could be afforded than that shown in the display of energy and zeal with which the present administration, aided by the foremost Mexican scientists, is carrying out an extended system of scientific explorations, investigations, and internal improvements; and the progress of which is being recorded in a valuable series of government publications; one of these —the *Annals of the Minister of Public Works*—being now before us. This volume, the third of the series, begins with an article by the able director of the National Meteorological Observatory, Sr. Mariano Barcena, calling attention, in the first place, to the great national importance, as well as necessity, of a well organized system of meteorological observations; (2) giving a description of the Mexican Observatory, its equipment, the questions it proposes to investigate, and the hours of observation; (3) an explanation, accompanied by charts, of the daily system of registration pursued at the observatory; and, finally, observations on the periodic phenomena of vegetation, and notes on the orography and geology of the valley of Mexico. Sr. A. Anquiano follows with a communication on the "Geographical Position of Chalco," prefacing the results of his labors by an able essay on the "Mexican Method" of determining the latitude of places, a "method" founded on an observation of the stars. It would be interesting to quote from this, but our limited space will not permit. The "Citlaltepetl Commission," consisting of the engineers, Srs. Plowes, Rodriguez, and Vigil, whose patriotic ardor induced the minister to commission them to explore "and be the first to plant the flag of Mexican science on the snow clad peak of Citlaltepetl," render their report of operations during the year 1877 in the form of an exceedingly interesting memoir. They ascertained the peak of the volcano Citlaltepetl (or Orizaba) to be 17,651 feet above the level of the sea, which is 292 feet more than Humboldt made it. After a somewhat exhaustive treatise on the "Telescope and its Amplifying Power," by Sr. Jimenez, we have a long and extremely interesting account of the Ancient Aqueduct of Zempoala, one of the most notable of existing monuments of the old Spanish rule. These aqueducts (for there were three) were projected and carried to a successful termination by an humble and ignorant Franciscan monk—the Friar Tembleque. The construction of these remarkable works, begun in 1554 and occupying a period of 17 years, was undertaken for the purpose of carrying water from Zempoala to Otumba (a distance of 27 miles), and was the occasion of a curious contract between the inhabitants of these two cities. It seems that Otumba, situated at a high elevation, needed water; Zempoala was blessed with water, but was sadly in need of spiritual advisers; the people of the former city, therefore, agreed to furnish a certain proportion of friars to minister to the religious wants of the parties of the second part, and the latter in return bound themselves to furnish water, and the labor and materials for the building of an aqueduct to lead it, to the parties of the first part. No tradition remains to state when these structures ceased to be used. The longest of the three extends across the valley of the Papelote, a distance of 2,960 feet, and consists of 68 arches, the highest of which has an altitude of 106 feet. Señor Salazar urges on the Minister of Public Works the importance of having these monuments of a past age repaired and restored, not alone for archæological reasons, but because Otumba to-day is as greatly in need of running water as it was in that remote period when these viaducts were constructed. Señor Barcena follows with a description and colored plate of a plant (*Gaudichaudia Enrico-Martinezii*) new to the Mexican flora, and Sr. Federico Weidner with some "General Reflections on the Iron Industry of the Country." Succeeding the latter paper, an exhaustive article by the same writer gives us, from a geological point of view, the structure, as far as can be ascertained, of the "Cerro de Mercado" of Durango, which is said to be one vast mass of iron. The author after a thorough examination of this hill, last year, concludes that it is of eruptive or volcanic origin. This is contrary to the statements made in most published works, the authors of which probably derived their notions from the views expressed by Humboldt, who was of the opinion that this mass of iron was an immense aerolite. Sr. Weidner, however, concludes that the great traveler never visited the locality in person, but obtained his information from heresay. He shows that the hill is deficient in the chemical constituents of aerolites, namely, iron, nickel, and cobalt, in a native or malleable state; but, on the contrary, is made up in a great measure of crystalline magnetic iron, and various useful oxides of the same metal. By a careful estimate of the quantity of iron contained in that portion only of the Cerro which appears above the surface of the soil, the author obtains as a result the enormous sum of 507,000,000 pounds, and this reduced to a metallic state would yield 250,000,000 pounds of pure iron. The structure of this remarkable hill is made apparent to the reader by means of an excellent geological section, in colors, accompanying the text.

The volume closes with some notes by Sr. Barcena on the "Hydrographic System of the Hacienda of Cienega de Mata, and its application to one of the theories that explain Natural Fountains."

In taking leave of this subject we have to congratulate the Mexican Government not only for the valuable matter contained in its scientific publications, but also for the very excellent style in which the latter are being issued. The general make up of the volume before us leaves little to be desired; the arrangement of the types is extremely tasty, the imprint is clean, sharp, and clear, the paper good, the margins of the pages broad, and the illustrations exceedingly well executed. It is to be sincerely hoped that the present state of peace, which our sister republic is enjoying, will endure for numerous years to come; and that the scientific work begun under such happy auspices may go on uninterruptedly until the whole country shall have been thoroughly explored. For as yet, we know but comparatively little about the geology of Mexico, and a great deal is yet to be learned, too, about her natural productions.

Correspondence.

Alum in Bread.—A Reply to Dr. Mott's Article in Scientific American of November 16, entitled "Deleterious Use of Alum in Baking Powder."

BY W. P. CLOTWORTHY, BALTIMORE, MD.

On August 13, 1878, I obtained letters patent for the exclusive right to use exsiccated ammonia alum in baking powders. This fact I state that the public may know the reason that elicits this reply to the remarkable article on adulterations in baking powders, in the SCIENTIFIC AMERICAN of Nov. 16th, emanating from the pen of Henry A. Mott, Jr. I wish the Professor had been equally candid in stating his reasons for contributing the article. It is rare for a chemist to turn philanthropist without some consideration. The analysis of forty-two baking powders requires no little labor; twenty-one were examined at the expense of the government for the benefit of the Indian Department, the others, no doubt, at the expense and for the benefit of the Royal Baking Powder Company. I hope his services have been liberally requited. The public certainly owe him nothing for his labor or opinions. An excuse can be made for the prejudice existing against the use of alum in any form for baking purposes; it is an inheritance from a preceding age; but no apology can be offered for a practical chemist in this day, who labors to keep alive and foster a prejudice by the suppression of truths and facts. Professor Mott, in attempting to prove a fraud in food, has perpetrated a fraud in facts. That this opinion may not be unwarranted, I will state the facts about alum, which may be new to the public, but familiar to every chemist. Alum was formerly a compound of sulph. alumina and sulph. potash. In the past ten years nearly all manufacturers of alum have substituted sulph. ammonia for the sulph. potash; this change removes from alum a dangerous and objectionable ingredient, and adds a healthful one. Professor Mott recommends the use of ammonia in the form of a carbonate—carbonate of ammonia is one of the results in baking powder of the decomposition which takes place between alum and bicarbonate of soda; in the complete decomposition which takes place pure alumina is eliminated, highly recommended as an antacid. During the process of baking, alum is completely decomposed through the liberation of carbonic acid. Professor Mott must have known this, yet with this knowledge warns the public on the deleterious effect of alum in bread.

