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SCIENTIFIC COMMISSION OF JAPAN.

There are two parts of the world now rapidly advancing to the front rank as centers of civilization, which fifty years since were practically unknown to the Caucasian race, namely, Australia and Japan. The former has been transformed from a savage wilderness to a state of comparative cultivation and wealth with a rapidity only paralleled on the continent of America. The latter, which for ages has remained in a state of barbarism, has at last shaken off, in a great measure, the prejudice and superstition that prevented its progress, and has shown that it has the material, power, and resolution to take its place with the most civilized nations of the earth. A few years will affect this wonderful transformation. The present generation may live to see it.

It is worthy of remark, that the most powerful influence in bringing about this great change in the condition of Japan is the outcome of American civilization. One of the oldest nations on earth now sits at the feet of the youngest, and asks for aid and instruction in all that pertains to the material interests of its people. Our engraving gives accurate portraits of the distinguished American citizens selected by the Japanese Government as a scientific commission to investigate and report upon the commercial industries and agricultural resources of the country, and to give counsel as to the best means of developing such resources.

The chief of the Commission is General Horace Capron, long and favorably known as a thoroughly scientific agriculturist, conversant as well with the various sciences collateral to agriculture, and late Commissioner of the United States Agricultural Department, in which difficult position he has won richly deserved commendation, from those qualified to judge, in all sections of the country.

Professor Thomas Antisell, of Washington, accompanies the party as an expert in the subjects of mining and manufactures. Professor Antisell's reputation as a technical chemist, mineralogist and geologist is well known, and General Capron is to be congratulated upon having secured his services.

The work of the Commission includes the examination of the country with reference to the introduction of railroads and other improved means of transportation. This branch is confided to Major A. G. Warfield, Jr., of Baltimore, Md. Major Warfield is looked upon in his profession as one of the most competent of its younger members; has already had much experience in the special class of work which is likely to be demanded in Japan, and is pronounced by no less an authority than Latrobe, of Baltimore, one of the best locating engineers of the country.

The Secretary of the Commission, Doctor Stuart Eldridge, of Washington, D. C., possesses high scientific and literary qualifications, and, although a young man, has achieved a prominent standing in his own profession.

The Commission is amply provided with the necessary equipments and instruments of precision; and, with such a *personnel*, there is much to be expected from its labors. We look confidently for a result which shall benefit not only our island neighbors, for neighbors they are both in interests and feeling, though so far distant in miles, but shall, perhaps, be of equal advantage to ourselves. While Japan is represented by such men as Mr. Mori, the Minister at Washington, and Consul Charles Wolcott Brooks, of San Francisco, international commerce must increase, community of interests be more fully recognized, and the good feeling, already existing between the great nations of the East and West, strengthen and become permanent.

By late advices from Japan we learn that the Commissioners were received with high honors by the Japanese Government, on arrival at Yokohama and Yeddo. At the former place a grand salute was fired from the forts, and on their landing they were received by a delegation of Japanese officials of high rank. On the next day they embarked on a Japanese war steamer for Yeddo, being saluted by the fleet at that fort on passing, and were received on landing by another delegation of Japanese officials, among whom were the Prime Minister and Minister of Foreign Affairs. A grand banquet was given there by the Prime Minister and Cabinet at the Summer Garden on the 9th of September, which was followed by a number of others at the residences of the different members of the Cabinet. On the 16th of September, the Commission had an interview with His Imperial Majesty, the Tumo, or Mikado, which is said to have been rarely accorded to foreigners, and was given on a scale of unusual magnificence. In every way the Commission have been most favorably received, and the members pleased beyond all expectation.

HISTORY OF ICE-MAKING MACHINERY.

[Condensed from the Milk Journal.]

Cooling and ice machinery have been practically divided into two classes. First, those in which heat is directly applied in order to produce cold; as, for instance, in the air machines, where the air is first compressed and subsequently expanded, and in the ether machines, where the evaporation is effected *in vacuo*, the speed of the process being accelerated by the use of an air pump; and second, those machines in which cold is produced by direct heat without the aid of power, as, for example, in the latest ammonia machine. Each machine has its partisans, and dire battle is done occasionally; ink has flooded fields of paper, and thousands of broken pens must have strewn the lists. It is claimed for the air machine that it requires the assistance of no chemical agents; that the machinery acts direct upon the air and water; and that it will produce cold air, refrigerate fluids, or make ice continuously as wished, with the aid of fuel alone. On the other hand, it is claimed for the ammonia machine that more ice or heat reduction can be got out of the coal used by it than

Charles W. Brooks, Japanese Consul at San Francisco. — General Horace Capron, Chief of Commission. — Prof. Thomas Antisell, Technologist and Geologist. — Major A. G. Warfield, Jr., R.R. and Mining Engineer. — Stuart Eldridge, M. D. Secretary of Commission.

any other, the quantity needed being only what will suffice to boil a solution, and that the only power needed is that small amount which works the pumps and keeps the cold conveying fluid in motion. As for the ether machine, it is claimed for it that the construction is of the simplest, that it is cheaper to maintain than any other, and that the congelation commences with the first revolution of the flywheel. Outsiders, who are factionaries of no particular maker, would mostly look at freedom from accidents in dealing with the machines, giving preference to the ether machine, where the process is carried on in a vacuum, and the resistance to overcome does not exceed 15 lbs. per square inch, as against three times the amount in an air machine, and ten times the amount in some ammonia machines. Others would judge by the lowest temperature which the invention could register. As a rule, the best machine of any class will be found to be that which is the safest, occupies the least space, needs the smallest quantity of fuel, works the most continuously, makes use of the cheapest medium, is the least costly to maintain, can be worked by hand or power; above all, that which costs the least, and which the best fulfils other purposes when not used for its own specific work.

AIR MACHINES FOR PRODUCING COLD AND ICE.

Among the first machines of this description were those of Newton & Williams, introduced into notice about twenty years ago. The latter compressed the air and passed it in that condition through a close chamber containing a liquid of low temperature, which absorbed and carried off most of the heat produced by the compression. The condensed air was then led to expand, in contact with the substance to be cooled, from which substance the heat was gradually absorbed. The main points of the air machine are epitomized in the foregoing, but the modes of operation have been somewhat varied. Sundry other inventors followed in the wake, but it was not until 1862 that the production of ice was economically attained by the Kirk air refrigerator.

The success of this ice machine led Mr. Kirk, of Glasgow, to study, in its turn, the production of an article for cooling liquids without making ice, and he has, during the present year, constructed a machine for this purpose, capable of cooling 45 barrels of water at the rate of 15° per hour. Here the water which removes the heat caused by compression, and that to be cooled, are injected as a shower through the compressed and expanded air of the hot and cold chambers, and are withdrawn by simple valves. When driven with compound engines, a surface condenser is attached, which enables clear water for divers purposes to be warmed by the exhaust steam. The machine, moreover, works noiselessly, and is as simple as it is effective for common refrigerating purposes.

In the ice making air machine of Mr. Mignot, of Paris, especial means have been adopted to inject the water in the form of spray into the very midst of the air as it is being compressed in the compressing cylinder. The cold air produced, being about 60° below freezing point, is conveyed through a trough with large cells containing the water to be congealed, and escapes at about 4° above freezing point, which would be at a temperature enabling even more work to be done if wanted. The chief feature of interest in this machine, which last year attracted great attention, lies in the injecting of the spray, which slightly diminishes the work necessary to compress the air. Another point to be admired in it consists in the fact that the compression and expansion cylinders are placed in easy conjunction with each other, and so work simultaneously. It is just possible also that the ice produced at so low a temperature would outlast the natural ice.

In the air machine of Mr. Windhausen, of Brunswick, the air is admitted into the compressing chamber as usual, and thence passes into a condenser formed of two series of pipes, whence it enters the expansion chamber to be dilated and cooled. The air then escapes through a valve into the refrigerator, containing the vessels of liquid to be frozen, that is, if ice is wanted, or directly into the room to be cooled, if a reduction of temperature there is desirable. He employs either a single or double acting cylinder, compressing on one side of the piston and expanding on the other, or a double cylinder, one for compressing the air, and the other for subsequently expanding it.

The above represent the most successful machines of the present day for the production of cold by the alternate compression and expansion of the air. Whether the system can eventually be brought into still more economical restraint, depends, we think, mainly upon the improvements brought to bear upon the steam engine itself. For the steam engine is a law with this kind of ice machine. At present, air machines are reputed too costly to compete with, for instance, the ether machines. An ether machine of 12 horse power will favourably compare with a Windhausen machine of the same power; for the former takes up only a space of six superficial yards, and will produce 400 lbs. of ice per hour, whilst the latter occupies one half more space, and turns out but 300 lbs. of ice. Perhaps it will eventually be found that the air machine will be the one most suited for the artificial refrigeration of air, apart from ice making, inasmuch as the requisite amount of cold can be regulated with the greatest nicety by means of a valve under the control of the attendant.

AMMONIA MACHINES FOR PRODUCING COLD AND ICE.

As the machine of this kind which first attracted notice after Dr. Faraday had shown the possibility of obtaining cold by the liquefaction and subsequent gasification of ammonia, the ice machine of Mr. Carré, of Paris, demands a mention, not only for that reason, but because it is still peculiarly adapted for ice manufacture on a small scale. This machine is fully described on page 265, Vol. XXIII of the SCIENTIFIC AMERICAN.

Mr. Mort, in 1867, patented a process of producing a temperature suitably low for the preservation of animal food by an improved machine, where ammoniacal gas was liquefied by pressure, and made to absorb heat on its release from liquefaction, which is well worth attention; and in 1869 he protected a process in which, as he says, he avails himself of the known affinity that ammonia has for water, and claims that, with nothing but a peculiar pump and a simple apparatus, the whole process of producing cold is carried on, and substances are refrigerated and frozen without the necessity for any medium of transmission other than the ammoniacal liquor itself. In the earlier ammonia systems of Carré, Tellier, Reece, and others, liquefaction was carried on under pressure alone, but Mr. Mort's process is one of liquefaction by affinity, by the aid of a slight pressure. It is, however, difficult to explain these differences without the aid of experiments.

A recent ammonia machine is the one patented by Mr. Reece, of London. A generating vessel is charged with a solution of ammonia, and a fire is then lighted under the boiler, which expels all the air. A strong solution of ammonia is then pumped up to the top of an analysing cylinder above; and, as the solution descends the different plates there, it is in a great measure separated from the water by the steam rising from the generator or boiler. The nearly anhydrous ammonia is now passed into a rectifier, where it is completely cooled by a stream of cold water, and rendered completely free from watery vapour. The perfectly anhydrous ammonia now descends into a liquefactor, where it is liquefied by the mere pressure of the gas upon itself. When a sufficient accumulation has accrued, the fluid is then run into a cooling cylinder until the coil therein is full; and when that is effected, access is given therefrom to a second cylinder, where the liquid ammonia assumes its gaseous condition, cooling the liquid inclosed in the inclosed coil. The now exhausted ammonia traverses the coil in the cylinder to an absorbing vessel, where it meets with the exhausted liquor from the distilling vessel, or generator, and is dissolved. The solution is now pumped through a horizontal heater, where it meets with the liquor proceeding from the boiler into the top of the analysing cylinder, where the same series of operations are repeated. If water is required to be cooled, it is sent through the coil in the cooling cylinder direct; and when ice is desired, a solution of chloride of calcium is made to flow through the coil, and round the ice forming cells in which the ice is made. A drawback to the use of this machine is that it has to be worked up to an enormously high pressure, and, if imperfectly constructed, would induce a very serious explosion. Another objection is its cumbrousness, and non-adaptability to working when on shipboard.

ETHER MACHINES FOR PRODUCING COLD AND ICE.

The principle of the ether process is the production of cold and ice by the evaporation of this volatile liquid; but as its tension is otherwise too small, this is carried on *in cacuo*. A machine of this kind also permits the continuous re-use of the ether without loss, provided that the stuffing boxes are kept in perfect order. In Messr. Siebe's machine, the ether is removed by an air pump worked by hand or steam, and the air is then allowed to enter the refriger..tor, where it becomes vaporized. It then traverses some branch pipes into the cylinder, and is forced through other pipes into a spiral coil surrounded by water, which acts as a condenser. An air vessel is constructed in the condenser, and sometimes an auxiliary condenser is placed in a bucket outside.

In passing through these coils the ether is liquified, and, parting with its heat to the environing water, is returned to the refrigerator. One adaptation of this machine is largely employed by brewers, who usually pass a continuous stream of water, or wort, through the apparatus, with a consequent reduction of 20° to 30° of temperature. Messrs. Siebe's machine, to make one ton of ice, will, they aver, cool 15,522 gallons of water, or 648 gallons per hour, 10°; whereas one ton of ice applied in the ordinary way will only cool 3,240 gallons, or 135 gallons per hour, 10°, showing a considerable waste to attend the use of ice by brewers, etc., and a great economy in the adoption of a refrigerating apparatus. In a similar way, we are informed that in Texas it takes 300 lbs. of ice to cool 1,000 lbs. of meat; and here, too, the ice machine is a necessity.

Professor Gamgee, during the past twelve months, has patented what he considers an improvement on the above kind of machine, viz.: by affording a greater area of conducting surface in proportion to the space occupied by the machine; in other words, he constructs his refrigerators and condensers on the tube within tube principle, and obtains a greater cooling power in consequence.

In working both the above machines, the ordinary ether is adopted; but the latest system of Mr. Tellier is based on the evaporation of an ether produced by the distillation of wood, and is carried on by him at Auteuil, near Paris, with marked success. This machine seems to be able to effect all that a refrigerating machine can effect, in the way of ice production and the maintenance of chambers at 28¼° during the hottest summer months. Like the majority of ice machinists, he is now busy developing a scheme for the importation of meat. He proposes to subject Australian newly killed carcasses to his process of cooling, etc., and send them homewards in vessels fitted up with his cooling machines.

FREEZING POWDER MACHINES FOR PRODUCING COLD AND ICE

There are in the market of nearly every country some scores of differently constructed machines, varying in price, for the production of ice by the use of freezing powders.

An inexhaustible freezing compound, which can be reconstituted by exposing it in shallow vessels to the sun's heat, when the ultimate crystals, of which it is composed, can be collected, is sold by Messrs. Brown Brothers & Co., of London, who are also venders of a series of excellent block ice making machines, the smallest of which, the "Paragon," costs £8, turning out a half pound block in eight minutes, and the largest, the "Industrial, No. 4," costing £72, and producing fifty pounds of block ice in half an hour. Cheaper machines than even the "Paragon" are sold for icing creams and the like, but we need not enter upon them. Of course the cost of the freezing powders rules the question as to whether it is more expedient to make ice in this way than to purchase foreign ice.

We have now completed our remarks upon ice machines, properly speaking; and, in order to imbue the minds of our readers with an idea of the value of these machines, we may state that the Windhausen air machine patent for North America was sold for £22,500, and the French patent for 750,000 francs. As much as 40,000 dollars has also been obtained for the right of using the Carré machine in a single Texan province.

The Factories of England---Sufferings of Workmen.

In the course of an article on sanitary reform, in *Chambers' Journal*, an intelligent writer says:

"If we turn back to the unhealthy state of the air in factories and workshops, it may be observed that the workmen of all countries show such a carelessness about their health that the best reforms often fail through the want of their co-operation. In some trades, where poisonous substances are used, the masters have tried to enforce the wearing of gloves or the frequent washing of the hands; yet the men have refused to conform to such simple injunctions. At a manufactory in the neighborhood of Newcastle, the workmen threatened to leave because they were desired to take baths at certain intervals. But nevertheless, great improvements have taken place in the last fifty years. White lead which is one of the most dangerous compounds of oil paint, has been rendered almost innocuous; and the largest manufacturers can now boast that years will pass without any of their men being attacked by colic; this is chiefly due to strict attention to the laws of cleanliness. The making of matches requires many dangerous operations, such as dipping the bunches into inflammable paste and placing them, when finished, in boxes. In the first of these the maker constantly breathes phosphoric vapor, and in the second, which is chiefly performed by women, spontaneous combustion frequently occurs, causing serious wounds on the hands. These have both been remedied by using machines instead of the hands, and a still greater benefit has arisen by a different preparation of phosphorus being employed.

"The Sheffield cutlers have suffered severely from the sharpening of steel knives and needles; the fine dust entering the mouth and nostrils, and the constant stooping over the grindstone deforming the chest. The preparation of skins and leather places the currier in an unwholesome atmosphere; and the cotton mills of Lancashire have a bad reputation. Ventilation is the principal remedy against these maladies.

"As for the long trail of smoke which our large factories emit from their chimneys, much has already been done to lessen it, though there is still great room for improvement. At one time, it was suggested that if they were built to an immense hight, the smoke would cease to be noxious, and Glasgow points with pride to some of these columns, higher than any building in the world excepting the spire of Strasburg cathedral and the largest pyramid of Egypt. But this was a very imperfect proceeding. There was nothing in the air to neutralize these emanations, and though the particles fell at a greater distance, attenuated, it is true, they were jnst as mischievous. Coal smoke is very disagreeable, but other gases from chemical works act as a mortal poison on vegetation. Such are the nitrous and sulphuric vapors from the manufactories of these acids; whilst the smelting of iron ore renders a country sterile for miles round. One of the most curious effects of this kind is to be found in the smoke of lime kilns on the vineyards of France; it gives the grapes and wine for some distance round a disagreeable taste; and in Burgundy, the kilns are always interrupted in their work from the time of the flowering of the vines to the season of ingathering. In the previous cases, condensation of the injurious vapors before leaving the chimney has been found eminently serviceable."

Fire-Proof Buildings---Views of the Sculptor, Mr. Hiram Powers.

The Providence *Journal* publishes a letter from Mr. Hiram Powers to a citizen of Rhode Island, in which, after alluding to the burning of Chicago, he says:

But it may be asked, "Is it possible to make a city fire-proof?" I answer, yes, and without any great extra expense. To prove this, I have only to say that, although there have been frequent fires in the city of Florence during the thirty-four years of my residence in it, not one house has been consumed, except a theatre, and that was not entirely destroyed. Rooms, full of goods, have been heated like ovens by ignited calicoes, straw hats, etc., but as the floors above and below were all covered by thin brick tiles, the goods burned without ventilation. And as there was no flame, a smell like that of a coal pit soon gave the alarm, and the fire was soon extinguished by no other engine than a squirt holding about a gallon, which discharged a well directed stream through some aperture. I once beheld some firemen marching to a fire in Florence. Foremost were three men with picks, next four men with buckets, then three men with highly polished brass squirts on their shoulders; all marching with an air of pomp and importance. The fire was at the residence of Mr. Clevenger, the American sculptor, and had been burning twenty-four hours on the end of a joist just under his fire place. He had smelt something like a coal pit for some time, and at length perceived smoke rising from the brick floor. On going below he found the room full of smoke, and a rush bottomed chair just under the joist was partially consumed. But the joist was not yet burned off, and why? Because the fire was bricked down. It could not rise and burst into flames.