About the first of last October I determined to vindicate the use of exsiccated ammonia alum as a substitute for cream of tartar, and accordingly issued a circular to the trade; from this circular I now give the following extract, which enters minutely into the subject:

"To claim that an experience of 35 years in compounding medicines should entitle my opinion on chemicals and chemical compounds to a respectful consideration, is neither presumptuous nor unreasonable. With this simple introduction I now avow myself the originator and patentee of exsiccated ammonia alum baking powder. The use of exsiccated ammonia alum has been declared unhealthful by the advocates of other baking powders, and every manufacturer using it has been held up for public reprobation. This has been done by rival manufacturers, either through ignorance or malice; if from the former they are to be pitied, if from the latter they are contemptible. These opinions have been promulgated by kitchen chemists, whose circle of knowledge begins and ends with cream tartar and soda; and even of these articles they only know that cream tartar is in some way derived from grapes. In this circular I propose to state a few facts in relation to cream tartar and exsiccated alum, and the combinations they form with bicarbonate of soda, and allow you to form your own opinion of their respective merits. Crude tartar is the incrustation found in wine casks. It contains coloring matter and about 15 per cent of lime. This article is purified and called the cream of tartar, but it is impossible to extract all the lime. Commercially pure cream tartar contains at least 5 per cent of lime. When cream tartar is used in proportion of two parts to one of bicarbonate of soda, you will have an average of 3 to 4 per cent of lime. In using cream tartar and soda in baking, a chemical change commences as soon as water is added; the cream tartar unites with the soda, setting free the carbonic acid gas, which lightens the bread, and the residue is Rochelle salts. This is what you eat in your bread, the cream tartar and soda entirely disappearing in the process of baking, by forming this salt. Any doctor or chemist will confirm the above statement. When I undertook to manufacture baking powder, I labored to improve the quality and cheapen the cost. The first I accomplished by retaining the carbonic acid until heat was applied, the latter, by manufacturing a more economical acid than foreign cream tartar. After more than a thousand experiments covering a period of six months, I discovered by exsiccating ammonia alum I provided an article that would possess the necessary qualities. This article no more resembles the ordinary alum than charcoal resembles wood—it is light, porous, friable, and without taste. This article, under the influence of heat, combines with the soda and forms Glauber salts. In baking, the alum unites with the soda, just as cream tartar unites. In using the baking powder prepared according to my formula, you have in your bread Glauber instead of Rochelle salts. To your physician apply for his opinion of these salts; I will bow to his decision. Another false impression these zealous guardians of the public health have made is, that I used the exsiccated alum because it was cheap. The fact is that when I commenced its use it cost by the thousand pounds 12 per cent more than the best cream tartar is worth to-day, and 33 per cent more than average price of that article for the past year. I have since reduced the cost of manufacturing, and as I did so, correspondingly reduced the price of powder to the public. I regard the quantity of soda in cream tartar baking powders as very objectionable; they generally contain about 33 per cent. In my powder only 20 per cent. The prejudice in the public mind against alum, originated in the habit of the English bakers buying damaged flour, and by the addition of crude alum, made their bread in appearance equal to that made from best flour. Against this practice laws were enacted, not so much against the qualities of alum, as against its use in covering up a fraud in flour. This was the common potash alum and uncombined with any carbonated alkali, and it passed into the stomach unchanged. It is a trick—for it deserves no better name—of our rivals to show by chemical analysis that my powder contains alum, but are careful neither to state the kind nor the change it undergoes in baking. The manufacturer who knowingly misrepresents the goods of a rival, may well be doubted when he speaks of the quality of his own.

"Great stress is laid on the fact that cream tartar is a vegetable acid, the product of the grape, hence it must be healthy. They forget that cream tartar is not entirely vegetable, but principally second handed minerals. It is a compound of tartaric acid, potash, and lime; the last two are minerals, which the grape takes up from the earth, but redeposits them as crude tartar when fermentation converts the grape into wine. In 1807 Sir Humphry Davy from this crude tartar first made the metal potassium. Of lime it is unnecessary to speak. The potash and lime form the bulk of cream tartar. In ammonia alum there is no more mineral substance than in cream tartar. The chemistry of nature is wonderful. Vegetation lives on minerals—wheat, corn, potatoes, are all mineral compounds. Lime, soda, potash, magnesia, sulphur, iron, etc., are all found abundantly in water and grain, and all these minerals are essential in food."

Professor Mott has given the Royal Baking Powder the benefit of his indorsement; it may be all that he claims for it. But baking powders are now judged by constituent ingredients and chemical analysis; to this test I propose to bring the Royal. It is now in the hands of a competent chemist, and when the analysis is complete I will give the public the benefit of a comparison between that powder and the Patapsco. I will take Professor Mott's analysis of Patapsco, which, though not correct, I accept as such. The comparison will be made on the healthfulness of constituents in combination, and the chemical changes they undergo in baking. This is a progressive age. The people want facts, and they will form their own theories. Will the reader believe that in the reign of Henry VIII. of England, a citizen of London was executed for burning coal, which was then a capital offense? A pope about the same time issued a Bull excommunicating all Catholics who used tobacco, calling it the devil's weed. To-day coals still burn, and tobacco solaces millions of the civilized world. If the Royal Baking Powder Company (what a misnomer) possessed royal prerogatives, the advocates of exsiccated alum would fare no better than they did under the sumptuary laws of England. Professor Mott has fulminated *ex cathedra* his blast, but we survive. "Truth is a torch, the more 'tis shook it shines." Our strength is in the intelligence of the age.

SMITH, HANWAY & Co., Baltimore.

The Elongation of Tree Trunks.

The *College Quarterly* says that experiments made at the Iowa Agricultural College show that the popular notion that the trunks of trees elongate is entirely erroneous. Tacks were driven into the trunks of various trees, and the distance between them accurately measured. At the end of the season they were found to have neither increased nor decreased their distances. In the experiment, tree trunks were selected of all ages, from one year up to five or six, and in no case was there any change whatever noticeable.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, December 14, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated:

PLANETS.

	H.M.		H.M.
Mars rises	4 57 mo.	Uranus rises	10 11 eve.
Jupiter sets	7 54 eve.	Neptune in meridian	8 48 eve.
Saturn in meridian	6 16 eve.		

FIRST MAGNITUDE STARS, ETC.

	H.M.		H.M.
Alpheratz in meridian	6 28 mo.	Procyon rises	7 40 eve.
Mira (var.) in meridian	8 39 eve.	Regulus rises	9 43 eve.
Algol (var.) in meridian	9 26 eve.	Spica rises	2 24 mo.
7 stars (Pleiades) in merid.	10 06 eve.	Arcturus rises	1 27 mo.
Aldebaran in meridian	10 54 eve.	Antares rises	6 30 mo.
Capella in meridian	11 33 eve.	Vega sets	9 52 eve.
Rigel in meridian	11 34 eve.	Altair sets	8 40 eve.
Betelgeuse in meridian	0 18 mo.	Deneb sets	1 02 mo.
Sirius rises	8 05 eve.	Fomalhaut sets	9 16 eve.

MOON'S PLACE IN THE CONSTELLATIONS AT 7 P.M.

Saturday, *Cancer*	26°	Wednesday, *Virgo*	22°
Sunday, *Leo*	9°	Thursday, *Libra*	6°
Monday, *Leo*	23°	Friday, *Libra*	21°
Tuesday, *Virgo*	7°		

REMARKS.

The sun will attain his greatest southern declination and enter the constellation *Sagittarius* December 21, 5h. 45m. evening, at which time winter begins. Mars will be 5° north of the moon December 21, in the morning. Saturn will be 90° east of the sun December 18, passing the meridian at 6 o'clock in the evening. He is now advancing among the stars, and will soon be again upon the equinoctial colure. Uranus will be nearly 4° north of the moon December 15.

Sympathetic Inks.

Under the name of sympathetic inks are designated certain liquids which, being used for writing, leave no visible traces on the paper, but which, through the agency of heat, or by the action of chemicals, are made to appear in various colors. The use of such means for secret correspondence is very ancient. Ovid, Pliny, and other Roman writers speak of an ink of this kind, which, however, was nothing more than fresh milk. It merely sufficed to dust powdered charcoal over the surface of the paper upon which characters had been traced with the colorless fluid, when the black powder adhered only to those places where the fatty matter of the milk had spread. Such a process, however, was merely mechanical, and the results very crude.

A great number of sympathetic inks may be obtained by means of reactions known to chemistry. For instance, write on paper with a colorless solution of sugar of lead; if the water that is used for the solution be pure, no trace of the writing will remain when it becomes dry. Now hold the paper over a jet of sulphureted hydrogen, and the characters will immediately appear on the paper, of an intense black color. The following recipes for inks of this kind are more simple: If writing be executed with a dilute solution of sulphate of iron, the invisible characters will appear of a beautiful blue, if the dry paper be brushed over with a pencil full of a solution of yellow prussiate of potash; or they will be black, if a solution of tannin be substituted for the prussiate. If the characters be written with a solution of sulphate of copper, they will at once turn blue on exposing to the vapors of ammonia. Another sympathetic ink is afforded by chloride of gold, which becomes of a reddish purple when acted upon by a salt of tin. A red sympathetic ink may be made in the following manner: Write with a very dilute solution of perchloride of iron—so dilute, indeed, that the writing will be invisible when dry. By holding the paper in the vapor arising from a long-necked glass flask containing sulphuric acid and a few drops of a solution of sulpho-cyanide of potassium, the characters will appear of a blood-red color, which will again disappear on submitting them to the vapors of caustic ammonia. This experiment can be repeated *ad infinitum*.

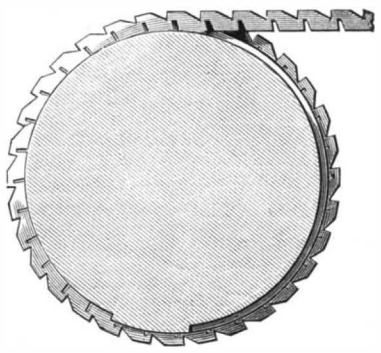
During the war in India, some years ago, important correspondence was carried on by the English by means of the use of rice water as a writing fluid. On the application of iodine the dispatches immediately appeared in blue characters.

Sympathetic inks which are developed under the influence of heat only are much easier to use than the foregoing. The liquids which possess such a property are very numerous. Almost every one perhaps knows that if writing be executed on paper with a clean quill pen dipped in onion or turnip juice, it becomes absolutely invisible when dry; and that when the paper is heated the writing at once makes its appearance in characters of a brown color. All albuminoid, mucilaginous, and saccharine vegetable juices make excellent sympathetic inks; we may cite, as among the best, the juices of lemon, orange, apple, and pear. A dilute solution of chloride of copper used for writing is invisible until the paper is heated, when the letters are seen of a beautiful yellow, disappearing again when the heat that developed them is removed. The salts of cobalt, as the acetate, nitrate, sulphate, and chloride, possess a like property. When a dilute solution of these salts is used as an ink, the writing, although invisible when dry, becomes blue when exposed to heat. The addition of chloride of iron, or of a salt of nickel, renders them green, and this opens the way for a very pretty experiment: If a winter landscape be drawn in India ink, and the sky be painted with a wash of cobalt alone, and the branches of the trees be clothed with leaves executed with a mixture of cobalt and nickel, and the snow-clad earth be washed over with the same mixture, a magic transformation at once takes place on the application of heat, the winter landscape changing to a summer scene.

There is a well known proprietary article sold in Paris under the name of "*Encre pour les Dames*" (ink for ladies). Hager, in a recent scientific journal, states that this consists of an aqueous solution of iodide of starch, and is "specially intended for love letters." In four weeks characters written with it disappear, preventing all abuse of letters, and doing away with all documentary evidence of any kind in the hands of the recipient. The signers of bills of exchange who use this ink are of course freed from all obligations in the same length of time.

NEW WIRE CLOTHING FOR BURRING CYLINDERS.

Heretofore two kinds of clothing for cylinders for treating fibrous material have been employed, one consisting of a set of serrated rings cut from sheet steel and secured to the periphery of the cylinder, and the other consisting of flat serrated iron wire. The serrated rings, of necessity, entail a great loss of material in their manufacture, and the iron wire clothing is so soft that it soon wears out or becomes dull, necessitating the reclothing or sharpening of the cylinder.



NEW WIRE CLOTHING FOR BURRING CYLINDERS.

Our engraving represents a new form of steel wire clothing for such cylinders, which was recently patented by Mr. Frank P. Pendleton, of Philadelphia, Pa.