The secret of fireproof building then is this: It must be made impossible for the flames to pass through the floors or up the stairway. If you will have wood floors and stairs, lay a flooring of the thinnest sheet iron over the joists, and your wood upon that; and sheath the stairs with the same material. A floor will not burn without a supply of air under it. Throw a dry board upon a perfectly flat pavement and kindle it as it lies, if you can. You may make a fire upon it and in time consume it, but it will require a long time. Prevent drafts, and though there will still be fires no house will be consumed. The combustion will go on so slowly that discovery is certain in time to prevent any great calamity.

But the roofs, how about them? Slate or tiles? Zinc melts too easily. I believe that hard burned tiles, if flat, would stand the frost at home; and if so, they constitute the best roofing. My house has no joists. All the floors are of tiles resting on arches. One of these arches was made over a room twenty five feet square, by four men in four days. The bri ks are about one and a half inches thick, and laid edgewise with plaster of Paris. There was no framework prepared to lay them on, unless you would so term four bits of wood which a man could carry under his arm. And yet this arch is so strong as to be perfectly safe with a large dancing party on it. I never have heard of one of those floors falling, and they are absolutely fireproof. Of course light arches like these would not do for warehouses.

It would pay, I think, to send out here for an Italian brick mason who knows how to build those thin but strong arches for dwelling houses. I know that there is a prejudice at home against brick or composition floors. "Too cold in winter," it is said. And so they are if bare, but cover them with several thicknesses of paper and then carpet them, and no one can distinguish the slightest difference between their temperature and that of wood floors. Who doubts this, let him try the experiment with the feet of the thermometer. The truth is that the brick or composition floor is no colder in itself than wood—the thermometer attests this—but it is a better conductor. I do not insure my house, as I know that it is not combustible.

SODA.

One of the chemical discoveries of the present century, the applications of which are the most varied, and the history of which is the least known, is the manufacture of soda. It is a metallic oxide; that is to say, the combination of a metal with oxygen. Like potash, with which it has many affinities and many common uses, it belongs to what the Arabs called, in the ninth century, alkalies,—a name which, as well as alchemy, has been adopted in most European laboratories. It has a strong affinity for acids, and combines with them to form various salts. This property is made use of in trades of various kinds, as, for instance, in scouring cloths that must be freed from greasy matters, and also in the manufacture of soap. The white and marbled soap has not even yet lost its superiority, and still occupies a first place among similar products of other nations. It is made by combining soda with the acid fat of olive oil.

The glass manufactories also consume an immense quantity of soda. Glass is composed of flint and different alkaline bases, such as potash, soda, lime, and barytes. Certain mineral oxides give it a variety of color, sometimes of a very undesirable kind. Should the paste contain traces of iron, instead of producing white glass there will be only the common bottle glass; and if the iron be in larger proportions, the dark green shade will be the result. On the contrary, add a certain quantity of oxide of lead to a pure base of potash, and the beautiful crystal glass is formed; a still larger dose, and the diamond paste, with its wonderfully dispersive power, will deceive many an unpractised eye. Between these extremes, the dull bottle and the many sided crystal, there is the window glass, which adds so much to the comfort and health of our houses, the gorgeous looking glasses to adorn our drawing rooms, the rich decorations for the dining table, the crystal pendants of our gaseliers, and many other objects which satisfy our commonest necessities, and minister to the highest taste or luxury.

When marine salt is acted upon by sulphuric acid, an acid gas is thrown off, and sulphate of soda remains. In the time of Leblanc, chemists were ignorant of the composition of the gas which escapes, and gave it the name, for want of a better, of muriatic acid; and marine salt was supposed to be a composition of this acid and soda, which was an error. In the present day, it is known that marine salt is composed only of soda and chlorine, and that muriatic acid consists of hydrogen and chlorine. Neither Leblanc nor his companions suspected the real case, that sulphuric acid could have no power over salt without the intervention of water. It is this simple agent, which, by decomposing, furnishes oxygen for the sodium, and hydrogen for the chlorine; giving, as a result, the soda which combines with the sulphuric acid, and a gas which flies off, now called, to adopt the more exact name of the new system, hydrochloric acid. Without water there could be no reaction; happily, it was always present in the sulphuric acid that was employed, and consequently this error in theory had no influence over the result in action. We have now reached the point of obtaining sulphate of soda; to obtain the common soda, it is necessary to divide it from the sulphuric acid, which was altogether Leblanc's discovery. Most chemists proposed a solution of this difficult question by heating the sulphate with various bodies; he laid his hand upon the one which gave the best results,—chalk (carbonate of lime) and charcoal. It is singular that he did not even know the exact theory of the reaction this produces, which latter chemists have fully defined; but his instinct was so sure, his first experiments were conducted with such accuracy, and the quantities were so irreproachably defined, that later years have in no degree changed the manufacturing process which Leblanc first laid down. First came the decomposition of marine salt by sulphuric acid; then the decomposition of sulphate of soda by the heated kiln, and the washing of the rough soda on the floor of the kiln.

SULPHURIC ACID.

From the first of these operations, one of the most important articles in modern industrial occupation intervenes—that of sulphuric acid. In a few years, a way of making it in large quantities was discovered, and the face of all chemical operations was changed. It is by the help of it, that, directly or indirectly, chemists are enabled to extract from the different salts the greater part of the acids used in laboratories and in the arts. Thanks to it, hydrochloric acid has been economically obtained, which has rendered such service in paper making, bleaching, dyeing of stuffs, also serving for the preparation of gelatin, of ammoniacal salts, and of disinfectants. Next is carbonic acid, which is used in the manufacture of soda water and all effervescent drinks, in the extraction of sugar from beet root, and the fabrication of alkaline bicarbonates; and last of all is azotic acid, the most powerful agent of oxidation, which dissolves all metals, even gold and platina, when united to hydrochloric acid, and is indispensable to the workers in metals. By sulphuric acid, phosphates are transformed into powerful manures; sulphates of aluminium, of potash, of magnesia, of ammonia and of iron are economically obtained, with many other important applications in agriculture, medicine, and domestic economy. The production of electric currents, of electro-chemical gilding and plating, the refining of gold and silver, the making of stearine candles, the purification of colza and other oils, the dissolution of indigo, are some among many other branches of trade which could not be carried on without sulphuric acid; and its being manufactured in such large quantities is entirely owing to the soda works.

HYDROCHLORIC ACID.

One of the most serious embarrassments arose from the immense quantity of hydrochloric acid which was poured out from the soda works in the form of gas. It was condensed as much as possible by passing it through a series of vessels full of water, thus obtaining acid dissolutions, which had a certain value; but more was produced than could be disposed of. Besides, much escaped into the atmosphere in the shape of corrosive acid vapor, which attacked the iron parts of buildings, dried up the leaves of the trees, and exercised a most pernicious influence on the health of the surrounding neighborhood. The winds carried it away to great distances, and the effects were perceptible miles away. The proprietors had to pay heavy damages; and it became a matter of existence or non-existence to the soda works to find a means of condensing and collecting this deleterious acid. All these difficulties have been surmounted; and as it has often happened in chemistry, each has become the means of fresh progress. One of the most curious plans tried to purify the air was to build the works near to old abandoned quarries, and to bury the inconvenient vapors in their depths; but the acid, penetrating the stone, rendered it moist and friable, so that portions fell, and houses built in the neighborhood were rendered unsafe. Two different arrangements are now adopted, both succeeding perfectly. One is to pass the gas through many hundreds of stone bottles, communicating with each other through well luted tubes; a current of water is driven through them in an opposite way to the gas, and the smallest portion of hydrochloric acid is thus dissolved. Another plan is what is called the absorbing cascade; a high, wide tower is built of flintstones, the interior of which is filled with coke, fragments of flint, or bricks set apart; the gas is introduced at the base, and before it can escape it has to pass through all the interstices of these hard materials. From above, a fine rain of water is continually falling, and, meeting the gas at every angle, retards its progress and absorbs the acid.—*Chambers' Journal.*

Experimental Science at Cornell.

Professor B. G. Wilder, Professor of Comparative Anatomy and Zoology, at Cornell University, Ithaca, N. Y., calls upon all persons, who desire to facilitate the cause of science, and the instruction of the young men under his charge, to send him specimens for dissection. For every specimen a written acknowledgment will be sent, and eventually, to each donor, a copy of any scientific paper in which may hereafter be embodied the result he will have helped to reach. The specimens may be sent at his expense as above. The package, if large, may be sent as freight; if small, by express. He says:

"We want brains of all animals, both wild and domesticated; nothing can be amiss, for if duplicates come of what we already have, the students can dissect the brains, or the skulls, if desirable, can be prepared. When possible, the size and weight of the animals should be noted; and especially the sex and apparent age. The most valuable collection that could be sent us would include a male and a female, an old and a young, of the same species, the size and weight, the age and sex being marked in some way upon the specimens themselves; these would be worth more than fifty heads of different animals and bearing no such information. When the animals are small, or any doubt could arise as to their specific identity, they should be sent entire; but if large, the heads alone. Of course, a badly damaged head would not be worth the sending, unless very rare; and in all cases the killing should be so accomplished as to avoid injury to either brain or skull; the head should be cut off with one or two of the neck vertebræ attached, so as to save the *medulla oblongata* at the nape of the neck, and should be kept in a cool place before sending.

"We want the unborn young of all animals, and at all stages of development; as a rule, the smaller the better, but, as with the brains, hardly any specimen of this kind would be amiss; for where it is too large for entire preservation in alcohol, special organs may be prepared (the brain, stomach, etc.), so as to be extremely useful in showing the manner of the animal's development. On account of the extreme delicacy of these specimens, great care must be exercised in procuring and sending them. When possible, they should be kept and sent in the womb, the fluid contents of which are the best protection; but if this cannot be, then they should be placed in a jar or can with water and a little salt; larger embryos (colts, calves, etc.) may be laid upon hay or tow, and packed in a box, great care being had to prevent any pressure upon the head, for the skulls of unborn animals are so soft as to yield, and the brains are then ruined. Still-born or aborted animals are particularly useful if the time since conception is known; but embryos are often found in animals killed in the chase or for food. Of course, the species from which the embryos are taken should be noted, and, in case of domesticated animals, the exact breed so far as known; the pure breeds are most valuable for both brains and embryos, such as the ass, the mule, the different breeds of horses, the Newfoundland dog, and indeed nearly all the breeds of dogs, the brains of which differ among themselves to a wonderful extent.

"Such monsters as animals with two heads or two tails, or an unusual number of limbs or toes, or with but a single eye in the center of the face, etc., usually die soon after birth, and are then looked upon as mere curiosities, and so thrown away. Such specimens are of the greatest value to science. Gœthe, who was naturalist as well as poet, well said: 'It is in her monstrosities that Nature reveals to us her secrets;' and many of the more obscure laws of life and organization have been elucidated by the aid of these unfortunate creatures, which go astray before they are born, and live only to die. The not infrequent occurrence of such malformations among the human race should alone induce a careful study of whatever may lead to a knowledge of their nature and possible causes. There are few persons, especially living in the country or upon farms, who have not occasional opportunities of procuring such specimens as we desire; but none are so likely to have them as the hunters, the butchers, and the stock breeders; let me ask all such to save and send the specimens that almost daily come into their hands. Their value to us and to science is not to be estimated by the little trouble it may take to procure them, or the price which ignorance sets upon them."

Advantage of Californian over European Wine Growers.

In Europe, they only reckon to secure in ten years one good crop and fine quality, and two more crops of fine quality, but small quantity; while seven vintages are reckoned as being of poor quality, small quantity, and total failures. In our State, the variation in quality seldom amounts to five per cent, while the most disastrous years have not lessened the crop below the ordinary yield more than twenty-five per cent in quantity. This very variation in quantity can be fully known three months previous to the vintage, thus allowing the producer ample time to secure his casks, and furnishing him positive knowledge as to the number required. In other countries, even fourteen days before the vintage, there is no certainty of a crop; a wind, a rain, or a hail storm is apt to occur at any moment and devastate the entire vintage. All is uncertainty there; nor has the vintner any possible means of positively ascertaining how many casks he must provide. In abundant years in the old countries, the exchange has often been made of so many gallons of wine for an equal number of gallons capacity of casks. The disadvantages of being forced to secure such immense quantities of casks in so limited a period are too easily perceived, and we certainly cannot appreciate our own advantage too much in being very differently situated.

Another great benefit, derived from the long continuance of the dry weather, is the exemption from weeds in our vineyards after the final plowing. Thus all the nourishment and strength of the soil go wholly to their destination, the vine, and hence the vigorous appearance that even the most delicate imported varieties acquire even in our poorest soils. They necessarily bear much more. This circumstance will also explain, in a measure, why our cultivation does not cost as much per acre as that in European countries, though our labor is so much higher. The advantage of our dry weather does not end here; it precludes the possibility of continued mildew, and allows the vintner to leave his vines unstaked, the bunches of grapes actually lying and securely ripening upon the very ground, without fear of frost or rotting. In this condition, the grapes mature sooner, are sweeter, and, it is believed, possess more flavor.—*Overland Monthly.*

PRESERVATION OF STONE.—Doctor Eugène Robert, of Paris, recommends copper salts as being the best preservatives of stone in a damp climate. These salts prevent the formation of lichens, to the action of which M. Robert attributes the destruction of stone. This is, without doubt, true for granite, but its efficiency for sandstone is questionable. The latter deteriorates by exfoliation, without the development of any vegetation.—*Les Mondes.*

EXTRAORDINARY EXPERIMENTS ON STEAM BOILERS.

Perhaps the most interesting and important experiments, relating to the explosion of steam boilers, that were ever attempted were commenced on Wednesday, November 22, 1871, by Mr. Francis B. Stevens, under the authority of the United Railroad Companies of New Jersey. We give, herewith, an engraving of the scene of the experiments.

At the suggestion and by the advice of Mr. Stevens, that corporation generously and philanthropically appropriated the sum of ten thousand dollars to be expended by him in experimental investigation of the causes and of the subject generally of steam boiler explosions.

Mr. Stevens collected nine boilers; and, after testing, by hydrostatic pressure, several times to the point of rupture, each time repairing them, he finally set them all up on the United States reservation at Sandy Hook—by permission of the Secretary of War—with the object of actually exploding them by steam, and thus observing, if possible, the conditions of explosion and with the intention of obtaining as much valuable information as possible.

These latter experiments were commenced on November 22, in presence of Joseph G. Belknap, Inspector-General of Steamers for the United States, Coleman Sellers, President of the Franklin Institute of Philadelphia, Professor R. H. Thurston of the Stevens Institute of Technology at Hoboken, N. J., B. F. Isherwood, U. S. Navy, Captain Woolsey of the Jersey city ferry, Mr. A. Smith of the North Shore Ferry Company, Messrs. Callan and Dripps of the Pennsylvania Central Railroad Company, Mr. Brown of the Camden and Amboy Railroad Company, and Messrs. Erastus Smith, Charles Haswell, Norman Ward, William and Andrew Fletcher, and other engineers and manufacturers, making a party of about fifty of our best known experts in engineering.

The first boiler tried was a steamboat boiler which had been in use thirteen years—a return flue boiler, 6 feet 6 inches diameter of shell, 28 feet long. It had been subjected, November 4, to a hydrostatic pressure of 82 lbs. per square inch.

At 2 P. M. a large fire of wood burning violently in its furnaces, the gauges, which were placed at a distance of about 250 or 300 feet from the boiler, indicated 58 pounds pressure per square inch. The pressure rose steadily and regularly at a rate of about 2 pounds a minute until, at 2.18 by Professor Thurston's time, a pressure of 90 pounds was reached, and the horizontal seams of the shell began to leak very generally, while a rent started in the flange of the steam chimney at its junction with the shell. At 2.23 P. M. the pressure had reached a maximum of 93 pounds, and the leaks allowed steam to escape as rapidly as it was generated. The pressure then gradually subsided to 90 pounds at 2.50 P. M., when the fires were extinguished and the experiments were ended.

The next experiment was made upon a new construction namely: a copy of the back end of the *Westfield's* boiler, in the spacing of its screw stay bolts and in its dimensions generally. The fires having been lighted, the steam rose in pressure very rapidly, reaching 165 pounds to the inch in 29 minutes; and, while the Professor was entering the figure in his note book, the explosion took place, at 3.51 P. M., with a loud report and producing remarkably interesting effects. One side of the "leg,"—for the construction was that of the "water leg" of a boiler—was thrown a long way out into the adjoining field, tearing down the fence in its way; the other side went in the opposite direction, cutting a large hole in the next boiler, letting out its steam and water, and putting an effectual estoppel upon the proposed explosion of that, at least until repaired. The brickwork of the furnace was thrown in all directions with tremendous violence, some portions falling unpleasantly near the party at the gauges. Both parts of the exploded boiler were deeply "dished." The staybolts had drawn out of the sheets; and, around the holes, were noticed curious markings, resembling the magnetic spectra in their outlines, and possibly indicating the distribution of strains in the metal while yielding under pressure.

The next day, November 23, another boiler was experimented upon, the gauges being now placed 450 feet from the enclosure. This boiler was built by T. F. Secor in 1845, and was removed from the steamer after being in use 25 years; and, when removed, it had a certificate for 30 pounds. It was a return tubular boiler, 12 feet wide and 15 feet 5 inches long. It had been twice subjected to the hydrostatic test, the last time to a pressure of 59 pounds without fracture.

On this occasion, the steam rose regularly, and at 50 pounds some of the traces gave way with a loud report, and at 53¼ pounds, the water standing 15 inches above the flues, it exploded with terribly destructive effects. The steam chimney, with a part of the boiler top, weighing altogether several tuns, rose to a great hight in the air, falling over four hundred feet from its original position, and the boiler itself was torn into hundreds of pieces, the flying fragments tearing down the high fence and injuring others of the boilers remaining to be tested.

Mr. Stevens concluded to leave the other proposed experiments until some days later, in order that all interested persons might have an opportunity to witness the effect of this last explosion, and to satisfy themselves that steam boilers are not necessarily safe because there is "plenty of water."

The public owe a debt of gratitude to Mr. Stevens and to the United Railroad Companies of New Jersey for the professional zeal and enthusiasm that has proposed and urged the prosecution of these experiments, and for the liberality which has enabled them to be carried out. We doubt not that thousands of dollars and hundreds of lives will be saved by this signal disproof of the prevalent belief among engineers that a boiler is safe from explosion so long as it has a good supply of water, even though old and worn out.

Other wealthy railroad and steamboat companies owe it to themselves and to the public that the New Jersey companies are not compelled to pay all of the expenses of these experiments, and that Mr. Stevens is not compelled to stop in this good work for lack of funds.

The experiments having now ceased for lack of means to continue them, *Congress* has been petitioned to provide funds to prosecute them to final results. We trust this petition will be granted as not only engineers, but the general public, are greatly interested in obtaining more light upon the subject. We know of no scientific work more worthy assistance from the General Government, and none from which more practical benefits are to be anticipated.

Williams' Car and Tender Loading Apparatus.

Mr. James Williams, of Bell's Depot, Tenn., has just patented an invention which consists in a box holding a sufficient quantity to load the tender with fuel or the car with freight. The box is pivoted on a frame higher than the tender and car, so as to tilt toward the tender and car, and the side of the box which swings down is hinged so as to be let fall upon the top of the tender or car and form a chute for conducting the contents into the vehicle to be loaded. The ends of the hinged side have pieces similar to the end boards of the box, which assume a vertical position when the side falls down, and form sides to the chute, preventing the escape of the contents of the box over the ends.

For loading tenders, the box is much smaller than is required for discharging a car load at once into a car, and is arranged in vertical ways. A hoisting drum and other necessary apparatus for lifting the box from the ground to the proper elevation for discharging is employed; but for loading cars the freight should be as high as the box to be put into it, or it may be carried up by elevators. The frame supporting this loading apparatus is mounted on car wheels to to be run along a temporary track, to facilitate the taking of the wood or coal from different positions, and conveying the load to the proper place for discharging.

THE refusal of Mechanics' Unions to reconsider their unreasonable restriction, whereby their own sons are denied the privilege of learning the trades of their fathers, is one of the mysteries of the age. We have before alluded to this, for we feel that the prosperity of the country, the interest of humanity, and the welfare of coming generations, all demand that the shutting out of boys from learning the trades ought to cease, so that they may be trained up to become good workmen, and be able to learn an honorable mode of living.

BOILER EXPERIMENTS AT SANDY HOOK.

Chromium and its Compounds in the Arts and in Medicine.

The following is a brief abstract of an interesting lecture on chromium, delivered by Dr. Louis Feuchtwanger, before the Polytechnic Club of New York. It was fully illustrated by specimens.

Chromium is a very remarkable metal, which is very sparingly distributed in the earth's crust. Chromic iron is the only mineral which is found in sufficient quantities to be useful as a source of this element. It is found in serpentine rocks, in veins and disseminated grains. It is quite abundant in Siberia, Styria, Asia Minor, the Shetland Islands, Cuba, and the United States. (The lecturer described the deposits of Pennsylvania, Maryland, North Carolina, and California, which he had carefully studied.)

The constitution of chromic iron is exhibited by the formula FeO, Cr_2O_3 or $(FeO,MgO), (Al_2O_3,Cr_2O_3)$.

The following analyses exhibit the percentage composition:

Locality.	FeO.	MgO.	Cr_2O_3.	Al_2O_3.	SiO_2.	
Baltimore, *cryst.*	20·13	7·45	60·04	11·85		Abich.
" *massive.*	18·97	9·96	44·91	13·85	0·83	Abich.
Bolton, Canada.	35·68	15·03	45·90	3·20		Hunt.
L. Memphremagog.	21·28	18·13	49·75	11·80		Hunt.
Beresof.	18·42	6·68	64·17	10·83	0·91	Moberg

The following minerals also contain chromium:

Crocoisite, PbO,CrO_3, containing 31·3 per cent of chromic acid.

Melanochroite, $3PbO,2CrO_3$, containing 23·3 per cent of chromic acid.

Vauquelinite, $3CuO,2CrO_3+2(3PbO,2CrO_3)$, containing 27·9 per cent chromic acid.

Pyrope, Bohemian garnet, a silicate of alumina, iron, and magnesia, containing from two to six per cent of chromic acid.

Ouvarovite, lime chrome garnet. Silicate of lime and chromium, containing 22 per cent of Chromic oxide.

Emerald, a silicate of glucina and alumina, colored by three-tenths of one per cent of chromic oxide, according to Klaproth.

The following are the more important applications of chromium compounds in the arts:

1. The yellow or neutral chromate of potassa is the basis of all the other preparations, being made directly from the chromic iron.

2. The red or bichromate of potassa is obtained from the foregoing salt, and is extensively employed in the arts. In photography it is the basis of most of the printing processes, on account of the property which it has of rendering gelatin insoluble by exposure to light. In dyeing, it is extensively used as a mordant. It is the material from which chromic oxide, chromic acid, and the metallic chromates are prepared.

3. Chromic oxide is the most insoluble green pigment known; it is extensively used in printing "greenbacks," and in staining glass and painting porcelain.

4. Chromic acid is a powerful oxidizing agent. It is extensively used on this account in chemical researches, is found very useful as an exciting fluid in galvanic batteries, was used for preparing the beautiful "mauve red" from aniline, is employed in bleaching palm oil, destroying the empyreumatic impurities of acetic acid, etc.

5. The chromates of lead, bismuth, baryta, strontia and zinc are extensively used as pigments, varying in tint from the vermillion red of the basic chromate of lead, to the pale straw yellow of the strontia salt. The common "chrome green" is a mixture of chromate of lead and Prussian blue.

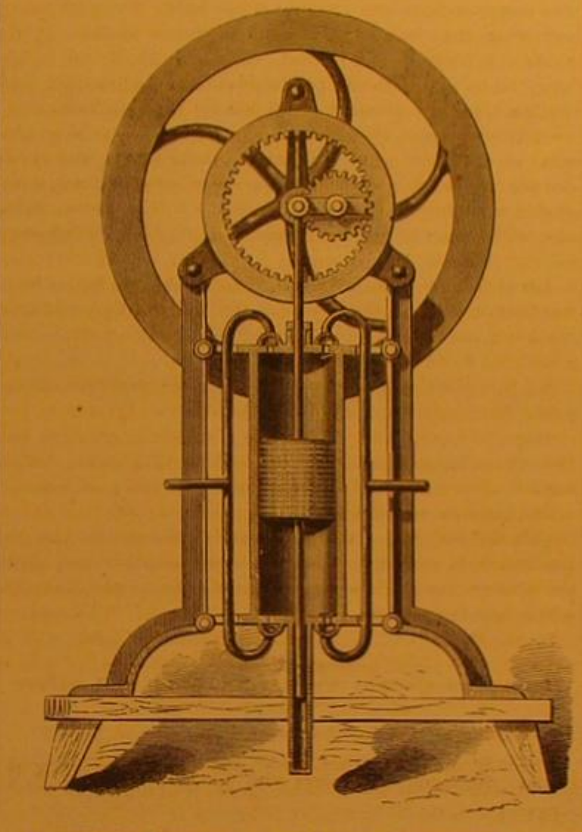
6. The beautiful violet chromic chloride has recently been introduced as a cancer remedy.

7. Chromium steel, made by combining about five per cent of chromium with cast iron, possesses most remarkable properties. On account of its excessive hardness, it is the best metal for the construction of safes, while its tensile strength, equal to a strain of 140,000 pounds to the square inch, especially adapts it to the construction of suspension bridges; it was employed in the St. Louis bridge, and will be used in the Brooklyn bridge.

FREE PISTON AIR PUMP.

Probably the most remarkable pneumatic machine which appeared in the French Exposition, or which has been yet constructed, is the *free* piston air pump, of Mr. J. A. Deleuil, of Paris. The peculiarity of this machine is that the piston works out of contact with the barrel of the pump, and of course entirely without friction. This piston is a metallic cylinder, and the barrel within which it moves is of glass. But though there is no contact between the surfaces, the space between them is exceedingly minute, being stated at the fiftieth part of a millimeter. It is of course necessary that the workmanship should be very superior, and that the strength of the whole machine should be such as to remove all danger of change of figure, or of any even very slight deviation of movement, or disturbance of the truly concentric adjustment.

The efficacy of this machine depends upon the difficulty and slowness with which gases make their way through very narrow spaces. The film of air between the piston and the wall of the cylinder is practically confined there, and forms a kind of lubricating cushion. The only resistance, therefore, which the piston encounters in its movement, is that which arises from the unequal density of the air above and below it. The engraving shows this machine in elevation. The piston is driven by means of the epicycloidal combination of La Hire, operated by a crank and flywheel. It is guided by a rod extending entirely through the barrel at bottom as well as at top. There are two valves at each end of the cylinder, one opening inward and the other outward. The outward opening valves both communicate with the same tube, which is recurved and united with the cylinder at both extremities. At the middle point of this tube, a branch leading from it may be connected with a condensing apparatus; so that the pump may be used for compression as well as for rarefaction. When used for the ordinary purposes of an air pump, however, this branch is open to the atmosphere. On the other side, the two inward opening valves are similarly connected, and the branch tube on that side establishes communication with the receiver to be exhausted. But when the pump is employed to compress air, this branch is open in its turn to the atmosphere. The valves, as drawn in the figure, are operated by the elasticity of the air. But, in the construction now given to this part of the apparatus, they are opened and shut mechanically by the piston itself. For this purpose, there are introduced two cylindrical rods passing through the piston and reaching from end to end of the cylinder, but capable of a slight longitudinal movement as the piston changes its direction. This movement opens a valve at one end and simultaneously closes the corresponding one at the opposite end; but this change having been effected, the rod remains stationary, the piston sliding on it as it continues its movement. The particular contrivance here described is not peculiar to Mr. Deleuil's pumps, however, as it has been often employed before.



The interior bore of the barrel must, of course, be very truly cylindrical and well polished. The piston is, in length, more than equal to its diameter. When the pump is used for compression, a greater length of piston is employed than is necessary for exhaustion. In point of fact, in this case, the difference of pressure on opposite sides of the piston becomes several times greater than it can be when the machine is employed only to produce a vacuum. There is no difficulty in carrying the condensation, in the course of a very few minutes, as high as five or six atmospheres. On the other hand, exhaustion is effected with remarkable rapidity. With a machine having a cylinder of four and a half inches in diameter, a twenty gallon receiver may be exhausted down to a pressure of less than half an inch of mercury in five minutes. Exhaustion may be carried lower than to the tenth of an inch in mercury.

The figure shows that the piston has not a continuously cylindrical surface from top to bottom. It is cut by grooves of very slight depth, and about half an inch apart. These grooves fulfil, apparently, a very useful function. Suppose the difference of pressure below and above the piston to be very great—the excess being, for example, below: the velocity, with which the air tends to escape on the upper side, will be much less than that with which it tends to enter the narrow space between the piston and cylinder on the lower. But before this superior velocity can be transmitted beyond the first groove, this groove must be filled with air of density equal to that below the piston. And before the same velocity can be propagated beyond the second groove, this second groove must be filled in like manner. As the movement is slow even when the pressure is greatest, it will take a much longer time to transmit, through all the intermediate grooves to the upper limit of the piston, the tendency to movement which exists at the lower limit, than it would do if the piston were quite continuously cylindrical; and thus we have the paradoxical effect of a *packing*, produced not by *adding to* the substance of the piston, but by *taking from* it. It is found, in fact, that the working of the pump may be interrupted a sensible time without turning a stopcock, and yet without vitiation, by the infiltration of air between the piston and cylinder, of the vacuum already secured.

How greatly the world would be benefitted by unlimited facilities for transportation and exchange of goods is shown by the fact that, while the people of Persia are starving by tens of thousands, the inhabitants of some of our Western States are burning corn in their stoves in place of coal.

The Coast Survey.

Professor Benjamin F. Pierce, the distinguished astronomer and mathematician, succeeded Professor Bache, and now superintends the operations of the coast survey. Some idea of the extreme accuracy with which the survey is carried on may be obtained from a description of the manner of measuring the base lines of the primary triangles. Four bars, each a little over two yards in length, are clamped together, end to end, making a combined length of over eight yards, or of exactly eight French meters. These bars are stiffened by being placed in a wooden box, allowing the ends to project beyond the box, the whole forming a measuring rod, which is used as follows: The compound bar is carefully placed in position in the line to be measured, and a powerful microscope placed over the forward end and adjusted so that its crosswise exactly coincides with the edge of the bar. The bars are then advanced until the rear edge comes into exactly the same position under the microscope that the forward edge has just left. A microscope is now adjusted over the forward edge again, the rod advanced as before and adjusted to its second position. This process is repeated until the base line of six miles, more or less, is measured. During the whole time, the temperature of the bars has to be carefully observed. The base line apparatus now in use was devised by Professor Bache, and has superseded the one here described on account of its greater accuracy. The measuring bar is so constructed that its length is not affected by changes of temperature, and greater nicety is obtained in making each successive length of the bar commence precisely where the previous one ended. Such accuracy has been obtained in the use of this apparatus that repeated measurements of the same mile do not differ from each other more than one twentieth of an inch. The necessity for such accuracy does not at first sight appear, but becomes evident when we remember that an error of a one-thousandth part in the base line is reproduced in such a way that all the lines measured will be in error a one-thousandth part. This, in a line of one hundred miles, would be about five hundred feet. An error of five feet in that distance would disgrace the survey. In order to verify the triangulation, a line is established by means of it at a considerable distance from the base, and then measured with the base line apparatus. The length of the line by the two methods should agree. It is a source of gratification to those who take pride in the successes of their own country that our coast survey, tried by these checks, is not surpassed by the most careful surveys of any other country. The accuracy which is indicated by this method of measuring the base lines is an example of the accuracy required in every part of the survey. In the triangulation, the form of the earth has to be rigorously taken into account, and the angles are obtained by repeated measurements with the most accurate instruments. The geographical positions of the various stations have also to be fixed by the most refined astronomical observations, reduced by the most elaborate and accurate methods. In this way, the assumed figure of the earth is constantly tested and the effect, upon the plumb line, of its irregularities and want of homogeneity shown. Two methods of making astronomical observations, first introduced into work of the kind by the United States Coast Survey, have drawn very flattering commendation from the old astronomers and masters of survey in England and Europe generally. They are that of determining the latitude with the zenith telescope, and that of determining the longitude with the aid of the telegraph. The accuracy obtained by these methods is such that they have nearly superseded all others.

A California Tea Plantation.

A writer in the *Overland Monthly* for January says: At Colonel W. W. Hollister's, I saw something I had never seen before. The Colonel has a tea plantation, in an evidently flourishing condition; but, though the plants looked thriving, and the planter believes that, in time, he will reap an abundant harvest, this is a venture I should not advise many to embark in for the present. Fortunately, Colonel Hollister has both the means and the disposition to make these experiments, of which the farming community of all California will some day reap the benefit. Shall I expose my ignorance by confessing that I never before knew that there is really but one tea plant? The different varieties we buy are only the result of the different manipulations in preparing it for the market. The plants themselves look to me like little, young orange trees. I saw them from one to four inches in hight, and the seeds are about the size and shape of a small hazel nut. Together with the tea, the Colonel has imported a "live Japanese," to take charge of the plantation; so that if tea raising succeeds at all, it certainly will here. His almond orchard, too, is on a grander scale than that of his neighbors: fifty thousand trees have already been set out—some of them, in fact, are over two years old—and fifty thousand more are being planted. Speaking of his neighbors: they are not so very near. The Colonel has a hundred thousand acres, more or less on which to plant tea, cotton or Canada thistles, should he so choose.

Joseph Gillott, who died at Birmingham, England, January 5, at the age of seventy-two years, had a world-wide reputation as a manufacturer of steel pens. He was born at Sheffield, and removed to Birmingham when about thirty years old. In 1803 Mr. Wise, of Great Britain, began the manufacture of steel pens. Mr. Gillott became interested in the business, and by his wonderful mechanical talent made several improvements and built up a large trade. About thirty years ago he put up the extensive Victoria Works, on Graham street, Birmingham, which are to-day one of the sights of the town.

It is an ancient proverb, "The feet of the avenging deities are shod with wool."

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Class Legislation and the "Working Man."

To the Editor of the Scientific American:

After repudiating the communistic nonsense which is so frequently and erroneously attributed to us as a class, it becomes our duty to oppose, with all our powers, the idea that our occasional troubles are to be remedied by exceptional legislation, and by defiance of the laws of political economy; in other words, that an evil can be cured by a folly, perhaps by a crime.

Class legislation, the parent of all jobbery, political intrigue and malversation of public property, is the favorite panacea, for short work, low wages and dull trade, of all the writers and talkers who are trying to tinker this matter; and such of us as value our independence, and believe that all legislative enactment should deal with the public as a whole and on general principles, will join with me in repudiating any violation of this principle, the maintenance of which is vitally important to the interests of any nation whereof the working people form a considerable portion. When government by public opinion is superseded by government by "rings," the interests of the working men are the first to go to the wall. We have had all sorts of special acts of Congress passed in the last few years; the majority of these are ostensibly intended to raise artificially the prices of commodities, and the public are informed that only by these high prices can high wages be paid. In the meantime, wages are falling on every hand, the charges for all the necessaries of life are, almost without exception, what they were when gold was at 180, and the public lands of the west (the almost boundless extent of which, offering new fields for industry and enterprise, is the real reason why wages are high in our country) are being jobbed away by millions of acres to rail road companies and other wielders of powerful influences, well known to Congress and to State legislatures, to lobbyists and other enemies of the public welfare. The loudest talkers and the most pretentious of our would-be friends are advocates of these class laws, who think they can bolster up a falling trade by an act of Congress or a subsidy; they have had their own way for some years, and now goods are at famine prices, wages are falling, the export trade and the enterprise of our merchants are on the wane, and, as usual, the working men suffer, more severely than any other body, the injuries resulting from a subversion of the laws of political economy. Have we not good reason for deprecating this suicidal policy, however specious may be the smooth speeches of the monopolists who are so disinterestedly advocating our interests, and who never, on any account, are influenced by considerations personal to themselves?