The improvement consists in notching or nicking the base of the teeth or back of the wire, so as to admit of bending the wire around the cylinders without breaking.

Petroleum and Gold.

As one of the leading staples of American export, our petroleum wells have been more valuable than gold mines. A recent discovery by Mr. John Turnbridge, of Newark, N.J., indicates that in some cases petroleum wells may be in fact, as well as in effect, real gold mines. He says that while investigating the peculiar behavior of the hydrocarbons and their singular quality of separating the precious metals from aqueous solutions, assisted by constant application that furnished evidence of the force of chemical action which could be satisfactorily measured, there occurred to him the probability that analogous effects might be traced in the operations of nature; more particularly in certain geological formations peculiar to auriferous soils. These ideas, he asserts, have been singularly verified in subsequent research by the discovery of gold in many samples of crude petroleum, also in the sediment or refuse of the distillation of that substance. The attraction existing between the hydrocarbons and many elementary bodies ought to create no surprise, especially if reference is had to the reducing action of the hydrocarbons in contact with metallic solutions. The procedure in the examples above referred to consist in pouring crude petroleum on vegetable fiber or wood shavings and firing it, collecting the ashes and making the usual fire assay. The cupel disclosed a small pellet. After due examination with the appropriate test it was found to be pure gold. The distillery refuse when assayed gave $34.85 value per ton. It may be mentioned in the last case considerable molybdenum was present, a substance resembling plumbago. Mr. Turnbridge has no knowledge of the locality whence these samples of crude petroleum were originally obtained. He infers, however, that oil wells in the vicinity of auriferous deposits may yield a larger quantity of gold than from oil wells situated in carboniferous strata. There has been, he states, a practical application of this discovery for the recovery of gold, applied in cases where quicksilver has failed to be of service.

Reduction of Nitrate of Silver by Means of Charcoal.

A very simple method of reducing nitrate of silver, analogous to that some years ago mentioned by the late Mr. Hadow, is given in the *Archiv der Pharmacie*, by Mr. C. F. Chandler. If crystallized or fused nitrate of silver be placed upon glowing charcoal, combustion forthwith takes place, the silver remaining behind in a metallic form, while nitrous oxide and carbonic acid are freely given off. The nitrate of silver is fused by the heat developed by the reaction, and is imbibed through the pores of the charcoal; as every atom of consumed carbon is replaced by an atom of metallic silver, the original form and structure of the charcoal are preserved intact in pure silver. By proceeding in this manner it is possible to produce silver structures of any desired size, possessing in every way the original form of the wood. A crystal of nitrate of silver is in the first place put upon a piece of charcoal, and a blowpipe flame is then applied in the vicinity, in order to start the reaction in the first instance, and as soon as combustion commences crystal after crystal may be added as these, one after another, become consumed. The silver salt is liquefied, and penetrates into the charcoal, where it becomes reduced. Pieces of silver may in this way be prepared, of one or two ounces in weight, which exhibit all the markings and rings of the original wood to a most perfect and beautiful degree.

New Agricultural Inventions.

Mr. Charles E. Macarthy, of Forsyth, Ga., has patented an improved Horse Power, designed more particularly to be located beneath a gin house for ginning cotton, but applicable for all purposes for which a horse power is ordinarily employed.

An improved Corn Planter has been patented by Mr. Thomas A. Sammons, of Lewisburg, West Va. This corn planter is designed to plant the corn in straight rows both ways and at varying distances apart. It is constructed upon the general principle of a reciprocating slide, passing alternately beneath a hopper, and carrying a number of grains from beneath the same to a discharge outlet.

An improved machine for Cutting the Bands of Gavels or bundles of grain, and feeding the same to the cylinder of a thrasher, has been patented by Mr. James M. O'Neall, of Fort Worth, Texas.

An improved Sulky Breaking Plow has been patented by Mr. Edward T. Hunter, of Hallsville, Ill. This is an improved sulky attachment for breaking plows, which is so constructed as to receive any ordinary plow; it may be adjusted to cause the plow to work deeper or shallower in the ground, and will allow the plow to be turned to either side.

Mr. Osman C. Du Souchet, of Alexandria, Mo., has invented an improved Check Row Corn Planter and Drill, which is so constructed that its operating mechanism may be at all times under the control of the driver. It will plant the corn in accurate check row, and is easily controlled.

An improved Thrashing Machine has been patented by Mr. Peter Parrott, of Red Bud, Ill. This is an improvement in the class of thrashing machines having an attachment for removing dust from the space in front of the cylinder, and having pickers for loosening or shaking the grain from straw delivered from the cylinder.

An improved Corn Planter has been patented by Mr. John H. Zarley, of Oakland, Ill. The object of this invention is to provide an efficient and cheaply constructed corn planter, which may be drawn forward by horses, but is arranged so that the seed valves may be operated by hand.

Messrs. Clayton M. Van Orman and James M. Hagenbaugh, of Athens, Mich., have patented an improved Grain Separator, in which the arrangement of the screens, feedboard, and blast of a fanning mill effect the thorough removal from the grain of all impurities. Only two screens are employed.

An improved Churning Apparatus has been patented by Messrs. William H. Foster and Isaac C. Roberts, of Louisburg, Kan. It is simple, inexpensive, convenient, and effective in operation. It will bring the butter very quickly, and at the same time gather it.

An improved Plow has been patented by Mr. Robert B. Mitchell, of Minneapolis, Kan. The object of this invention is to improve the construction of sod, stirring, and other plows, so that the cutter may be moved forward as it is worn or ground off. It prevents roots, grass, and other trash from gathering upon the share.

Messrs. John B. Martin and William T. Carothers, of Clarence, Mo., have patented an improved Hay Loader capable of placing hay upon stacks or ricks, or upon wagons. It is simple in its construction and effective in its operation.

Naphtha and Benzine.

We have often been asked the difference between benzine and naphtha, many people wanting to know whether naphtha didn't include benzine, or whether it wasn't the same thing under a marketable name. A prominent refiner says that benzine is the first product that arises from the process of refining crude oil, and bears the same relation to naphtha that that distillate does to refined oil. In other words, benzine is crude naphtha. The reason it is not quotable under the name of benzine, therefore, is because it has to be reduced to naphtha before it is marketable in any extensive quantity.

The process that benzine is subject to, to produce naphtha, is not a separate business, but is carried on by the regular oil refiners in the same stills and retorts that the refined oil is produced. The benzine is treated with sulphuric acid, and the result is naphtha, which is in wide demand in Europe, especially in France, for the purpose of producing aniline dyes, while it is also put to many other purposes.