I will give an instance of the effect of attempting to make things pleasant by resisting the laws of Nature. Recently, in London, the number of laborers engaged at one of the docks was much reduced by the weather, and employment was scarce. The men out of employ offered to take lower wages; the men in work resisted their being engaged. Now the wages of a dock laborer are none too high anywhere; he is required to exercise only physical strength, and no man with knowledge of a handicraft would willingly spend his time in hauling bales of goods. Therefore the work is always done by men who are not accustomed to anything but a rough and penurious life; and in resisting the reduction of wages, the hands in work had as fair a claim as any man can possibly have. We take it for granted, then, that it would be a great hardship to these people to have their scanty pay still further reduced, for reduction of such a pittance means dispensing with some of the actual needs of existence. But, in candor, we must consider the case of the majority, who were out of work. They say: "You have had your five dollars a week for some time, we have had nothing; we are willing, and shall be glad, to take four; you do not want your meals diminished in number to two in a day, we are without a meal at all. Let us, whose necessities are greater than yours, have our turn. Our willingness to take less wages is a proof and a good indication that, and how far, our needs are greater than yours. Let us have a chance. Your talk, of its being for the interests of laborers as a class that wages should be kept up, means only that *your* pay must be maintained at its present rate; our only chance of getting work, and thereby bread, is by the reduction of wages." What can legislation do in such a case? What is the use of fighting against Nature, and attempting to make water run up hill? If men would reflect and see that the curse of society is too much legislation, that the interference of the government with trade and economical questions is as illegitimate as it is with religion, dress, and diet, there would be some chance for the permanent elevation of the social status of the working people. We have our brains full of vigorous life, we have almost exclusive possession of the mechanical ingenuity which now produces so large a share of the world's subsistance, we may say, without boasting, that we are loyal and law-abiding, and capable of the moderation and self-restraint without which man is a worthless blatherskite; and other trades and professions cannot refuse to call us brothers, if legislators and grievance mongers would only leave us to our own independence.

The most scandalous malversations of the public funds ever contemplated are the proposed subsidies to ship builders, and I am glad to see that no workmen are found clamoring for access to the public purse. Why? Not because a workman has not as much right to a share of the public money as another, but because employment created at the national expense is only pauperism on a large scale; and the workmen are not the persons for whose benefit subsidies are voted. They have always been the victims, not the *protégés* of class laws and special legislation; and if there are some among us who are not yet aware of the fact, they will certainly soon find it out.

In conclusion, let me say that we are not less anxious to repudiate the accusation of communistic ideas than we are that of a desire for national aid and public eleemosynary benefits; and a summary of all that we can say or think on this subject is comprised in the following short, pithy, and peremptory sentence: Let us alone.

In another letter, I propose to remark on some of the legitimate remedies for our troubles and difficulties.

New York city. PRINTER.

Zinc Amalgamation for Extracting Gold and Silver.

To the Editor of the Scientific American:

I am glad to see that Mr. Butler asks if extraction of gold and silver by this mode "has been practically used in any place on a large scale." I hope for some light on the subject in reply to his query. I have sought (by private means) to learn if such was the case. I have thus far only heard from those who set forth their theories, but fail to adduce facts.

What we need, are facts. It is the business of the miner, the world over, to mine and raise the ore. Then the ore is taken by the stamp mill or the smelting works and the metals extracted. Now many seem to think the miner should step aside, from what I conceive to be his legitimate business, to test any new process which seems to have a correct theory behind it. He should not; when facts are shown, proving that such a mode, at such an expense, will do more for the miner than the millman or smelter can do to-day, that mode will find speedy adoption. The field is a large one. The waste is now enormous. The reward to the successful man will be great.

Let me give you some figures, from a mine in Colorado, so well attested to me that I am ready to be responsible for them. The mine yields gold and silver, and the figures cover a period of forty-one weeks, ending December 9 ultimo. The gross yield, in currency, was over $72,000; the actual profit, from this yield, was over $29,000.

Tests, repeated week after week, render it sure that less than three fifths, in value of the gold and silver, was obtained. The actual value, in currency, of the metal wasted was, therefore, more than $48,000.

This difference was actual waste, a subtraction from the wealth of the country of just so much actual value, in all probability never to be regained, aside from the loss to the parties owning the property. LAMBDA.

Boston, Mass.

Iron and Copper Pyrites in Gold and Silver Ores.

To the Editor of the Scientific American:

The gold found in this combination, instead of being of a bright yellow color and metalic lustre, is of a grayish brown, dull tint. In this condition, it is known as "rusty gold," and seems to be quite indifferent to the action of quicksilver. Experience shows that this class of ore, on melting, gives a regulus of bright gold, containing 99 per cent of the original. This experiment indicates that there is a film of some other substance upon the surface of the rusty gold. Besides ferruginous sulphuret of copper, may there not be tennantite, white copper and the different classes of arseniate of copper, all of which contain more or less arsenic and sulphur? In some instances the amount of silver in the pyritical ores is usually very small. A small portion, alloyed with gold, is saved in the stamp mill; but by far the larger part, being in a state of sulphide which will not amalgamate, is lost. Why? This is the problem of which the solution has been long looked for.

The fact that copper is found in these ores in combination with silver as well as gold, indicates that the species of silver is the sulphuret, that is, brittle sulphuret of silver, which contains silver, antimony, iron, sulphur, arsenic and copper; sulphuretted antimonial silver, containing silver, antimony and sulphur; or, it may be, carbonate of silver, composed of silver, carbonic acid, oxide of antimony, and a trace of copper. However, the striking resemblances, of these species containing sulphur, antimony, arsenic and copper, would lead one unskilled in mineralogy and metallurgy to form a fixed idea that the film of some substance found on the surface of rusty gold is a combination of the heretofore mentioned impurities. Of course, this coated gold can be saved only to a small extent by the ordinary stamp mill process.

The partial desulphuration effected by the many patent processes which have infested the territories will not accomplish this. Why? The chemical nature of this coating has not yet been absolutely ascertained

The fact that so high a roasting is required to remove it, clearly indicates that it is not sulphide of iron; while other circumstances would lead us to believe it to be oxide of iron; but may it not contain antimony and arsenic? It has been generally supposed that desulphurating ores by heat would remove the impurities that impeded amalgamation. This has proved an erroneous idea; sulphur is not the only obstacle to the process of amalgamation.

In Colorado ores we have, in combination with gold and silver pyrites of iron and copper and all these in combination contain more or less antimony and arsenic, which are directly opposed to the affinity of quicksilver. Hence it is palpable that these impurities must necessarily be removed by chemical agencies accompanied with mechanical power to stir the substance up and keep the whole in motion, reducing them to chlorides, and then running them off by means of a faucet (thus leaving the ore in a condition for amalgamation) before the amalgamating process is commenced. The shameful loss in these and all other classes of gold and silver ores, proves that the processes of chloridizing in use are a failure, and that heat by roasting, alone, only partially removes the impurities at an astounding cost. Scientific men, so called, have made stupendous mistakes of judgment; but they have been surpassed by the blunders of practical men, so called. The scientific men without practice and the practical men without science, the honest men without capacity and the smart men without honesty, have done so much to destroy the mining industry of the territories, that the very fact of its continued existence, after such terrible trials, is proof of its inherent vitality and future prosperity. The great question apparently still remains unsolved by practical operations on a large scale: Will mere desulphurating by roasting leave auriferous pyrites, in a condition suitable for the extraction of the gold and silver by amalgamation? Experience thus far is discouraging; but we need not doubt some simple expedient will be discovered; overcoming the difficulty. That such an invention is needed appears from the fact that chloridizing and smelting, two processes which are acknowledged to be metallurgically perfect, are too expensive to be applied to a large class of ores, for which amalgamation will probably always remain the available method.

PERCIVAL STOCKMAN.

[The above is by an experienced miner who has spent many years in the mines of California and in the silver mines of Mexico and South America.—EDS.]

Turbine Water Wheels---A Proposition.

To the Editor of the Scientific American:

I propose to the builders of turbine water wheels throughout the United States, or to as many as may see fit, to meet me at the Grand Central Hotel in the city of New York on some day to be appointed, for the purpose of selecting some suitable place, near one of our cities, say Boston, New York, Philadelphia, Baltimore or Richmond, where we can have our water wheels tested and examined by a committee of competent and disinterested persons; with the understanding that said committee shall reject all wheels sent them which may be made or finished differently from those offered for sale; and that all the wheels sent to the committee, and not rejected by them, shall be examined and properly tested; and that a report of the merits of each wheel tested shall be published; and that all expenses shall be equally divided and paid by those who send wheels to be examined and tested. N. F. BURNHAM.

York, Pa.

Condition of our Navy Vessels.

Since the Spanish war speck has appeared on the horizon, our daily papers have taken up the subject of our war vessels; and, from the discussions and information otherwise obtained, we should doubt if our naval authorities are prepared for an emergency, should hostilities be commenced between this country and Spain. On the authority of the *World*, we learn that at the Brooklyn navy yard there are three still unfinished vessels lying, on which not a day's work has been done since the close of the war. These are the first rate screw steamships, Java and New York, each of 2,490 tuns burden, and the ironclad Colossus, 2,127 tuns, and fitted to carry ten guns of large calibre. The Java is constructed of white oak, the New York of live oak, and both will be splendid vessels if they do not rot before they are launched. The Colossus will require a year's work for her completion, but the others could be finished much sooner if there were any money to carry on the work. There are no vessels in commission, although a number are lying there for repairs. Among these are the Minnesota, first rate, 2,912 tuns and forty-five guns; the Roanoke, second rate, ironclad, 2,260 tuns and six guns; the Florida, second rate, 2,135 tuns and twenty-five guns; the Tennessee, second rate, 2,135 tuns and twenty-three guns; the Hartford, second rate, 2,000 tuns and eighteen guns; the Canandaigua, third rate, 955 tuns and ten guns; the Iroquois, fourth rate, 695 tuns and six guns, and the Portsmouth, fifth rate, 846 tuns and fifteen guns. There are also two storeships, the Guard and the Supply, the former carrying four guns and the latter two. It might be imagined, on viewing the rather formidable array of guns and ammunition presented at the yard, that the country was fully supplied; but on closer examination such would be found to be not the case, as by far the larger quantity of powder is the remnant of what was left over after the war, and consequently has not improved by age. Most of the guns are Parrotts, of which there are three hundred, ranging from twenty to one hundred pounders. Of smooth bore guns there are three twenty inch guns, twelve fifteen inch guns, twenty-eight nine inch guns, ninety-seven eight inch guns, and one hundred howitzers. This enumeration includes only those which are serviceable. The small arms comprise a number of pistols and cutlasses, and about two thousand Remingtons. The above quantities represent the whole of the navy yard supplies, and it may well be asked: What would be done if war were declared?

Of all the vessels now at the yard, only the Canandaigua is nearly ready for active service, though the Hartford and Portsmouth are also fitting for sea. The Canandaigua can be made ready in about ten days. In case of war, little assistance could be furnished from here, unless large extra expenditures were authorized by Congress. With abundance of men and money, only one vessel in addition to the Canandaigua—the Portsmouth—could be made ready in a month, and then only as a sailing vessel.

In six months, under the same conditions, eight vessels could be made ready, including the ironclad Dictator, now lying at New London. Perhaps the most formidable engine of war would be the Stevens floating battery, which is at the present time being put in a state of completion, and is expected to be quite ready for action within forty days' time. As the battery now lies in the yard at Hoboken it appears unwieldy, but ere a fortnight a vast change will be apparent. It has been pronounced by naval connoisseurs one of the most formidable of engines of war. Its keel was laid down in 1840. Since then it has been on the verge of completion thrice, but the changes in naval architecture have been so numerous and important that it has been taken apart to make it conform to these improvements. It is nearly 300 feet in length, is 25 feet beam, and draws 21 feet of water. Its frame is built of the stanchest of live oak. This is covered by teak planking, which in turn is backed with two foot teak slabs. The outside armor consists of five inch chilled iron plates. These are secured to the wood by headless bolts. By this method, the surface on each side of the vessel is smooth, and affords no opportunity for plunging shots to tear off the plates. Its battery will consist of seven guns; four of these are 500 pound rifled Rodmans. The remaining three are 250 pound rifled Parrotts. Her prow is composed of solid iron, backed by oaken logs, and will prove a powerful ram. It is confidently expected that she will be enabled to steam at the rate of twelve knots an hour. Taken altogether, she is a war ship that, if brought into action, will astonish the Spaniards quite as much as did the Monitor the people of the Merrimac.

PREPARATION AND COMPOSITION OF ALLOYS.

The following instructions are extracted from Fesquet's translation of Guettier's metallic alloys, noticed in our last issue:

As generally practiced, the metals to be combined are melted by processes and in apparatus which vary, according to the quantity of alloys to be cast or the nature of the metals under treatment.

The metals easily fusible, such as lead, tin, etc., are melted in a ladle, or in wrought or cast iron kettles.

The more refractory metals are melted in crucibles, whose qualities of solidity and resistance to the fire are the more sought for as the metals have a higher point of fusion, or are more valuable.

For gold, silver, and platinum, we require crucibles of a superior quality, which will not crack, and thus lose in the fire the metals they are intended to receive.

For copper and its alloys, although requiring crucibles as solid and lasting as possible, we look more towards economy, because the work is frequent and regular, and we operate on quantities of less value.

When the mass of metal becomes considerable, whether because many castings are to be made, or because of the heavy weight of the pieces, instead of the crucibles, we operate in reverberatory furnaces, and sometimes in cupolas.

The processes of melting and mixing the metals in a crucible, however simple they appear at first sight, require certain precautions upon which we cannot too strongly insist.

The alloys made in one operation are always very difficult of preparation, when the metals, such as zinc and lead, copper and lead, for instance, possess a sort of "antipathy" in their affinity. It is with much trouble that we obtain, in this way, thoroughly homogeneous castings, presenting the same body and grain of similar alloys, which have already passed through a previous fusion.

In order to arrive at the best possible results, without employing the method by separate operations, it is proper, as a rule, to endeavor to operate according to the following principles:—

1. To charge the crucible, and melt first the least fusible of the component metals.

2. When this metal is in fusion, to heat it up to such a point that it will be enabled, without too great a cooling, to bear the introduction of the other component metals.

3. Once the first charge is in fusion, to introduce the other metals in the order of their difficulty to melt.* Whatever are the proportions of the component metals, and no matter which is the basis of the alloy, it is absolutely necessary that the most refractory metal should be melted first. Its fluidity, indeed, gives the measure of the temperature necessary for finishing the alloy. By charging first a fusible metal, it may volatilize and become oxidized, and the crucible may also break by raising the temperature high enough to receive, without too much cooling, a less fusible metal. At the same time, there will be more waste, and the proportion of the alloy will be sensibly changed.

4. To present at the flame of the furnace the metals which are to be subsequently added, in order to heat them as much as possible, and thus facilitate the change of temperature which takes place when the new metal is added to that or those already melted in the crucible. This practice is especially good when we have to introduce a volatile metal, such as zinc, which, being melted too rapidly, may cause the crucible to break.

5. To stir after the introduction and melting of each component metal; and to cover the crucible, at the same time that the fire is increasing more or less, according to the less or greater fusibility of the metal.

6. To cover the alloys rich in zinc with a layer of charcoal dust. This is not necessary when there is not in the alloy any metal, such as copper or iron, having a high point of fusion; or when the proportion of zinc added does not require a protracted heating, and the alloy may be poured out immediately. With alloys rich in tin, the charcoal dust will cause the scorification* of part of this metal; therefore it is preferable to cover the surface of the molten mass with refractory sand or pulverized sandstone.

7. To stir thoroughly the molten alloy just before it is cast, and, if possible, during the pouring out. The stirring is to be done with a stick of white wood, burning without splitting; and not with an iron rod, which has a tendency to produce dry alloys, and may modify the nature of the compounds by adding some iron to the alloy—a small proportion, it is true, but nevertheless appreciable.

8. To carefully clean the crucible after each operation, in order to maintain the accuracy of the mixture, and facilitate the fusion.

Such are the main conditions for obtaining alloys in one operation. If alloys thus prepared give some trouble in obtaining good results, they are very economical, and present the advantage of keeping, as strictly as is allowed by the fusion, the proportions of the mixture.

Moreover, in practice, it is generally acknowledged that a small proportion of an old alloy, added to a new one, improves it by giving it the homogeneousness which otherwise would be imparted only by a second fusion.

In ternary or quarternary alloys, made of copper, zinc, tin, and lead, it will always be well, in order to obtain more homogeneousness in the final mixture, to alloy beforehand the more fusible metals, such as zinc, tin, and lead; and to combine this first alloy with the copper, under the best conditions possible. In this way the last combination will possess better qualities than an alloy made in one operation.

However, we repeat it, alloys made by the first direct method, although much more simple and economical, do not answer all the wants of the arts, and do not present the same guarantees as those which have been remelted. For instance, runners from bronze or brass castings of a first fusion, when melted again, and when the primitive proportions were good, present a better grain, and a metal without defects, which is more easily worked than another alloy made directly by one operation.

The pieces cast with alloys made by the direct method—we always mean those in which copper is a component part—are possibly less liable to breakage and shrinkage than if made from old metal; but, on the other hand, the surfaces are not so clean, and the grain is not so close and easily worked. Moreover, such alloys are not very fluid, and do not produce sharp casts. These defects are more to be guarded against in the case of statuary and ornamental bronzes than when pieces of machinery are to be produced.

As a rule, the oftener a metal is melted, the more it loses its previous qualities.

* This is a general rule, to be applied in most cases; but there are exceptions. For instance: gold will easily dissolve in melted tin, and platinum in many metals. If platinum were first melted, and zinc, for instance, added, the temperature necessary to obtain the fusion of platinum would be sufficient to volatilize the zinc.—*Trans.*

* The author uses the word "scorification," but we do not think that the term is entirely appropriate. Nevertheless, it is certain that charcoal is not favorable to alloys of tin and copper, and that pure clay crucibles are to be preferred to those of plumbago for such alloys. Metallurgists know that at a certain period of the refining of copper, the metal is carburized and brittle. In order to prevent this carburization, it has been recommended to give a coat of pure clay to the interior of plumbago crucibles.—*Trans.*

THE AMERICAN HISTORICAL RECORD

"The American Historical Record, and Repertory of Notes and Queries, Concerning the History and Antiquities of America and Biography of Americans," is the title of a new publication, edited by Benson J. Lossing, and published by Chase & Town, 142 South Fourth street, Philadelphia, which promises to be interesting and useful. Those with literary and antiquarian tastes will find in it—if the future numbers correspond with this specimen number—much rare information and a medium for the exchange of such items of history as are at present traditional or to be found only in books so rare as to be only accessible to few. The plan of the publication also comprises historical discussions and essays, current historical literature, records of the proceedings of historical societies, engravings, etc. It is a monthly. The subscription price is $3.00 per annum. Mr. Lossing is well known to the public as an author eminently fitted to conduct a magazine of this kind. We make the following extracts pertaining to early American industries:

BUTTON MAKING.—It is a notable fact in the history of American manufactures, that the first maker of covered buttons, Samuel Williston, is yet living. In early life he was preparing to enter the ministry, when his eyesight so failed that he was compelled to give up study. He kept a country store in wh'ch the wooden buttons, then in general use, were sold. His wife covered some of these buttons with cloth. They became popular. Williston and his wife contrived machinery to do the work, the first ever employed in the United States. An immense manufactory grew from this seed, and made half the covered buttons of the world. Williston's factories are still running at East Hampton, Mass., and he is worth several millions of dollars.

THE OLDEST DAILY AMERICAN NEWSPAPER.—On the 28th of October, 1871, the *North American and United States Gazette* of Philadelphia celebrated the one hundredth anniversary of its birth. It was first established by John Dunlap, in 1771, with the title of *The Pennsylvania Packet and The General Advertiser*, a small folio sheet, published weekly. It was an adherent of the republican cause in America. In September, 1784, Dunlap & Claypoole commenced publishing it daily, and it was the first daily newspaper printed on the American Continent. Its name was soon changed to *The American Daily Advertiser*. Forty years later it was merged into the *North American*. In July, 1747, *The North American* and *The United States Gazette* were consolidated with the present title; and since 1854, Morton McMichael (for a long time a partner in the ownership of *The North American*) became its sole proprietor, and remains so. It has been a deservedly influential publication during its century of existence.

A RELIC.—In Pittsfield, Massachusetts, is an anvil which was brought to this country in 1663, by Elweed Pomeroy, who had forged upon it the ponderous horse shoes used in the reign of the first Stuart, King of England. Like the Egyptian anvil in the British Museum, three thousand years old, the Pittsfield implement, of precisely the same shape, is as sound as when the first blow was struck upon it.

COAL.—Bituminous coal was mined near Richmond, Virginia, so early as the year 1700; and a Richmond farmer used it in making shot and shell during the Revolution of 1775–'83. According to the statements made by Volney L. Maxwell, in a lecture at Wilkesbarre in 1858, anthracite coal was first used by Obadiah Gore, a Connecticut blacksmith in the Wyoming valley, in 1768. Jesse Fell, of Wilkesbarre, was the first to use it for domestic purposes. Philip Ginter, a hunter, discovered the Lehigh coal in 1791. The Schuylkill coal was first sent to Philadelphia in 1812.

Sewage Poison.

It had better be admitted at once, says the *Engineer*, that the specific property, that renders emanations from sewers and cesspools so dangerous to health, is not clearly understood. A gentleman of eminence has lately directed attention to the use of charcoal as an agent effectual for the absorption and destruction of sewer gases; but the question after all is, whether typhoid fever is produced by gaseous products exhaled from organic matter in a state of decomposition, or is attributable to the presence of a specific germ. It is certain that those whose calling brings them into daily contact with decomposing matters of the most offensive kinds are not affected by any special forms of disease; and it is also well ascertained that sewage emanations, possessing little or no offensive smell and not necessarily the result of decomposition, have produced typhoid and other complaints. There is no longer a doubt that cholera poison is a perfectly specific source of disease.

It has been collected from our sewers and experimented upon until its properties and characteristics have been clearly ascertained. It produces choleraic symptoms, of any degree of intensity proportioned to the dose employed and composed of such minute cells that it will pass through the closest filter. The probability is that other diseases are also produced by specific germs borne in the atmosphere; and if so, it will be unsafe to place implicit reliance upon charcoal or any mere deodoriser. Doubtless the gases that are evolved by decomposing sewage matter will, of themselves, seriously affect health; but there is nothing to show that charcoal has any effect in checking the spread of special diseases, or in arresting the passage of germs, of such minute dimensions that they will pass through finest filters and even elude the search of the most powerful microscope. The object of sewer ventilation is not, as is sometimes supposed, merely to purify or destroy foul and stinking air, but it has for its further aim the destruction or dilution of the insidious and probably inodorous poisons that associate with these foul smells. Where access can be had to furnaces and chimney shafts, complete destruction of all sewage products can be accomplished; but in the absence of such means, reliance must be placed on free dilution by discharging the sewer air above the roofs of houses and beyond the lungs of our populations. The experience and conclusions of Dr. Alfred Carpenter cannot, at this time, be too prominently placed before the public for it is only at a juncture like the present that they are likely to receive attention. He says: "Many facts have been brought to my observation as to the power of sewer gas to produce disease; as a factor in the production of typhoid fever its power is now well known. Many other diseases of the system have been directly traced to its influence; thus diarrhœa, dyspepsia in all its forms, palpitation of the heart, various forms of asthma, convulsions, especially in teething infants, and headaches, both persistent and intermittent." These, and a further list of complications, are the inevitable results of exposure to sewer gas whether it reach the system through traps from public drains, or attacks us more directly from soakage under our houses, or through the medium of a contaminated cistern or well.

The Pursuit of Strength.

Those unfortunates who devote their lives to the pursuit of strength, according to *Hall's Journal of Health*, who rise at unearthly hours, and shiver under ice cold shower baths, who never eat as much as they wish or what they wish, who live as mechanically as possible, and conscientiously deprive themselves of about all reasonable enjoyment, are certainly to be pitied. Still their terrible system leaves them alone during the night. If they eat, drink, move, and have their being under its supervision, through the day, at night they can sleep undisturbed. But a new school has arisen in California. Some crack-brained enthusiast has announced that he has prolonged his life for years by sleeping with his finger tips touching his toes. The reason of the advantage of this proceeding is not at first evident, but is easily understood when we read that "the vital electrical currents are thus kept in even circumflow, instead of being thrown off at the extremities and wasted." The discoverer has given the valuable secret gratuitously to the world, actuated solely by a desire to benefit suffering humanity. "Machines, warranted to hold the body easily in this position, can be obtained only of," etc., etc. If the method comes into general use, our posterity will, we fear, be a "stiff-backed generation."—*Chicago Tribune.*

Automatic Check Rein Attachment for Harnesses.

Scarcely any one accustomed to driving has failed to experience the annoyance of being compelled to alight from his wagon to uncheck and check his horse to allow the latter to drink. Every one who drives for pleasure would gladly escape this inconvenience, which, in muddy, rainy, or cold weather, is so disagreeable that we fear the wants of horses are often neglected on account of it. And those who make driving a business would, we should think, gladly avail themselves of so simple a device as we herewith illustrate, when once convinced that it would obviate the necessity of descending from their seats, either to check or uncheck their horses.

The neglect spoken of is probably suffered more by horses hired from livery stables than those owned by their drivers. Such horses will be far more likely to be attended to when this device is attached to their harnesses, as to water them will then give no trouble to their drivers.

The device detracts nothing from the ornamental appearance of the harness. It is entirely out of the way, and costs but little. The inventor informs us that, without advertising or attempting to make a business of selling the device in advance of facilities to manufacture, he has taken orders for a large number in the town where he lives, in the short time since he obtained his patent.

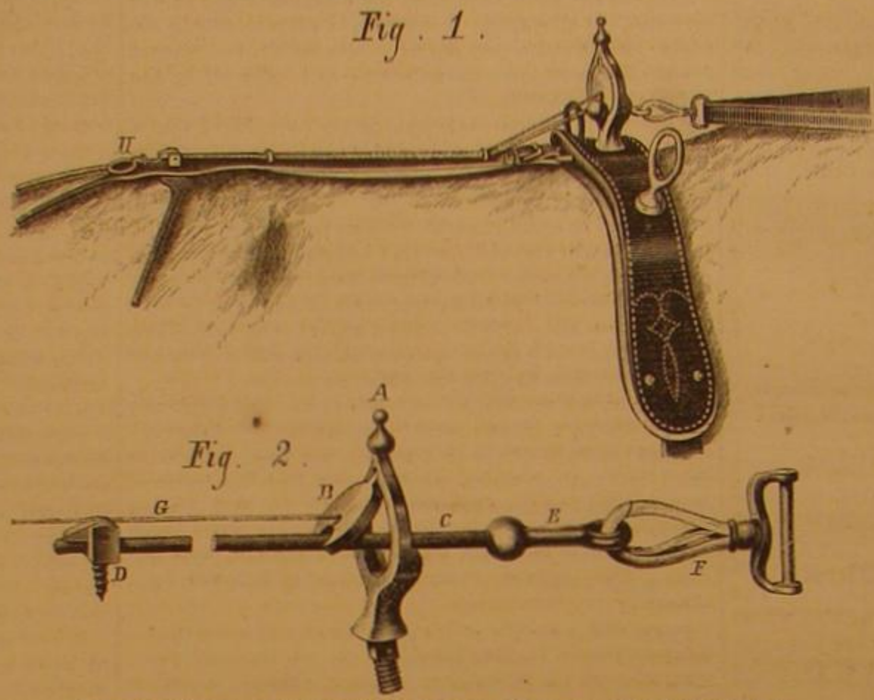
The terret, A, Fig. 2, is substituted for the ordinary check rein hook. It has a pivoted catch, B, made circular, except the recess at the bottom, and having a bevel edge which abuts against a corresponding bevel on the interior of the ring of the terret, so that it can swing backward, but cannot swing forward through the terret ring.

An elastic rubber cord, C, is fastened to the back strap of the harness, by means of a small catch or dog, D. The cord, C, passes forward over the back strap, or through it if made tubular, (as will be done on fine harnesses), till it reaches the terret ring, being somewhat stretched to give it the proper length and tension. At the end near the terret, it has attached to it a metal piece, E, the rear end of which is enlarged into a ball or knob, which, when pulled through the terret ring from the front, passes far enough back to let the pivoted catch plate, B, fall to its place, the recess in the bottom of the catch plate receiving the neck of the piece, E, while the ball engages the plate; so that the piece, E, cannot be drawn through forward again until the catch plate is raised. In an eye at the front end of the piece, E, is attached the snap hook, F, having a loop at the front end, through which the check rein passes.

The cord, G, is attached to the catch plate, B, and when drawn backward, raises B and releases E. The horse can then lower his head to drink, and when he has finished drinking, by drawing upon the driving reins he is caused to raise his head, the elastic cord, C, retracts, carrying back the piece, E, through the terret, A, where it engages with the catch plate, B, and the horse is thus checked again. The cords run through loops on the back strap, or through a hollow tubular back strap, as above mentioned.

The cord, G, which is used to release the piece, E, has a ring, H, Fig. 1, at its rear end. A small hook is screwed into the butt end of the whip stock, by which this ring is easily reached, and the cord pulled to uncheck the horse.

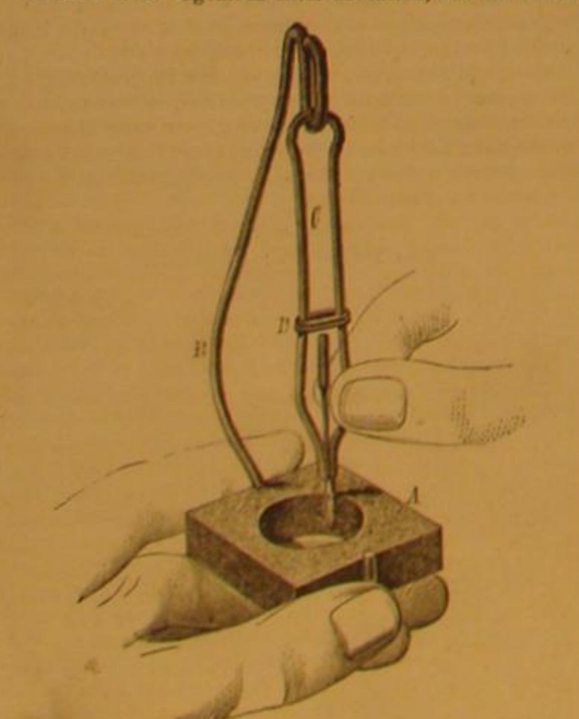
This invention was patented November 7 and November 21, 1871, by John Schofield, of Worcester, Mass., who may be addressed (Box 709), for further information.



SCHOFIELD'S AUTOMATIC CHECK REIN ATTACHMENT.

MECHANICAL NEEDLE SHARPENER.

This is a most ingenious little invention, and one which



has in it the elements of a wide spread popularity. It costs little, and does its work quickly and far more perfectly than it can possibly be done by hand. For sharpening sewing machine needles, or, in fact, any other needle or small pointed instrument, it appears just the thing that has been long needed.

In the engraving, A, represents a pedestal, made of fine emery cemented together, forming a solid stone. The pedestal is square, and has in the center a circular opening.

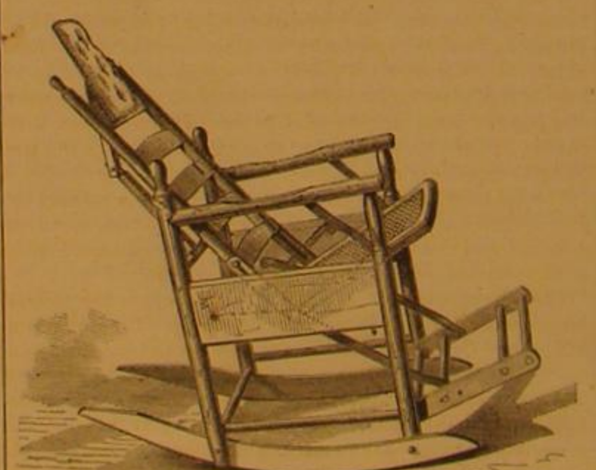
From the pedestal rises a curved standard, B, to which is linked the swinging clamp, C. The latter has two grooved jaws, which grasp the needle as shown, being held firmly together by the sliding loop, D.

The needle being clamped in the jaws, as shown, the swinging clamp and the needle are grasped by the thumb and finger of the operator, and swung rapidly around the inner wall of the opening in the pedestal. At each passage of the needle point, around and against the wall of the opening, it is ground evenly on all sides, and a few turns brings it down to a fine sharp point, the bevel being formed by the inclined position of the needle upon the face of the opening.

The invention was patented June 28, 1870. For further particulars address Currier, Philpot & Co., 5 Haymarket street, Boston, Mass.

HAUPT'S IMPROVED EASY CHAIR.

Next to a comfortable bed, an easy chair is one of the luxuries which adds as much to the comfort, of both the well and the sick, as any article of furniture in modern use. Much ingenuity has been expended to perfect this class of furniture, and there are many that "lap one like a mother," and



whic!. are looked forward to with pleasant anticipation as the first haven of rest into which the weary sink, in the quiet evening hours at home.

Our engraving illustrates an addition to these modern comforters, which seems to possess all the requisites of ease and convenience sought in devices of its kind.

The back, seat, foot rest, and head rest, are all self adjusting and actuated by the movements of the occupant, who is enabled to assume an erect, horizontal, or any intermediate position desired, with very slight exertion.

If the sitter desires to lean back, he places most of his weight on the rear end of the seat, and throws his body backward. This movement starts the pivots of the chair bottom that previously rested in depressions at the rear ends of grooves in the side pieces. The seat moves forward, its rear end descending into these grooves, its front end being raised by swinging braces hinged to the arms and seat. At the same time, the foot rest is moved forward by a rod jointed to the chair bottom and pivoted to the foot rest. The motion of the parts will cease when the movement of the sitter ceases, or will be reversed by his reverse movement.

The parts move harmoniously, smoothly, and easily, and the position of the sitter is changed with that facility which adds so much to the luxury of such chairs.

The invention was patented through the Scientific American Patent Agency by William W. Haupt, of Mountain City, Texas, October 17, 1871.

Science Perfecting Swimming.

Frederick Barnett, of Paris, has patented a novel yet simple apparatus for swimmers. The invention consists in supplying to man, by art, the apparatus which has been given to the frog by nature. For the hands, he has a large membranous fin which is held to its place by loops passing over the fingers and a strap around the wrist. The surface presented to the water by these fins is so large as to add greatly to the effectiveness of the strokes of the arm, but not so large as to exhaust the muscular power. Their effect is to very much reduce the effort usually required in swimming. But the greatest ingenuity is displayed in the form and fitness of the fins for the legs, which are attached to the ankles, and are so formed that they act upon the water, both in the movement of bringing the legs and throwing them back. They act so finely in treading water, as swimmers call it, that one can really walk, if not on the water, at least in it. The difference between swimming with this apparatus and without it, is very much like the difference between rowing a boat with a handle and the blade of an oar. The old swimmer has no trouble in using the fins at first trial, and is surprised to find with what strength he can swim without exhaustion. He easily swims twice as fast with the apparatus as without it, and with it he can sustain himself for hours upon the water, or swim many miles.

Tungsten Colors.

Fine colors are prepared from tungsten, which, being permanent and little acted upon by heat, can be used to advantage on many occasions. Tungstate of baryta is a pure white; tungstate of nickel, clear green; tungstate of chromium, dark green; tungstate of cobalt, violet; tungstic acid, a beautiful clear yellow, passing into orange. Tungstate of soda is not employed in colors, but is recommended for rendering fabrics uninflammable; for this purpose it is better to combine it with phosphate of soda. Metallic tungsten was at one time supposed to improve the hardness of steel, but we hear very little of its use for this purpose, and it seems more probable that the accidental admixture of manganese was the real indurating constituent. It is also claimed that tungsten largely increases the magnetic power of iron.

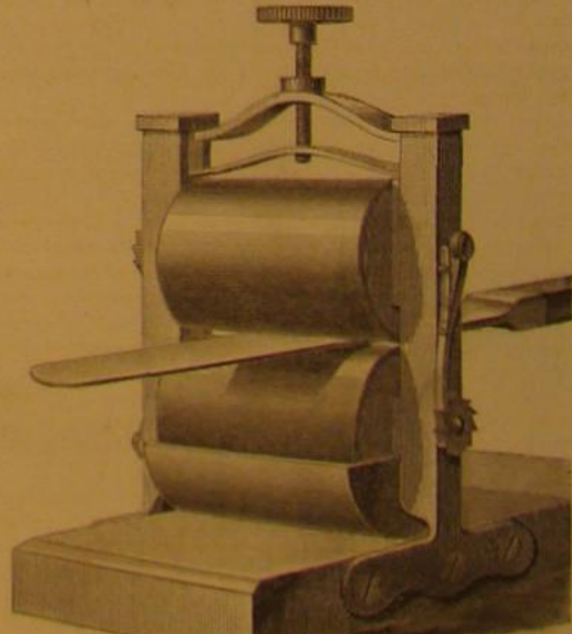
KNIFE CLEANER AND POLISHER.

This is a very neat implement, and we should judge a very efficient and convenient appliance for cleaning knives and forks, designed for hotels, restaurants, or private families.

The engraving illustrates the device so fully that only a few words of explanation are required.