This demand is partially instrumental in keeping up its price, but its rapid evaporation also has a tendency in that direction, as any large seller of it has to take into consideration the depreciation that might take place by the time he sells it on that account, and for the same reason buyers give no more orders than immediate necessity requires.

All refiners, however, do not produce naphtha, but some of them sell the benzine, which is largely used for fuel purposes, for which it is much better than coal, as it is not only absolutely cheaper, but gives a steadier heat.—*Parker Daily*.

FOR joining the porcelain heads to the metal spikes used for ornamental nails, the *Prakt. Maschinen Construct.* recommends the use of a thick paste made of a mixture of Portland cement and glue.

Notes & Queries

(1) Detroit asks whether a boat propelled with a force of 3 miles an hour on still water will with the same propelling force run 6 miles an hour in a current running 3 miles an hour? A. We think so.

(2) J. C. R. asks: Which was the first railroad built in the United States? That is, a regular, incorporated road, connecting two points, and conveying passengers, freight, etc. A. We believe that the road now known as the Baltimore and Ohio Railroad was the first in the United States chartered for carrying on a general transportation business.

(3) J. R. E. asks how to make an ordinary sunshade for a telescope when placed, and what kind of glass it is composed of. A. Any very dark glass will answer, providing it is perfectly plane. It should be placed between the eye and eyepiece.

(4) W. H. G. S. writes: I wish to give a blue color to screw heads, wire and steel. What shall I use? A. Heat them in a sand bath, or apply shellac or copal varnish, to which a little Prussian blue has been added.

(5) T. McW. asks (1) for a good recipe for making Babbitt metal. A. By weight, 4 parts copper, 8 parts antimony, 96 parts tin. 2. What is meant by heating surface in boilers, and how is it computed? A. The term heating surface, as ordinarily used, refers to the surface which has water on one side, and flame or the products of combustion on the other. 3. I have a peculiar kind of steel which I cannot harden by fire and water, neither will it caseharden by prussiate of potash. What can I do with it to harden it? A. Assuming your account to be correct, we judge that you cannot harden it.

(6) A. Van B. writes: A correspondent in your last issue asks how to keep rubber belts from slipping. Mine slipped considerably, but I checked it by throwing powdered rosin in between the belt and pulley while running. The pulley soon becomes covered with a tough black coating, very much like leather, and there is no more slip. [This expedient can be used to advantage in certain cases, but it is better to have a belt large enough to drive without using any preparation.—ED.]

(7) E. B. C. asks: 1. Does a more powerful battery produce better results in telephone or microphone? A. A powerful battery is not required for either. 2. Can you give me a short description of the principle and construction of the aerophone? A. We think it has not been perfected.

(8) A. T. L. asks for a recipe for a liquid boot or shoe polish. A. Clausen's ink is made as follows: Nutgalls, 8 parts; logwood extract, 10 parts; boil together in water, q. s., and add Castile soap, 4 parts; glycerin, trace. Crooker's—Logwood extract, 6 ozs.; water, 1 gallon; ivory black, 1·5 oz.; glycerin, 1 oz.; bichromate of potassa, 0·125 oz.; copperas, 0·125 oz.; boil together. Sefton's—Orange shellac, 64 ozs.; alcohol, 4 gallons; pure asphaltum, 60 ozs.; neat's foot oil, 1 pint; lampblack, q. s. Ovington's—Water, 1 gallon; logwood extract, 6 ozs.; water, 1 gallon; borax, 6 ozs.; shellac, 1·5 oz.; water, 0·5 pint; bichromate of potassa, 0·375 oz. Mix the solutions, and add 3 ozs. ammonia. Shaw's—Borax, 3 ozs.; orange shellac, 5 ozs.; water, q. s.; boil and add soluble aniline black or nigrosine, q. s. Rub the spots with strong aqueous solution of ferric chloride, and dry before applying the dressing.

(9) J. S. & R. M. write: 1. We propose putting in a steam engine of 20 horse power, and we are informed there is an engine that weighs 2,700 lbs., that has a balance wheel weighing 500 lbs., cylinder 10 x 10 inches; cutting off at ¾ stroke, running at 180 to 200 revolutions a minute, and they say that it is 20 horse at 70 lbs. steam. Will such an engine develop 20 horse power? A. The engine would develop 20 horse power under the above conditions, if well constructed. 2. How can we calculate the power of an engine? A. To determine the power of an engine, multiply the mean pressure on the piston in lbs., by the piston speed in feet per minute, and divide the product by 33,000.

(10) A. L. G. asks: 1. With a boiler 15 inches in diameter by 30 inches in height, with five 1½ inch tubes 18 inches long, firebox 12 x 12, and all made of iron plates ¼ inch thick. What is the greatest number of pounds of steam to the square inch it will hold, and what fraction of a horse power will it give to an engine having a cylinder 2 x 4 inches, situated 2 feet from the boiler, and connected by 40 inches of steam pipe? A. You can carry 150 lbs. of steam, and might develop 1 horse power. 2. What is meant by the pitch of a wheel in a propeller, and what is the inclination of a cylinder? A. The pitch of a propeller is the distance it would advance in the direction of its axis at each revolution, if it worked without slip. The inclination of a cylinder refers to the angle made by its axis with a horizontal or vertical line.

(11) J. H. asks: 1. Has steel been used for portable boilers? A. Yes. 2. What size boiler is required for an engine having a 3 x 4 inch cylinder? A. Diameter, 24 inches; height, 45 inches; heating surface, 65 to 70 square feet.

(12) J. A. M. asks: How large must an air pump be for an engine steam cylinder 8 x 8, making 100 revolutions per minute with 90 lbs. of steam, allowing the pump to be 4 inches stroke, double acting, to be attached to surface condenser? A. Diameter, 3½ inches.

(13) J. A. F. asks: 1. What shall I paint my boiler and smoke stack with, and where can I get the paint? My engine is a thrashing engine, and of course is out of doors during the fall of the year. A. Get some black varnish made from petroleum, from a dealer in machinists' supplies. 2. How shall I care for the boiler inside? A. Leave the boiler perfectly dry, unless you can coat the interior with oil. 3. What shall I do for the engine. Is it necessary to take the piston out of cylinder and oil it? A. If the engine is to stand for some time, remove the piston, coat it and the cylinder with tallow; the same for the journals. Cover all finished parts of the engine with a mixture of white lead and tallow. 4. I find my steam gauge does not indicate less than 10 lbs. when boiler is cold. What is the trouble and how can it be repaired? A. In such a case it is best to send the gauge to a maker for repairs.

(14) "Zebra" wishes to know the best test of the genuineness of white lead; also the simplest way to try the comparative value of two samples of ground white lead. Also the name of the best work to consult upon the manufacture of Portland cement. A. See answer No. 29, p. 283, current volume, SCIENTIFIC AMERICAN. Also pp. 102–105 Normandy and Noad's "Commercial Analysis." The relative value of different samples of white lead in oil is roughly judged from the weight of a given measured quantity, the covering properties when compared on glass with a sample of finest white lead, and the color and general appearance of the sample. You may consult Reid's "Manufacture of Portland Cement."

(15) J. B. B. asks: Can I arrange an electric battery so as to heat a platinum wire for the purpose of cutting wood? Is it practicable? A. Two or three Bunsen cells will do it. It is impracticable save as an experiment.

(16) D. S. M. asks how to color butter to make it yellow, without injuring it in any way. A. A little annotto is often used. If pure, it is not injurious.

(17) H. C. M. asks: What substances are there that will absorb light during the day when exposed to light, and give it out again at night? A. 1. Heat strontium theosulphate for fifteen minutes over a good Bunsen gas lamp and then for 5 minutes over a blast lamp. 2. Heat equal parts of strontium carbonate and lac sulphuris gently for 5 minutes, then strongly for 25 minutes over a Bunsen lamp, and finally 5 minutes over a blast lamp. 3. Precipitate strong aqueous solution of strontium chloride by means of sulphuric acid, dry the precipitate, and heat it to redness for some time in a current of hydrogen, then over a Bunsen lamp for 10 minutes, and for 20 minutes over a blast lamp. Mix any of these with pure melted paraffin for use as a paint, and expose for a time to sunlight. The two former yield a greenish phosphorescence in the dark, the latter a bluish light.

(18) Z. asks: Is the Great African Desert below the level of the sea, and if so, could it be made into an inland sea by flooding from the ocean? A. A considerable, though relatively small, portion of the Sahara is below the sea level, and the flooding of the lowest portion has been proposed. The greater part of North Africa lies at a higher level, the exception being a chain of old lake beds or chotts on the border of Algeria.

(19) J. P. L. asks: How can I make a filter to cleanse rain water from smoke as it passes from the roof to the cistern? The coal which is burned here (bituminous) gives us a great deal of trouble in this regard. A. The carbonaceous matters may be removed by passing the water through a large barrel half filled with fine gravel and pounded, freshly-burnt charcoal (free from dust), distributed in alternate layers, each several inches deep. Over this spread a clean piece of bagging, and fill in with fine gravel or coarse clean quartz sand for 12 inches or more. The inlet pipe should discharge at the bottom of the barrel—the filtered water flowing from the top.

(20) F. E. H. asks: Can percussion caps be so composed as to explode when pierced by a sharp pointed needle? If so, of what should they be composed? A. Such an arrangement is employed in the needle gun. The composition may be of mercuric fulminate.

(21) C. A. N. asks: What is the horse power of an engine 30 inches stroke, 14 inches cylinder, 51 revolutions per minute, 60 lbs. mean pressure in cylinder? A. Piston area = 153·94 square inches. Piston speed = 255 feet per minute. Indicated horse power = $\frac{153{\cdot}94 \times 60 \times 255}{33{,}000} = 71{\cdot}4$.

(22) P. O. asks: If I admit steam 100 lbs. pressure in a cylinder 15 x 24 inches, and cut the steam off when piston has traveled 6 inches, what will be the pressure at 6 inches, 12 inches, 18 inches, and 24 inches, or just before it exhausts? A. The pressure will vary about in the inverse ratio of the volume, so that, approximately,

$$\frac{\text{vol. of cylinder up to point of cut-off} + \text{clearance vol.}}{\text{vol. of cylinder at any point of expansion} + \text{clearance vol.}} = \frac{\text{pressure above zero, at the given point.}}{\text{pressure above zero, at point of cut-off.}}$$

(23) H. T. S. asks: What size should I make the holes in the side of a fan wheel, 20 inches in diameter? Also what size should the nozzle be? A. Allow an opening of from 17 to 20 square inches at inlet and discharge.

(24) E. M. D. writes: I am constructing a telephone according to directions in SCIENTIFIC AMERICAN SUPPLEMENT No. 142, using a bar magnet in place of horseshoe magnet and soft iron core. 1. Would it reduce the strength of bar magnet to cut a thread on one end of it? A. No. 2. Will a bar magnet, used in Bell telephone, lose its power to such a degree as not to work? A. Not readily. 3. Is No. 22 copper wire of sufficient size for a telephone line of 1,000 feet? A. Yes; but larger would be better.

(25) S. & Y. write: We have a pair of burrs on which we grind plaster. The burrs are about 4 feet in diameter and 1½ foot thick. We are running them as an over runner at this time, but wish to change them and make the lower burr run instead of the upper. Can a pair of burrs of the above size be run in that way, and if so, what is the maximum speed at which they can be run? A. If properly arranged, you can run them, after the change, as fast as is allowable for over-running stones.

(26) J. J. asks: Which tire makes a wheel the strongest, 1·25 x 0·56 inch iron, or 1·25 x $\frac{5}{8}$ steel tire? A. The steel tire will be the strongest, comparing good qualities of steel and iron.

(27) E. L. W. asks: Is a ton (2,000 lbs.) of first class coke equal in heat giving power to a ton (2,000 lbs.) of coal? If not, please give me the relative value of coke and coal in heat giving power? A. Calling the evaporative power of good anthracite coal 1, good bituminous coal rates at about 0·92, and coke from 0·89 to 0·95.

(28) J. W. S. asks what to impregnate paper with to give it an agreeable smell while burning. A. You may try a strong ethereal or alcoholic solution of benzoin, tolu, storax, olibanum or labdanum. To burn well the paper should first be impregnated with an aqueous solution of niter and dried.

(29) M. G. asks whether hydrogen and oxygen can be produced as rapidly and copiously in the decomposition of water by the galvanic battery as by the action of sulphuric acid on zinc or lead in the one case, and by heating chlorate of potassa in the other. A. Yes, with a very powerful current.

(30) T. G. H. asks for names of useful treatises on mechanical movements. A. "Scientific American Reference Book," and "507 Mechanical Movements."

(31) R. B. T. writes: We have just set up a new engine; the cylinder is 8 x 12, has a common slide valve. We think the valve is too short; it is set 0·125 inch open when on center, takes steam 10 inches before cutting off; the exhaust is very free. The engine runs about 110 revolutions per minute. We think we could save steam by using a longer valve, and cut-off about ⅚ stroke, and make the exhaust space in the valve shorter, so that it will shut in a portion of the exhaust and form a cushion for the piston. About how much of the exhaust can we shut in without overdoing it? A. You can obtain a good action by making the ratio of compression equal to the ratio of expansion, with the proviso that the final cushion pressure must not exceed the initial pressure.