Two elastic faced rollers are mounted in the uprights of a suitable frame as shown. The lower part of the bottom roller is inclosed in a trough for holding the brick dust, emery, or other polishing material. Each roller is controlled by a ratchet and pawl, so that it can only turn in a direction opposite to that in which the other can turn. The rollers are pressed together by a spring, which is adjusted to give the requisite pressure by a screw at the top of the frame.

In use, the knife to be cleaned is thrust in between the rollers, one of which turns while the other is held from turning by the ratchet and pawl. As the knife is drawn back again, the roller which first turned is held and the other one turns, each alternately turning and remaining stationary as the knife is drawn out and thrust in, and thus dividing the labor between the two strokes, rapidly cleaning the knife and giving it the required polish.



This knife cleaner is the invention of William S. Beebe Joseph T. Baynes, and Abraham King, whom address, for further information Watervliet, N. Y.

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(Illustrated articles are marked with an asterisk.)

ACCURATE WORKMANSHIP.

It has been truly said that no work of human hands is perfect, and that though we may strive to our utmost to secure entire accuracy in workmanship, it will be forever beyond our reach. On the other hand it has often been asserted that the works of Nature are perfect, that they are far superior in every respect to human handiwork, and upon this assumption many a moral homily has been based.

That this proposition has been so generally accepted, affords a forcible instance of the readiness of mankind to accept as truth whatever is presented to them as a generalization. Formulate an idea and lay it down as a proposition, and nine out of ten will accept it as true, because five of the nine will lack the power to detect its falsity, and the remaining four will have too much indisposition to the mental labor involved in logical reasoning, to test whether the proposition be correct or otherwise. About four tenths of the human race are mentally lazy, five tenths are so credulous as to accept anything as a principle which is clothed in the garb of a generalization, and certainly not more than one tenth think for themselves.

Only in one sense are the works of nature more perfect than the works of man. In their adaptation of complicated means to ends, they are for the most part unquestionably above any human production. Yet even on this point there is much illogical inference. We once heard a Professor of Anatomy, in lecturing on the hand, speak of its complicated structure and its marvellous machinery, as one of the greatest evidences of a beneficent design pervading creation. Five minutes later he spoke of the carpal bones and their investing ligaments as being peculiarly liable, on account of their structure, to obstinate and deep seated inflammation when injured; but he did not adduce this as an evidence of a beneficent design. Yet surely there is as much reason to believe that all the effects of a peculiar construction are designed as that one of them is.

But turning our attention to the mechanics of nature, we find that, so far as perfection in form is concerned, human work may stand well in a comparison. It has been said that the types of all the forms employed in the arts are found in Nature; but if we admit this, we shall find on examination that these types are in the majority of instances extremely imperfect. Nowhere in Nature is found a perfect sphere, a perfect cube, a perfect square or prism. We look in vain for perfect cylinders, for absolutely straight stems of trees, for filaments perfectly uniform in size throughout. No individual of any species exactly resembles any other, and even the elementary parts of animal and vegetable structures differ from each other. The anatomist might dissect a thousand subjects without finding two femoral bones that would not differ in some way; and even in the same body the corresponding parts on opposite sides are often found to be somewhat different. So much for the uniformity and mechanical accuracy of natural things. If man's mechanical productions are not perfect, they excel in the particulars named.

There are many practical difficulties in securing accuracy in construction, but we shall find that they may be placed in two categories. The first category includes our own imperfections. These are nature's imperfections. Our vision is so limited that, in very fine work, we must supplement it by the magnifying glass and the microscope. The command of mind over muscle is so far from absolute that, even when the former has been trained to command and the latter to obey through long years of practice, the control of the one and the obedience of the other are still defective. Eye and ear and touch, all tell us falsehoods and never more than approximate to truth.

The second category is found in the lack of rigidity in the materials which we use. Even the diamond, the hardest substance known to man, is elastic and changes its size with every variation of temperature. Nothing we can touch is precisely alike under any two different sets of circumstances. Some things change by absorbing or losing moisture. Others when once changed never resume their original form. So mobile is matter, that a toy cart drawn by a baby hand over a stone floor will generate vibrations the waves of which flow along through the granite, through the legs of the most solid workbench, and set the particles of the material in hand dancing to an entirely new step. All matter through out the universe, though some of it may seem to the superficial eye to be at rest, is in constant agitation. While the large masses are whirling through space with inconceivable velocity, the smaller masses—molecules—are each moving through what may be—for all we know—even wider orbits in proportion to their size, than those of the sun, moon and stars. The slightest external change is followed by a change in their movements. A man goes on board an ocean steamer with a shingle nail in his pocket, and instantly the compass needle in the binnacle feels the fact, and varies somewhat in its indications. Change, change, is written upon each and every atom of the universe. Nothing shall be constant, nothing shall be uniform. The combined intelligence of mankind cannot command a force strong enough to chain one infinitesimal atom. Endless variety—nothing stable—this is a fiat from which we vainly strive to escape, and to which we cannot find one solitary exception.

HIGH AND LOW STEAM.

An error prevails somewhat extensively among steam users who have not studied the theoretical principles of steam generation, which we propose briefly to correct. It is erroneously supposed that high steam contains much more heat than low steam, and that on this account it will be more efficient in heating buildings and driving engines. We would say to those who entertain this notion that a pound of steam at any pressure contains practically a constant number of heat units. In other words, a pound of steam at either low or high pressure will raise the temperature of a given quantity of water the same number of degrees. This has been thoroughly proved by experiment, the variations from the law being too small for notice in common practice.

It is only the sensible heat of steam which is measured by the thermometer, (the temperature), that increases under pressure, and this increases only as the latent heat diminishes so that the sum of the two is always a constant.

These being facts, it is certainly folly to incur the greater danger of high steam for heating buildings. The low steam will, pound for pound, both in evaporation and consumption, heat just as many cubic feet of air space as high steam.

But although the theoretical working power of steam is measured by the heat it contains, in practice there is a gain in using high steam for propelling engines. Steam generated under pressure is capable of expanding more than low steam, and as this expansive power can be made to perform work, there is a practical economy in using as high pressures as safety will admit; not that the steam contains the power to do more work, but that we can utilize a larger portion—a small proportion at best—of its working capacity. It follows that it takes no more fuel to produce a pound of high steam than a pound of low steam. There is, however, with high temperatures resulting from increased pressure, a greater loss through radiation, to make up for which more fuel will be consumed.

It may be asked: If these things be so, why, in testing the evaporative power of boilers, is it recommended to evaporate under atmospheric pressure? Why will not one pressure do as well as another, provided the proper allowance for radiation is made? We answer that it will make no difference at what pressure we make the test, provided we can keep the pressure uniform. There is usually more or less difficulty in maintaining a constant high pressure, while, with free discharge of steam, there is none in maintaining the atmospheric pressure. It is only for convenience sake that atmospheric pressure is considered by some as more desirable.

In conclusion, we would say that the heat which passes from boilers in the steam generated is the true measure of their working capacity. The heat which passes out in water mechanically suspended does no work. It is only then when the true proportion of the mechanically suspended water is determined that the working capacity of boilers is properly tested.

THE LATE JAMES FISK, JR.

The man whose name heads this paragraph achieved, in a very short time, a prominence in the railway and financial world that has given an interest to the circumstances of his death which his personal merits and character would never have elicited from the public. Our columns are no place for condoning the faults of the deceased by expatiating on his amiability and generosity, nor for homiletics on the scandalous and flagitious vices of which he and, we regret to say, his popularity were very largely composed. Cowardly and wanton assassination has cut him off in the midst of all his notoriety, wealth and pleasures; and New York, amidst the many black deeds that have been committed within her borders, has no greater stain upon her reputation than the murder which has just been committed.

It is difficult to account for the continued existence, in our midst, of so large a number of persons ready to commit the darkest and most violent crimes upon little or no provocation. The absurd and cowardly habit of carrying concealed weapons has much to answer for in this particular, and the great quantity of intoxicating liquors consumed by a large portion of our population is the chief cause for their production and use on the slightest pretext. But the bravado of the murderer obtains its principal stimulus from the fact that the law is full of uncertainties, that political influence and money have a protective power even under the shadow of the gallows, that, against the most adverse circumstances, a long delay is sure to be accorded to the guilty, and that thus the world may cease to take an interest in the matter, as we have often seen occur in our rapidly changing and effervescent state of public opinion. We are justified in these statements by the events which followed the crime of Foster, who murdered Mr. Putnam on the latter's alighting from a street car. The popular indignation against the dastardly perpetrator of this outrage was very great, and inquest, trial, and condemnation followed its committal with a promptitude which is an integral part of the majesty of the law, and the chief means of prevention of crime. But before the day of execution arrived, the culprit was reprieved by one of the hole-and-corner legal processes which discredit the whole American nation and people; and before long the murderer, the object of as righteous an indignation as ever animated the public mind, will probably be let loose to prey once more on society. It is by such precedents as that of Foster that crimes like that of Stokes are created and encouraged; and it may require the commission of a few dozen more outrageous villanies to get the popular sentiment on this subject into a condition more permanent and beneficial than a mere temporary frenzy.

It is quite time that some trustworthy system of administration of the laws was introduced into our social affairs. At present, with a vehement outburst of indignation at the time of the crime, followed by utter indifference to the sequel, and with political intrigue, corrupt judges, and monetary influence as complications, the process of the law is less certain and less logical than are the freaks of a gambler's fortune. If the wicked act which we now deplore does something to awaken the people, these lines will not have been written, and James Fisk, Jr., will not have died, entirely in vain.

TEACH THE CHILDREN TO DRAW.

Teach a child first to read; not merely to speak words in the order in which they occur, but to read understandingly, slowly, and carefully for ideas. Next teach him how to use numbers in arithmetical calculations, and show him that in all the business of life, in all its study, in all its science, the statement of facts in figures is the most important element. Then teach him to draw. You may stop your teaching right there, if you will, and rest confident that, if the boy thus taught has any disposition to mental acquisition, he will find a way to make it. Not that further good teaching will not greatly assist his progress, but that the acquirements named form a solid foundation upon which he *may* and, if his tastes are for learning, *will* build a noble superstructure.

The fundamental value of the two first elements of education named are generally appreciated by educators in this country; the third is only beginning to be appreciated. In the Boston public schools, drawing is now to be made a part of the course of study. The teachers are, we are told, to be taught how to teach drawing, at least such of them as have not the requisite knowledge. This accomplishment should be a part of every teacher's legal qualifications for employment in a public school, not merely because it enables him to give lessons in drawing, but because in the present age the power to draw rapidly and well is a means for the expression of ideas scarcely inferior to language; nay, without which it is impossible to convey certain ideas at all, in the absence of the objects delineated by the skilled pencil of the draftsman.

We cannot carry with us in our pockets geological and mineralogical cabinets, collections of shells and plants, museums of machinery and galleries of art. The power to represent such things as we cannot have at hand in talking about them has become essential to every one who aspires to anything like eminence in science or the arts. Even in walks of life not intimately connected with science and art, (daily becoming fewer) the power to draw is one that often saves time and money.

We speak, of course, more particularly of free hand drawing. Mechanical or geometrical drawing, as it is called, pertains to certain branches of business which will engage only a few out of the many youths now in American schools. A knowledge of it and skill in it can easily be acquired after the other, and will be attained by those who find it necessary to their callings.

No study so interests the young as free hand drawing. It does not weary as do studies which exercise the mind without practising the hand; and if the pupil is put to it in early youth, it cultivates a habit of keen and thorough observation which of all things is the most important discipline to which a young mind can be subjected.

The fault of superficial observation will scarcely ever be found in a pupil who has been taught to sketch from nature. Perhaps no greater or more universal fault than this can be met with in the men and women of America. As a rule, things are glanced at, not seen. In all matters except accounts, we are as a people inaccurate. Hasty, careless, we plunge along headlong, and things pass by us in a confused stream, as do the near objects we view from the windows of an express railway train.

Now while we advocate rapidity in all matters of mere motion, and never yet traveled a hundred miles by a quick train without wishing we could do it quicker, we know that we defeat one of the main objects of life when we attempt to force our minds beyond their normal pace. Let us refuse to look at things at all, rather than to waste time by a half look.

We believe the fault in American character would be greatly remedied by a system of general instruction in free hand drawing, and that the effects upon progress of the discipline thus obtained would be felt most favorably in all the other departments of study pursued in our schools. It appears somewhat astonishing that this fact, proved by years of experience in Europe, should have remained so long unrecognized by American educators.

THE STUDY OF BOTANY.

The study of botany has claims to far more general favor than it receives. No science can be pursued with greater facility, without the aid of a living teacher. It requires but an inexpensive apparatus. A good magnifying glass, small pincers, a press for preparing specimens, a tin box for collecting plants, a pocket knife and a good text book are all that are needed. Any section of country affords ample scope for filling a herbarium, which, by exchanges, can be made as complete as desired. Specimens are easily preserved, and when well cared for, always afford great pleasure in their exhibition.

The advantages of the study are, besides the pleasure derived from any healthy mental occupation, the healthful exercise of body in searching for specimens, the cultivation of the finer tastes, and the vast fund of useful information to be obtained. The dependence of mankind upon vegetable products, for supplies of food and clothing and articles of luxury, is greater than upon either the animal or mineral kingdoms. The animals that give us labor, or from which we obtain food, derive their sustenance from vegetables, and thus indirectly plants are made to contribute to the direct demands made upon them for the sustenance of the human family. A large number of the medicines that we rely upon to cure "the ills that flesh is heir to" are of vegetable origin. We adorn our homes by surrounding them with beautiful flowers, and even the resting places of the departed are made attractive by the sweet scents and exquisite colors of the floral realm.

It is pleasant enough to inhale the fragrance and to feast the eye upon the softly shaded tints of beautiful flowers, but there is all the difference, in the pleasure ordinarily derived from this source and that afforded through the intelligent inspection of flowers by the skilled botanist, that exists in the degrees of delight, derived by cultivated and uncultivated ears from music. To the botanist, there is far more in flowers and foliage than mere color and odor. There are delicate structures, each of which has a definite purpose and meaning. There are beautiful analogies, properties hidden from the common eye, and nice relations which form a basis of classification. All of these things are delights to the minds that comprehend them.

But there is practical profit in the study, as well as unfailing pleasure. Every intelligent farmer ought to know something of botany. By it he often can tell when his land is in danger of being seeded with troublesome weeds, and can exterminate them before they overrun the soil.

We once lived in a rural neighborhood where the practising physician was a proficient in botany. He had doubtless saved the farmers of the county in which he resided thousands of dollars by his gratuitous hints. We once heard him give warning to a farmer, pointing to a conspicuous plant that reared its head above the fine green of a luxuriant meadow. "Pull up by the roots every weed of that kind that you see on your farm." There were few, and it would have cost little to obey the good doctor's injunction. It was disregarded, and three or four years later the farm was literally seeded with a plant till then scarcely known to any farmer in the region.

But little need be said by way of instruction to those who may be induced by our remarks to undertake the study of botany. The driest part of the study, as sometimes taught, is the terminology and nomenclature. Instead of attempting to master all this at once, the better way is for the student to commence with a plant specimen, and endeavor, by means of the analytical method explained in all good text books of botany, to ascertain its name and properties, looking up the necessary definitions as he proceeds. A flower of good size and of simple structure, such as an apple blossom, a butter cup, or sweet briar blossom, should be first undertaken, the many rayed, composite flowers being more difficult. By pursuing this course, the task of learning many definitions is distributed so much as to be almost insensibly accomplished.

The practice of preserving specimens should always be followed. Nearly all text books describe the proper method of doing this, and we need only add to their directions that success in it depends principally upon the patient thoroughness with which the work of laying down the plants in papers for pressing is performed. A plant well pressed is easily mounted so as to look well, while one ill pressed is not worth mounting at all.

Some of the best and most instructive studies in this latitude are found in plants that appear in bloom while the snow has scarcely melted away in the spring. Indeed we have often found anemones and trailing arbutus on the sunny side of a knoll while the snow still rested on the other, and one must start early in the season to find some of the crowfoots in blossom. How many of our young readers will make a beginning next spring?

PURE AIR.

We recently heard a Professor of Chemistry say that the greatest curiosity in his cabinet was a specimen of pure iron. This metal, which is present everywhere, is so difficult to obtain free from impurities, that not half a dozen men on the face of the globe have ever seen it. We are beginning to entertain the same opinion of pure air. Of all the chemical mixtures known to the man of science, we doubt if any gases are so rare as pure and unadulterated air. If it starts right, it soon gets mixed up with organic germs, dust spores, mephitic gas, carbonic oxide, sulphuretted hydrogen, cholera in disguise, and typhoid in odors, until plants wither and animals die, and lamps cease to burn. That this should be the condition of things is not astonishing; on the contrary, the chief surprise is that, with all mankind diligently engaged in filling the waters with pollution and the atmosphere with gases, we are not worse off than we really are.

The habits of the present generation are such as to give rise to more refuse matter and poisonous products than those of previous ages. The fuel we use, the articles we manufacture, and the waste of sewage, combine to create more impurities than were known to our forefathers; and if it were not for the fact that science has given us remedies, nearly in proportion to the increased evil, our population would diminish under the high pressure system which at present prevails. Considering this state of facts, it is not at all astonishing that the attention of Sanitary Commissions, Boards of Health, and Parliamentary Committees is called to the subject, and that we hear of so many reports and propositions to remedy the evil.

The recent illness of the Prince of Wales has occasioned an inquiry into its probable cause, and we see that it is traced to the imperfect sewage of the district of country where this nobleman's party were recently hunting. The disease, from which the Prince appears to have fortunately recovered, is called typhoid, or more properly "night soil fever," and "cess pool fever." Since its rise has been unmistakably traced to disorders of the intestines, the medical faculty have been disposed to give it the name of *enteric* fever; and by this name it appears likely to be henceforth known. The approach of the fever is, in most instances, slow and insidious, and hence the particular occasion on which it was contracted is often overlooked; but all authorities agree that the foul air, proceeding from sewers and cesspools, is the chief cause of this form of disease. By reference to the reports of the Metropolitan Board of Public Works of London, it will be seen that different experiments were made to improve the ventilation of the sewers; but all of them were declared to be too expensive, and no other way could be found than to allow the gases for the future to continue to escape from the middle of the streets. To burn the gases by means of high chimneys would take two hundred and fifty furnaces for the city of London alone, at the cost of two millions of dollars, and a yearly outlay of half a million for fuel, exclusive of the wages of labor. To disinfect the sewers of a large city chemically would be a worse undertaking than pumping out the ocean by Paine's magneto-electric machine. It is evident that both of these schemes are impracticable, and the contamination of the air and water is likely to go on for ever if no better remedy can be found. But this is not all; the present system of sewage acts as a destructive agent in other ways. It not only pollutes the water and gives rise to pestilent fevers, but dilutes a most valuable manure, and destroys it for all useful purposes. We spend fabulous sums of money to destroy the very article which, if properly treated, would be worth millions of dollars.

Now suppose some inhabitant of Mars were to visit our earth. He would naturally be received half way by a self-appointed committee of our first citizens, and, in the course of the inevitable *fêtes*, balls, dinners, and receptions through which he would be obliged to pass, might be shewn through a house "replete with all the modern improvements." The water arrangements, upon which we particularly pride ourselves, would be pointed out, and then would come a sail around the city at low tide, when the mouths of the sewers would be belching forth their greatest stench; and the practical side of the question would be exposed to view, and the chairman would deplore the fact that, in spite of our scientific knowledge, we were unable to abate this nuisance, and he was sorry to inconvenience his noble visitor, and he would about helm and get out of it as fast as possible.

What opinion would this son of Mars form of our boasted civilization? In one place he is shown where we pour the noxious matter in; and where it comes out we deplore our inability to neutralize its deleterious effects. He would probably ask: *Why pour it in at all?* And that would show us at once where the Columbus egg of this difficulty lies, and afford the solution. Why pour it in at all? Why pump water up hill to let it run down? Why spend millions to undo what never ought to be done at all?

It is evident that the building of such works as the Thames embankment, the construction of great chimneys to carry off foul gases, and the immense loss to agriculture, could be avoided if we applied the remedy at the outset, and that would be by using the ounce of prevention and disinfecting all animal matter by dry earth, and never allowing it to pollute our waters.

While our water arrangements appear to us, individually, a great convenience, they are, collectively, the fruitful source of most of our diseases, and ought to be differently regulated.

In spite of all precautions, much impurity would be likely to find its way into the sewers: but the worst evil could be stayed, and disinfecting rendered substantially unnecessary. Pure air is irreconcilably hostile to contagious disease. If we cannot aspire to have it out of doors, it is in vain to look for it in factories, shops, and overcrowded houses.

Nearly all writers on this subject expend all their force and arguments in favor of a complete system of drainage and sewage. We would not gainsay the value of these precautions, but would again repeat that the true remedy is to stop filling the sewers with matter that no power can afterwards cleanse.

> "The river Rhine, it is well known,
> Doth wash the city of Cologne;
> But tell me, nymphs, what power divine
> Shall henceforth wash the river Rhine?"

PORTABLE FIRE EXTINGUISHER.

The value of a ready means of extinguishing fires at their very commencement has often been dwelt upon in these columns. We have shown, by facts, figures, and argument, that a large proportion of all the fires which occur could, by such means, be extinguished before extensive damage occurs.

Without making invidious distinctions between the portable fire extinguishing apparatuses now in use, we may well refer to the history of a single one as ample proof of the correctness of our position. We refer to that known as the Babcock Fire Extinguisher, which has made for itself a most honorable record, and is becoming quite extensively introduced. We have not space to enumerate the large number of fires which have been almost immediately extinguished by this machine, but the number is very great. A few words, however, as to the origin of the present form and use of the device, may not be uninteresting.

The original machine was of French origin, and is known as the Carlier and Vignon Machine. To this machine as a starting point, have been added a great number of American improvements. Observing the bulletins of the Northwestern Fire Extinguisher Co., 407 Broadway, New York, announcing the dangerous fires that have been recently controlled at the outset by the use of these portable extinguishers, we have taken pains to investigate its claims upon public favor, and are satisfied that it deserves to rank among the best of modern appliances for saving property.

The machine as now used employs what is known as the Bate and Pinkham mode of charging, by which the liquid acid and the solution of bicarbonate of soda are kept separate until the apparatus is required. By this means there is no gas generated except at the time of using, and consequently no loss of gas or strain upon the cylinder during the intervals. The moment the two materials are allowed to commingle, which is done by simply pulling out the knob of a stem which controls a stopper, a large quantity of carbonic acid gas, in which no fire can live, is generated under great pressure which forces out thoroughly mingled water and gas in a fine, small stream through the nozzle of a small hose, provided with a stopcock to control the flow. Suitable arm straps enable the person using the device to place it upon his back, leaving his hands free to direct the flow from the hose.

A very small portion of the mingled gas and water, a mere film, is sufficient to extinguish a fire that has not been so long in progress as to heat the burning material through and through to the point of ignition. The gas extinguishes the flame, and the water cools the material, a most scientific combination.

It is becoming quite common for merchants and manufacturing establishments to have one of the extinguishers on each floor of their building, ready for immediate use.

It occupies not much more space than a water pail, and no more skill is required to operate it than pouring a bucket of water on an ignited floor.

SCIENTIFIC AND PRACTICAL INFORMATION.

FORTIFYING RAILWAY STATIONS.

Some years since the subject of permanently fortifying important railway stations was discussed by the Prussian Government and abandoned as impracticable. Russia has, however, taken up the project and is putting it into actual practice. The two frontier termini of the Brest and Kiew railways in the direction of Austrian Poland are thus being protected by a citadel and a few outlying forts, probably destined to be the nucleus of a consolidated military fortress in the future.

TEST FOR SILK FABRICS.

The *British Trade Journal* states that Mr. John Spiller, in the course of some investigations made last year, found that hydrochloric acid was an energetic solvent of silk, although it left wool and cotton unacted on, at least for a lengthened period. The practical bearing of this discovery was exemplified by the immersion of several so-called pure silk ribbons and other fabrics in the acid, when the silk was dissolved away, leaving the threads of the adulterating material intact; thus by obtaining a small sample, and immersing it for a few seconds in the hydrochloric acid, or preferably by dropping a little of the acid on the center of the sample, if it be pure silk a hole will be produced; but, if impure, the threads left will immediately indicate the nature and extent of the adulteration.

METEORIC IRON IN GREENLAND.

The Swedish arctic expedition has brought home a number of masses of meteoric iron found there upon the surface of the ground. These masses vary greatly in size, the largest weighing 49,000 Swedish pounds, or twenty-one tuns English, with a sectional area of about forty-two square feet. This has been deposited in the hall of the Royal Academy at Stockholm. Another piece, weighing nine tuns, has been presented to the Museum of Copenhagen. These specimens considerably exceed in size the famous mass at Yale College, which weighs 1,635 pounds, but are not larger than some blocks that have been observed in parts of South America. The Swedish chemist Berzelius was one of the first to examine meteoric iron to see if it contained elements different from those found on minerals of terrestrial origin; but he never detected anything new. This result is rather disappointing, as meteoric iron is now believed to come from sources outside of our world.

ILLINOIS AND ST. LOUIS BRIDGE.

This important work is progressing successfully and rapidly. The St. Louis *Railway Register* states that thirty-eight of the large skewback anchor steel bolts to be used in the bridge have arrived. The work of putting them in place has been begun, and there will be no further necessity for delay on their account. The yellow pine and white oak to be used in the construction of the bridge have also begun to arrive. The pine is from Georgia. The oak is from Southern Illinois. Both the pine and the oak are of the best. Work will be commenced in this department at an early day.

HOT WATER PIPES AGAINST WOOD WORK.

We are asked whether these are dangerous. Our own opinion is that no fire ever originated from hot water pipes or from low steam pipes, except where materials liable to spontaneous ignition have been placed on or near the heating apparatus. Artificial heat will, of course, increase the probability that oily wool, greasy wood, metal cuttings, etc., will take fire. The ordinary wood work of buildings will not ignite at 212°.

LA FEUILLE DES JEUNES NATURALISTES.

A journal of a most interesting and valuable kind, under the above title, has recently entered upon its second year. It is published in Paris, and its object is to become a means of communication and mutual instruction between such French youths as are willing to devote their leisure hours to the study of natural history. The facilities for such pursuits are great in France, as almost every large school has has its own museum, containing specimens culled and arranged by the boys themselves. The editors, with commendable liberality, invite communications from young naturalists in other countries, promising to translate and publish any which shall be found suitable for the pages of this magazine.

EVAPORATION OF CHLORINE.

Those of our readers who use chloride of lime in manufactures are well aware of the quantity of the chlorine which escapes from the salt, and is lost. A good test for determining the amount of free chlorine has recently been published by Dr. Graeger. He takes a dilute solution of strongly acidified protosulphate of iron, and triturates it with a one tenth solution of permanganate of potassa. The compound must be kept in a close stoppered bottle. A solution of a weighed portion of the bleaching powder to be tested is added, through a pipette, to a portion of the protosulphate and permanganate solution in a stoppered flask, and the bottle well shaken. After this has stood a short time, the amount of protosulphate of iron undecomposed is estimated by means of the permanganate solution. One gramme of bleaching powder, containing 0·3546 grammes chlorine, requires 0·278 grammes protosulphate of iron; but the reaction is made additionally certain if the above named quantity of the iron salt be doubled. Care must be taken that ammonio-sulphate of iron is not used, lest that most dangerous explosive, chloride of nitrogen, be formed.

BREAKWATERS.

The obvious desirability of these important constructions, in situations where the water is deep and the expense of laying foundations, to say nothing of the superior erections, is very great, has frequently attracted much attention to the question of floating breakwaters. It has been recently asserted by an eminent authority, that at a depth of fifteen feet below the surface, wave action is reduced to a nullity, or zero; and experiments fully prove the correctness of this calculation. Of the great economy to be effected by a floating breakwater, with at least fifteen feet of material below the average horizontal line of wave motion, there can be no reasonable doubt; for an estimate of the cost of building breakwaters in the usual manner, namely, on a solid foundation, is given by an English engineer as ranging from $750 to $2,100 per foot run; and the splendid erection of this kind at Plymouth, England, which secures calm water to a large bay while the sea outside is one of the most tempestuous known in the world, costs $75,000 a year to keep in repair. Mr. Thomas Cargill, C.E., in discoursing on the subject before the Society of Engineers, London, Eng., points out that the idea of a floating protection to a harbor is probably derived from the observed action of sea weeds. The Gulf weed always has calm water to leeward, although the enormous masses of it seldom are more than twenty-four inches deep in the water. In these days of cheap iron construction, a system of connected iron cylinders, securely fastened together and anchored at the ends might prove valuable, especially as the protection of iron from the action of salt water by cement is now known to be practicable and thoroughly efficient.

NEW BOOKS AND PUBLICATIONS.

SCIENCE RECORD FOR 1872. Being a Compendium of the Scientific Progress and Discovery of the Past Year. 400 pages, octavo. 100 Engravings, Steel Plate and Wood. Handsomely bound in muslin, $1.50: extra binding, half calf, $2. Munn & Co., Publishers, 37 Park Row, New York, Office of the SCIENTIFIC AMERICAN.

This new and elegant work presents, in convenient form, notices of the leading subjects and events, pertaining to science, that have occupied public attention during the past year. The progress of the more important public works is duly chronicled, with illustrative engravings. The leading discoveries, facts, and improvements, in chemistry, mechanics, engineering, natural history, and the various arts and sciences, are recorded and illustrated. Sketches of prominent scientific men, with illustrations, are given, and among the portraits are those of Faraday, Murchison, Darwin, Agassiz, Huxley, and Herschel. The Mont Cenis tunnel, the Hell Gate works, the Brooklyn suspension bridge, the Hoosac tunnel, the St. Louis bridge, the United States Patent Office, and other works are illustrated. A large amount of useful information, tables, descriptions of improvements, with engravings, are likewise presented. The book is one of much interest and value, and should have a place in every library.

THE NATIONAL ENCYCLOPEDIA. A Compendium of Universal Information, Brought down to the Year 1871, with the Pronunciation of Every Term and Proper Name. By L. Colange, L.L.D., Editor of Zell's Encyclopedia. Illustrated with five hundred wood engravings. Complete in eighteen numbers. New York: Francis B. Felt & Co., 91 Mercer Street.

The first two numbers of this work are received. As a popular work of reference it gives, in a compressed form, a vast fund of general information. Specimen numbers will be sent to any address on application. It is issued semi-monthly, at 40 cents per number.

THE MANUFACTURE OF RUSSIA SHEET IRON. By John Percy, M.D., F.R.S., Lecturer on Metallurgy at the Royal School of Mines, London, and to the Advanced Class of Artillery Officers at the Royal Artillery Institution, Woolwich, Author of "Metallurgy." With Illustrations. To which is added an Appendix on American Sheet Iron. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut Street. Price, by mail, free of postage, 50 cents.

This is a pamphlet, containing an alleged exposition of the secrets of Russia sheet iron. Those interested in metallurgy will find it an interesting contribution to metallurgic science.

LORD BANTAM. A Satire. By the Author of "Ginx's Baby." Author's Edition. New York: George Routledge & Sons, 416 Broome Street.

Those who have read "Ginx's Baby" will need no assurance of ours that its successor, "Lord Bantam," will repay the reading. The sharp pen of the author scarifies whatever and whoever it touches, but in a good humored way that redeems it from the charge of bitterness.

THE HOOSIER SCHOOLMASTER. A Novel. By Edward Eggleston. With twenty-nine Illustrations. New York: Orange Judd & Co., 245 Broadway.

This is a graphic picture of "Hoosier" life, entirely free from any thing morally unwholesome, and possessing elements of popularity second to very few recent publications of its kind.

A HAND BOOK ON SILEX. Embraced in Three Practical Treatises. I. On Soluble Glass, and all its Applications in the Arts. II. On Glass Making in all its Details. III. A Guide for Soap Making; the Manufacture of all Soaps, and their Manipulations. Containing a large Number of Useful Formulæ for Rendering Wood and Timber Fire and Dry Rot Proof, Silicifying Stones, Mortars, Cements, and Hydraulic Lime, White Washes, Paints and Cements, and How to Protect Wooden Shingles, Pavements, Railroad Sleepers, etc., etc. By Dr. Lewis Feuchtwanger, Chemist and Mineralogist. New York: Published by L. and J. W. Feuchtwanger, No. 55 Cedar Street.

This book contains much of the subject matter treated in the author's original work on soluble glass, the first edition of which is exhausted, the two departments on glass making and on soap making, having been added. The author has had a large experience as a practical chemist, which is in this work placed at the command of such as wish information upon the subjects enumerated in the title.

CHICAGO AND THE GREAT CONFLAGRATION. By Elias Colbert and Everett Chamberlain. With Numerous Illustrations by Chapin & Gluck, from Photographic Views Taken on the Spot. Cincinnati & New York: C. F. Vent. Chicago: J. S. Goodman & Co. Philadelphia: Hubbard Brothers.

This volume supplies information in regard to the material prosperity of Chicago antecedent to the great fire, a full account of the fire, and the condition of the city subsequent to the catastrophe. It is a large octavo of 528 pages.

HANNA'S COMPLETE READY RECKONER AND LOG, TABLE, AND FORM BOOK. By J. S. Hanna, Lumber Inspector, Lockhaven, Pa. Philadelphia: J. B. Lippincott & Co., Nos. 715 & 717 Market Street.

This is a very handy and reliable pocket manual, for those who have to perform calculations relating to measurements of lumber and other building materials, wages, board, rent, etc., etc.

NEW YORK OBSERVER YEAR BOOK FOR 1872.

Improved from their last year's issue, both in contents and appearance. It contains a list of all the Protestant clergymen of the country, classified into the various denominations, and other ecclesiastical information not attainable elsewhere. Price $1. New York Observer, 37 Park Row, N. Y.

THE HOME FIRE INSURANCE COMPANY, Broadway, N.Y.,

Has issued a set of twelve beautifully illuminated calenders, neatly fastened together—very convenient and ornamental for the counting room or library. Each card has the calender for the month, and is embellished with an appropriate original design, printed in colors.

ALMANACS.—We are indebted to G. W. Childs, of Philadelphia, for a copy of The Public Ledger Almanac for 1872. The cover is embellished with patriotic devices printed in colors, and the contents comprise much valuable information. Ninety thousand are issued, and a copy is presented to each subscriber of the Ledger.

The publishers of "WORK AND PLAY," a magazine for children of both sexes, have issued an annual, containing directions for playing indoor and outdoor games, tricks, charades, etc. It is well gotten up and illustrated, and is from the house of Milton, Bradley & Co., Springfield, Mass.

TO CITY SUBSCRIBERS.

The SCIENTIFIC AMERICAN will hereafter be served to our city subscribers, either at their residences or places of business, at $3·50 a year, through the post office by mail carriers. The newsdealers throughout this city, Brooklyn, Jersey City, and Hoboken keep the SCIENTIFIC AMERICAN on sale, and supply subscribers regularly. Many prefer to receive their papers of dealers in their neighborhood. We recommend persons to patronize the local dealers if they wish the SCIENTIFIC AMERICAN or any other paper or magazine.

Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—Encke's Comet.—Will some of your readers inform me which constellation Encke's comet is in?—W. E.

2.—Gearing for Saws.—Is it practicable to run a circular saw, of 48 inches or more diameter, with a bevel gear instead of a belt?—A. K.

3.—Waterproofing Cotton Cloth.—I am making a tent of cotton cloth; is there any way in which I can make it waterproof?—H. W. U.

4.—Face Worms.—Can any of your correspondents give me a remedy for the grubs or face worms, so common about the nose?—H. E. A.

5.—Emery Belts.—We wish information as to the manner of making and using emery belts, on which to polish the prongs of fluting irons or tongs.—S. & B.

6.—Field Glass.—Is there any difference in the construction of a day and a night field glass? If not, how can I determine the night adjustment?—F. H.

7.—Shellac and Linseed Oil.—Can I mix shellac varnish with linseed oil, and form a preparation that will give some luster when applied to bare wood?—W. W.

8.—Cement for Sheet Iron and Rubber Packing.—Can any of your readers inform me how to make a cement that will unite firmly Russian sheet iron and thin rubber packing, and remain unaffected by changes of weather?—J. M.

9.—Varnishing Pitch Pine.—I am informed that some process has been discovered, by which varnish can be applied to pitch pine, so as to prevent the wood from turning dark and becoming dingy in appearance. Can any of your readers tell me how it is done?—J. H.

10.—Coating Iron with Quicksilver.—Can iron weights be coated with quicksilver, by using hydrochloric acid to effect the union? Will some one refer me to some work whence I can get a sufficiently clear account of the process to enable me to repeat it, or state the process for the public benefit?—T. H.'s S.

11.—Dimensions of Boiler Grate.—I have a marine boiler, 7 feet in diameter, 12 feet long, with grate surface 5 x 7 feet inside the boiler, which is cylindrical. The draft returns between two inch tubes. I would like to know if the grate surface is sufficient to burn shavings and cuttings.—B.