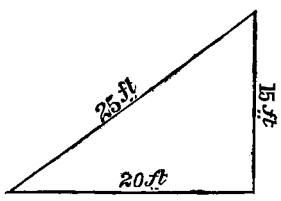
(32) D. B. L. writes: Our boiler after being repaired was tested at 110 lbs. cold water pressure. Three days after it gave out where it was repaired at 58 lbs. steam pressure. To find the leak we put on 80 lbs. cold water pressure, and could not find it. We then put steam pressure at 40 lbs., which made the leak very great, whereas with cold water pressure we could find none. Can you explain it? A. The phenomenon is probably due to the change of shape in the boiler when heated.

(33) F. C. writes: Our engine is a plain slide valve engine, 24 x 9, steam following almost to end of stroke. How shall I make a valve to cut off at ¾? Our exhaust now is 1 inch, steam ports 0·75, bridges 0·75. Length of valve 4½ inches, cavity 2⅜, travel of valve 2 inches. Will I have to enlarge the steam chest; the valve uses the whole length of it now? A. As the length and travel of valve must be increased, it will be necessary to lengthen the steam chest, unless you can apply an independent cut-off valve.

(34) T. P. writes: A small basement room 9 feet high is to be heated by a furnace in an adjoining room. By carrying the hot air pipe through the partition midway between the floor and the ceiling it will stand at an angle of about 45°. If carried through at the top of the room it will of course be nearer vertical. In which position of the hot air pipe will the room be most easily heated? A. Place the hot air pipe in the position first described. Take the cold air from a point near the floor through a flue opening above the roof.

(35) G. M. P. asks: What is a good and cheap substitute for salt for raising the temperature of water to 230° Fah.? A. An oil bath is often used instead. Chloride of calcium will answer as well as salt, though not so cheap.

(36) J. D. reminds us of an old and good method of drawing a perpendicular to a straight line for the purpose of squaring foundations, etc. From the corner of the foundation take two lines respectively 15 and 20 feet, and connect them by a line of 25 feet; the angle included between the two shorter lines will be a right angle. The numbers 3, 4, 5, or, as in the present case, their multiples 15, 20, 25, are taken to measure respectively the perpendicular, base, and slant side of the triangle. It is obvious that any scale may be used so long as the ratio of 3, 4, 5, is observed.



(37) J. H. asks what kind of iron to use in making cast iron armatures. A. Soft gray iron.

(38) F. H. C. asks: How can I etch cheaply on glass to imitate ground figures or transparent figures on a ground background? A. For this purpose the sand blast is now generally used; the glass is covered with a film of wax or varnish, through which, with suitable needles or gravers, is etched the design; a fine sharp silicious sand impelled by a current of air is then directed from a suitable jet over the prepared surface, and the etching is accomplished in a few minutes. Glass is etched also by hydrofluoric acid; the plate may be prepared as for the sand blast, and placed face downwards over a shallow leaden tray, containing powdered fluorspar moistened with strong oil of vitriol and gently warmed; the gaseous hydrofluoric acid given off rapidly etches the portions of the glass not protected by the wax or varnish. Hydrofluoric acid should be used with great care.

(39) L. H. writes: I have seen it asserted that the parasites that infest the Asiatic tiger's paw are an exact miniature image of itself. Is this so? A No

(40) J. G B. asks if there is any way of melting brass in a common sand crucible for castings of a pound or so in weight for a small engine. A. You may melt small quantities of brass in any common stove having a good draught, using a coal fire. You may use borax as a flux.

(41) F. & Co. ask: 1. In making a telephone as described in Figs. 4 and 5, SUPPLEMENT 142, must the diaphragm be entirely free, or can it be punched and the screws which secure the flange pass through it? A. The diaphragm should not be punched. 2. In new form of telephone in No 20, current volume, must there be a battery in the circuit, or is the telephone sufficient to work it? A. A battery is required.

(42) J. M. B. asks: What will prevent the hair from falling out? A. Keep the pores of the skin open by frequent bathing and change of underclothing. Bathe the head with clean soft water, and stimulate the scalp with a moderately stiff brush morning and evening. The head should be occasionally cleansed with a weak solution of glycerin soap in dilute spirit of wine, with care to remove all traces of soap from the hair. Use no pomades or oils of any kind.

(43) B. H. P. asks (1) how to make malleable iron, such as used in wrenches. A. Malleable iron castings are made from mottled iron. They are cleaned by tumbling and then packed in iron boxes with alternating layers of rolling mill scale. The boxes are carefully luted and packed in an annealing furnace, where they are kept at a white heat for a week or more, and then allowed to cool gradually. 2. How is steel or iron made to adhere to the face of the jaws of the wrench? A. By welding.

(44) J. G. E. asks: What is the highest column of water that can be raised from a well by means of a siphon pump with 60 lbs. steam, likewise a 1 inch column of water with 60 lbs. steam? A. Lift, from 26 to 27 feet.

(45) W. H. W. asks: 1. Is there any solution excepting rubber that will make cloth thoroughly waterproof, or at least withstand the attack of water for an hour or so? It should be applied by dipping the cloth in the solution. A. Linseed oil boiled with a little wax and litharge is useful for some purposes. Cloth prepared with paraffin, balata gum, the gum of the asclet pias or milkweed, naphtha solution of the dried pulp of the bamboo berry, anhydrous aluminum soaps (see pp. 149 and 159, "Science Record," 1874), are also employed. 2. Is there any chemical that could be combined with the solution, imparting some property to the same for which rats or mice would have an antipathy so as to prevent their attacks? A. A trace of phenol will generally suffice.

(46) J. L. asks: Is the balata gum softened by animal oils or fat? A. Yes.

(47) P. L. W. asks. What distance would a 100 lb. weight have to fall to run a sewing machine for 5 hours? A. For an ordinary family sewing machine, requiring about one thirtieth of a horse power, the weight would have to fall about 3,300 feet in the 5 hours.

(48) W. G. R. asks: 1. What is the valve yoke of a steam engine? A. We presume you refer to the rectangular yoke that receives the back of the valve in the class of engines having balanced valves. 2. What should be the diameter of the bore of an engine of 1 horse power with 100 lbs. pressure, also the length of stroke? A. Diameter, 2¾ inches; stroke, 4½ inches. 3. How are the back gears of a lathe made so as to be thrown out of gear when it is wished to use the lathe at a high speed? A. Ordinarily by a cam and lever, or tight and loose joint. 4. Would ¾ of an inch thickness of sheet steel be strong enough for the boiler of a small model locomotive? How much pressure would it stand to the inch? A. If the diameter does not exceed 3 inches, you can carry a pressure of from 50 to 60 lbs. per square inch.

(49) J. W. W. asks: Which will stand the most pressure, a piece of round iron 1 inch long and 1 inch in diameter, or a piece of gas pipe the same dimensions, both being set upon end? A. The round iron.

(50) W. M. B. writes: 1. I have one eighth inch basswood, cherry, butternut and walnut. Which do you advise for the sounding board of a microphone and Hughes telephone? A. Either will do, but pineor spruce is better. 2. Would a glazed earthen jar do for the outside of battery described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 149? A. Yes. 3. Could I make insulated wire myself? If so, how? A. Wire may be insulated by giving it a coat of shellac varnish and allowing it to become dry and nearly hard before winding.

(51) W. H. S. asks how to satin finish tubing like sample sent. A. The specimen has been electro-plated with silver in the usual manner, and the electric current then reversed for a few moments, thus redissolving a portion of the plate, the remainder presenting the peculiar satin like luster.

(52) S. W. C. asks: Has carbon for telephone purposes ever been made by subjecting the black deposited by a flame to a heavy pressure? A. Yes. Edison's carbons are made in this manner.

(53) "Hardware" asks: 1. Where is best to take hot air in a room, at register near ceiling or in floor? A. At or near the floor. 2. Where is best place to have ventilation, near floor or near ceiling? A. If connected with a flue having a good draught it should be near the floor.

(54) R. W. J. asks: What causes the cracking noise in the pipes of a steam heating apparatus, when a fire has been started to warm up the building? Is it the water in the pipes made by condensed steam, or is it the expansion of the pipes from being heated? A. The noise is due to both causes in some degree, but principally to the water, which produces violent blows.

(55) C. N. A. asks how to temper steel tools for working on stone or similar work. There is some preparation which is put in water which accomplishes the purpose when the steel is heated and plunged in. A. Heat the tools to a cherry red, and plunge in clean, moderately cool water. A little common salt is sometimes added to the water.

(56) G. B. asks: 1. Is the height to which water is raised by a hydraulic ram measured from the ram itself or from the spring from which the supply comes? A. From the ram. 2. Can a hydraulic ram be constructed to discharge 1,000 gallons of water per minute? A. Yes.

(57) L. D. writes that benzine will answer much better to exterminate roaches, moths, etc, than anything else. It will not hurt furniture in the least, will evaporate, and can be easily applied.

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

M. B. W.—No. 1 is a silicious clay—it might be useful in the manufacture of some grades of pottery, etc. No. 2 is a ferruginous shale—contains about 80 per cent of silica and 10 per cent of alumina, besides lime, magnesia, iron oxide, and water.—W. S.—It is fibrous talc—talc of good quality is in considerable demand for paper making and other purposes.—W. G. H.—The sand contains no precious metal—the glittering particles are mica.—S. F.—The specimen you send consists of a mass of the long hairs which have been attached to the seeds of the "milkweed" (*asclepias*), or, as it is sometimes called, from the silky nature of these appendages, "silkweed." We believe that this material is put to no other economic use at present than that of a filling for cushions and pillows. The beauty of this silk like down long ago attracted attention, and many unsuccessful attempts have been made to put it to some practical use in the arts; but, as you have probably noticed, the hairs are both brittle and weak, and an examination with a lens will show that it wants the roughness and angularity necessary to fit it for being spun like other fibers. It has, however, been mixed with cotton and woven into fabrics having a silky luster and capable of taking brilliant dyes, but the manufacture has never been prosecuted. The plants, though widely distributed over the United States, and quite common, are nevertheless not abundant enough in a wild state to afford much of a supply, and we believe no experiments have been made in cultivating them.

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

COMMUNICATIONS RECEIVED.

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

Manufacture of Porous Cups for Tyndall Grove Battery. By W. H. S.
Cylinder Condensation. By F. F. H.
Sawdust. By W. H. M.
Keely Motor. By G. R. S.
Firing. By A. P. A.
Steam Launches. By G. F. S.

HINTS TO CORRESPONDENTS.

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

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

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

English Patents Issued to Americans.

From November 8 to November 12, inclusive.

Electric light.—T. A. Edison, Menlo Park, N. J.
Feed water apparatus.—S. J. Hayes *et al.*, ——.
Pipe, manufacture of.—W. Radde, N. Y. city.
Potato digger.—L. A. Aspinwall, Albany, N. Y.
Refrigerator.—J. A. Whitney, N. Y. city.
Screw cutting machinery.—C. D. Rogers, Providence, R.I.
Sewing machine.—Wilson Sewing Machine Company, Chicago, Ill.
Wire machinery.—C. D. Rogers, Providence, R. I.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

October 15, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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

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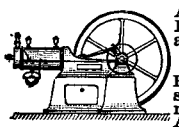

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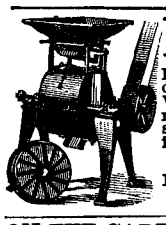

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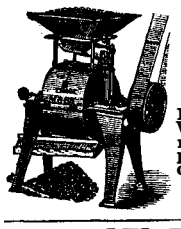

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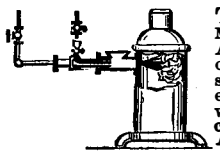

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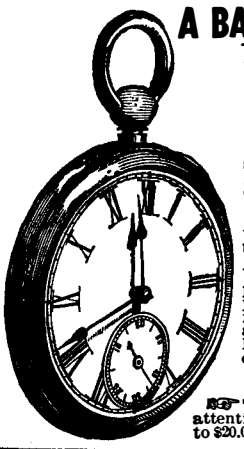

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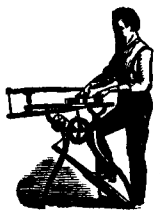

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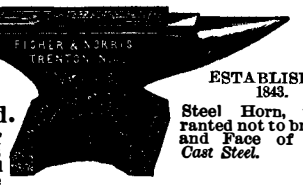

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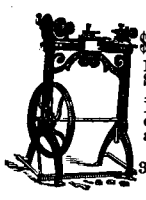

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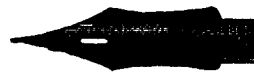

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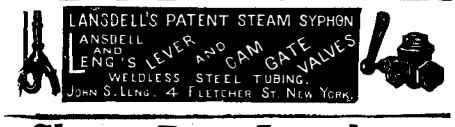

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