12.—Steam Boilers.—Mr. G. H. Gregory, of Toronto, Canada, in commenting on a letter from Mr. Nicholson, published on page 5 of our current volume, asks how it was that the motion of the steamer, in a sea so rough as that described, did not throw the water into contact with the upper row of tubes, which were red hot, and so cause an explosion.

13.—Proportions of Saw Mill Gearing.—Supposing the pitman and saw of a Muley saw mill to weigh 200 pounds, and be attached to a crank wrist of 26 inch stroke, and running at a speed of 350 revolutions per minute, how much counterbalance will be required, or, in other words, what proportion of the weight of saw and pitman is necessary as a counterbalance, to make the crank wheel run with the least vibration?—T. B.

14.—Frictional Electricity.—I have a battery of this kind—turning with a crank, and designed for medical treatment—that I cannot get to work; and I desire to get, from some of your many readers, a possible remedy. It turns freely; the mechanism is all correct. The permanent magnet is strong, and I can observe no derangement of the revolving magnet. I have examined all points of contact, insulation, etc., and have tried it with close contact and none at all, without success. What shall I do?—M. H. K.

15.—Compound Screw Gearing.—You have given an answer, furnished by J. P. N., of New York, to my query in regard to compound gearing; but unfortunately, I am no better off than before, as the rule given by J. P. N. will only apply to simple gearing, as I understand it. In speaking of compound gearing, I refer to those lathes on which the wheels, intermediate between spindle and screw, must be compounded. What I want is a quick method of finding the wheels without making elaborate calculations. As J. P. N.'s rule will only find the spindle and screw wheels, I take it for granted that he did not understand my query. Will he please try again?—R. F. S.

16.—Application of Light Engines to Saw Mills.—Since the war, steam threshers are being introduced into this part of the State; but, as most of the threshing is done early in the fall, many of them are idle during the winter. Some attempts have been made to use them for driving saw mills during the winter season, but none that I know of have been successful. Now, in theory it would appear that a ten horse power would saw half as much as a twenty horse power. Thus far, however, we have not been able to do that much with ours; so what we want to know is how to apply such power to get satisfactory results. Timber is scarce, but we frequently have large trees, requiring at least a fifty inch saw; so, to make the proportions more definite, we want to know how to apply a ten horse power engine to a fifty or fifty-six inch saw so as to give the best results.—Nemo.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

J. J. W., of ——.—White cedar, placed in the ground for fence posts, is very durable. We know some that has lasted more than sixty years.

M. M., of Mo.—We see no advantage in constructing boilers as you propose.

E. M. W.—You will find the subject of ice formation discussed at length in the Scientific American, Vol. XXII. We do not wish to reopen the discussion at present.

Oil in Winter.—To J. S., query 7, Jan. 1: By mixing kerosene oil with seal or sweet oil in a warm state, it will be prevented from getting stiff in cold weather. The right proportions will be found upon trial.—W. H. B., of N. J.

Etching on Glass.—F. H. can etch on his glass vessels as follows: Coat the object to be etched with a thin film of wax; then, with a sharp instrument, draw the desired characters carefully, cleaning the wax off in the figures; go to some chemist and get some fluoric acid, which must be handled very carefully. The acid comes prepared in metal bottles. Pour some of the acid in a small lead pan, which place in a still larger vessel filled with sand; heat the sand and place the glass object over the gas liberated from the heated acid, and it will soon be found to be beautifully etched. Great care must be taken when this is going on, for the gas, as well as the acid, is of a very deleterious character.—E. X., of Mass.

M. H. B., of Ill.—In order to trim a flat boat, would the excess of weight upon the heavy side be precisely double the amount necessary to carry to the light side? Ans. Yes.

Frictional Electricity.—This can and has been used for telegraphing. It is not as good as chemical electricity for the voltaic arch.—E. X., of Mass.

Preparation of Cotton Seed Oil.—Query No. 23, Jan. 6. Treat the oil with ozone or ozonized air; either will accomplish the desired result.—C. F. D., of N. Y.

Cleaning Paint Brushes.—J. G. M. should try soaking them in hot rancid grease.—W. H. B., of N. J.

Cleaning Castings.—Query No. 15, Jan. 1. I advise L. V. B. to try the sand blast for cleaning his brass castings.—W. H. B., of N. J.

Rotary Motion.—W. T. V., query 13, Jan 1, 1872, can impart rotary motion, of any desired speed, to the vertical shaft described, by a suitable train of gearing, actuated by a barrel spring.—J. M., of N. Y.

Back Pressure.—To R. R.: The back pressure upon piston will not be materially increased, provided you leave the end of five inch pipe open. Do not use any back pressure valve. The pipe must be laid so that it will not "trap." You should use long round bends instead of elbows.—J. M., of N. Y.

Gun Scattering Shot.—H. W., query No. 3, Jan. 1, can prevent his gun from scattering by inserting a ring about half an inch in width in the nozzle of the gun, beveling from the outer edge to nothing at the inward. It can be fastened in with rivets: it should be made of metal about one sixteenth of an inch in thickness, and be fitted very neatly.—W. H. B., of N. J.

Bronze Paint.—This can be made by mixing chrome green, two pounds, ivory black, one ounce, chrome yellow, one ounce, good Japan varnish, one gill. Grind all together and mix with linseed oil.—E. W., of Mass.

Gun Scattering Shot.—If H. W. will inclose his shot in strong, round paper cartridges, just fitting the band, his charge will not scatter very much. Cartridges may be formed over a round wooden stick, and glued with mucilage or any suitable cement.—H. E. A., of Conn.

Bronzing Iron.—To bronze iron, J. G. H. should obtain, at any paint store, a bottle of gold size and some bronze powder: mix the articles in a saucer to the proper consistency and apply immediately, as it soon dries hard. Any sort of brush can be used.—H. E. A., of Conn.

Fusing Sulphur.—F. C. A. can fuse his sulphur by a heat of 226° Fah. If the heat is carried above 450° Fah., the sulphur becomes dark colored and thick, like molasses. F. C. A. would do well to consult some book on chemistry.—H. E. A., of Conn.

Cement for Leather and Iron.—E. A., query No. 4, in No 1, present volume, can make a very good cement for leather and iron by making a compound of glue dissolved in vinegar, heated over a moderate fire; then stir in one third its weight of white pine pitch. This should be done in a glue pot, where it should be kept and heated whenever wanted for use.—J. L. T., of O.

Gun Scattering Shot.—E. A., January 1st, asks how his gun can be made to shoot closer. It can only be done by having the gun rebored, so that the bore shall taper towards the muzzle. There is, however, an article on this subject on the 394th page of Vol. XXIII, Scientific American. The Roper gun, made in Hartford, Conn., has a close shooting attachment, which consists of a ring of steel gradually tapering towards the muzzle (of the cap) which is screwed on at the will of the sportsman.—E. X., of Mass.

Compound Gears in Screw Cutting.—If R. H. S. will follow my example, he will find it both simple and reliable. Let him make a fraction of his leading screw and screw to be cut, with his leading screw for numerator. Now let him split these into factors, and by adding a cipher to each, he will have the gears required; but the numerators are always the driving gears. Suppose he wants to cut twenty-four threads per inch. Example 1: Four twenty-fourths is equal to (2 divided by 6) multiplied by (2 divided by 4). Now by adding a cipher to each, the gears will be (20 divided by 60) multiplied by (20 divided by 40). If he has not two twenties, let him increase one numerator and one denominator, say one fourth, which would be (25 divided by 75) multiplied by (20 divided by 40); if he still has not got these gears, let him alter them again until he finds a right set of gears. Now I will give him another method from the same factors. Example 2: Four twenty-fourths is equal to (2 divided by 3) multiplied by (2 divided by 4). By multiplying the first fraction by 12 and the other by 15, he will have: (24 divided by 36) multiplied by (30 divided by 120); or he can multiply by any numbers to suit his gears. If this is simple and reliable enough for R. F. S., I hope he will acknowledge it, as I have been solicited to write a book on screw cutting.—C. F., of N. J.

Tightening of Belts.—I notice in Vol. XXV., No. 21, that G. W. F. wants to know whether belts are tighter in wet or dry weather. In Vol. XXV., No. 26, E. O. McC., of S. C., says belts slacken in wet weather, and thinks that what he saw of a few (probably) new belts is a proof of the truth of his statement. Now I fully agree with E. O. McC. in answering the query, but I judge from a much broader observation than E. O. McC. or S. S. F. (Vol. XXVI., No. 1.) I have worked around leather belting for a number of years, and for the last three years have had belts of the following dimensions under my care: one 142 feet long by 36 inches wide; one 178 feet 6 inches long by 34 inches wide: one 85 feet 6 inches long by 34 inches wide. These belts are all double and made of the best of leather, all running from one fly wheel 30 feet in diameter to 6 and 7 feet driven pulleys. Now I know that on a damp day these belts sag from 6 inches to 18 inches more than they do on a pleasant day. I hear some correspondent say: Your machinery drives harder. Well, I will tell such that we were stopped eight weeks on a spinner's strike in the summer of 1870, and that, during all that time, the belt, half way between the pulleys, would indicate the state of the atmosphere as well as a barometer.—J. D. C., of Mass.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

Cements.—M. M.
Fire Kindler.—D. W.
Flying Machine.—W. F. W
Gas.—J. S. P.
Geometrical Problem.—W. P. M.
Latent Heat.—F. of T.
Massachusetts Institute of Technology.—W. O. C.
Mechanical Movement.—E. N.
New Steamboat Act.—T. W. B.
Psychic Force.—J. C. B.—P. P. H.—J. A. S.
Rupture of Boilers.—T. W. B.
Strains on Trusses.—J. McR.
To Smoke or not to Smoke.—E. E. S.
Answers to Correspondents.—S. E. C.—R. R. R.—C. S.—G. W.—P. L. S.—E. B. R.—O. C. W.—W. J. B.—W. O. B.—C. D. S.—W. Q. & Co.
Queries.—W. E. H.—W. J. P.—T. B.—C. G.—M. L. D.—W. E.—G. A. L.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

Shoe Fastening.—Samuel P. R. Triscott and George Alfred Wheeler, Worcester, Mass.—This invention has for its object to furnish an improved device for fastening the ends of boot and shoe laces, which shall hold the laces or strings firmly and securely. The device can be readily struck up out of sheet metal, in two pieces, so that it can be very easily and cheaply made, and, at the same time, can be ornamented in any desired style or manner.

Saw Filer's Vise.—Nathan H. Baldwin, Laconia, N. H.—This invention has for its object to furnish an improved vise for saw filer's use, holding the saw firmly, and enabling it to be adjusted in any required position. The foot of the vise rests upon the bench or support, to which it is secured by a hand bolt. The standard of the vise has its lower end jointed and secured to the upper end of the foot by means of a bolt and hand nut. To the upper end of the standard is pivoted the middle part of the rear jaw of the vise. Upon the lower edge of the middle part of the rear jaw is formed a half circle, having a slot formed in it upon the arc of a circle having its center at the pivoting point of the said jaw. A cross head bolt passes through the slot of the half circle, through a hole in the upper end of the standard, and has a hand nut screwed upon it, so that by turning the head of the bolt across the slot in the half circle, and tightening up the nut, the jaws may be securely held in place when adjusted. By a simple adjustment, the jaws may be reversed for holding the saw to joint the teeth.

Circular Saw Mill.—Melancton W. Danks, Fulton, N. Y., assignor to himself and J. E. Harroun, of same place.—The object of this invention is to provide convenient and efficient means for feeding, gigging back, and changing or varying the feed to circular saws, so as to adapt the feed to light or heavy work; and it consists in a series of bevel friction wheels, so arranged that, while the feed motion and the gigging motion of the carriage is produced by means of said bevel friction wheels, the feed may be varied at the will of the attendant, as may be desired or necessary. The inventor does not confine himself to any particular number of bevel friction wheels, nor to any particular diameter or proportion for either the sliding wheels or those on the feed shafts. Neither does he confine himself strictly to saw mill feed work in the application of his bevel friction wheels, as they may, he claims be applied with great advantage to many other purposes.

Adjustable Cut-off Valve.—George W. Smith, New Haven, Conn.—The valves oscillate in shafts. A combination of adjustable packing with grooved flanges of the ends of the valves, and with the slides, is employed A combination, of a walking beam provided with spring catches at its ends three armed plates, ropes or chains, and springs, with each other and with the valve shafts and driving shaft, is another of the claims. A combination of pins, spring, bent levers, and connecting rod, with spring toes, walking beam, and governor, constitute the third claim. We judge that the invention is calculated to give a very sensitive and efficient variable cut-off.

Hair Switch.—Benjamin Franklin Burgess, Jr., Boston, Mass.—This switch is made so as to be divided into three strands for braiding, composed partly of human hair and partly of thread or silk, or other suitable material. This thread portion is surrounded by the human hair, or forms the central portion of the switch, the arrangement being such that the human hair alone shows, and, being such, the natural hair of the wearer can be perfectly matched, which cannot be done with any dyed material. A switch, made according to this invention, will not get rusty like other artificial switches. It can be combed and braided the same as human hair, and, being composed of human hair and fine thread, keeps perfectly clean, and is entirely unobjectionable for ladies' wear.

Harvester.—John B. Thomison, Lynchburg, Tenn.—This machine is to be used either as a reaper or mower, and is so constructed as to rake the grain and drop it automatically upon the ground, in such a way as to place it out of the way of the machine on its next passage. As usual in this class of machines, the details are such as require diagrams for their illustration. We can only add, therefore, that the means employed for making the change from mower to reaper, and *vice versa*, are simple and easily adjusted, while the whole seems to be a substantial structure, capable of doing its work with small waste of power, and with little wear of parts.

Pruning Knife.—David Morris, Bartlett, Ohio.—In this invention, pruning is accomplished by a knife that slides toward and away from a stationary hook, said knife moving in guides, and being moved by a rod that runs through the tubular handle of the instrument. The extremity of said handle bears levers with cogged segmental heads, which engage with the serrations on the head of the rod, and enable it to be reciprocated, by working the levers, so as to move the sliding knife.

Smut Machine.—John Wernwag, Harper's Ferry, W. Va.—This invention relates to an apparatus which receives grain as it comes from the threshing machine in a hopper whence it is carried through a conveyor trough, wherein it is secured and wherefrom it is discharged into a revolving conical screen, within which it is beaten and separated from refuse grain and from which it is emptied into a fan by whose blast it is winnowed, the dust passing off through a trunk, the good grain falling through a spout, and the refuse grain being charged by a conveyor.

Car Couplings.—Franklin Nalley, of Battle Ground, Ind.—This invention has for its object to furnish an improved car coupling, so constructed as to couple the cars automatically when they are run together. By this construction, as the coupling link enters the bumper head, it pushes a catch back, which releases the coupling pin and allows it to drop into place, securing the link. By inserting the double coupling link in the upper and middle holes, in the middle and lower holes, or in the lower hole and beneath the bottom of the bumper heads, cars of different hights may be coupled with the same facility as if they were all of the same hight.

Spring Bit for Cleaning and Enlarging Wells.—James H. Boyd, of West Monterey, Pa.—The object of this invention is to produce a convenient tool for cleaning out or enlarging oil wells. The invention consists in the application, to the shank of the bit, of a spring for crowding it against the well, and of a catch for holding the spring close to the bit during its application to the well. When the tool is to be applied to a well, the spring is held close to the shank by the spring catch, so that the insertion of the tool will be facilitated. The projecting outer end of the catch at the same time holds the bit clear from the wall of the well, preventing it from scraping while being let down. As soon as the device is being worked, when in its proper place the catch will release the spring, causing the same to crowd the bit against the wall of the well. For enlarging a well, the bit is used with a long spring. In this case the spring will enter the smaller part of the well and cause the bit to work in the larger part of the same upon the shoulder. For cleaning out wells the short spring is used, which crowds the bit against the wall of the well for properly scraping the same.

Head Rest for Car Seat.—John C. Giffing, of New York city.—The head rest is attached to a base block, which rests upon the top of the seat when the head rest is attached. The head rest is secured in this position by two metallic straps. The ends of the base block are sawed in a distance equal or about equal to the width of the straps. The straps are bent to form square cornered staples. The front leg of the staple shaped strap extends down on the front side of the back of the seat. The back leg extends down on the back side of the seat, and may be shorter than the other leg. The width of the block is designed to be about equal to the thickness of the back of the seat, so that the legs of the two straps will straddle the back of the seat. In fastening the head rest to the back of the seat, the parts of the strap are slipped into the slots in the ends of the block, where they are fastened by pins. In leaning back or resting against the back of the seat, the person's back will bear against the front legs of the straps, which will keep the head rest in its proper position when the head bears upon the cushion. When not in use the head rest is folded up, in which condition it may be carried in a satchel or overcoat pocket without inconvenience.

Clothes Wringer.—John Fox, of Farmersville, Iowa.—This is an improved clothes wringer, which, adjusting itself to the varying thickness of the articles passing through it, and being easily adjusted to operate upon larger or smaller articles, as may be desired, forms a very convenient and useful utensil.

MINERS' SQUIB.—John Holmes, of St. Clair, Pa.—This invention relates to an improvement in squibs for the use of miners in the process of blasting coal, rock, etc. The paper is cut in a peculiar form, one end is saturated with a solution of saltpeter and dried, and then the beveled side is covered with mucilage or paste, so that when the paper is rolled into a tube the edge will adhere. The paper is rolled around a tapering piece of iron or other material of suitable size and form, and the tube is filled with powder. The match, properly prepared, may be rolled in the end of the tube, or attached to the end of the tube in any other suitable manner. The powder is prevented from escaping from the end of the tube by means of a stopper of soap or other suitable material in the end. The squib may be dipped in liquid sulphur to render it more inflammable, if desired. It is used for the purpose of throwing fire through the small opening left in a cartridge by the withdrawal of the tapering piece of iron or the needle, after the cartridge has been tamped in the hole which has been drilled in the coal or rock, or through a tube called a "blasting barrel," that is generally put into the hole with the cartridge and left in when the blast is discharged. Squibs of some kind are used, by all miners, ordinarily made upon the spot and consequently very imperfectly prepared, and with material unsuited to the purpose. The object of this invention is to furnish these squibs as perfect as they can be made of the most suitable materials, and have them ready for use in mining and other districts.

CLOTH SHEARING MACHINE.—Michael Craven, of Dedham, Mass.—This invention refers to a new shear rest for shearing cloth, such as plain and fancy cassimeres, satinets, shawls, etc. Its object is to prevent the forming of flocks on the back of the goods while being sheared. A roller as long as the brush of the machine is used, which hangs in arms that project from a rod, whose ends are journals by which the roller frame is pivoted to the frame of the machine. The roller is carried up clear of the brush. The cloth is drawn over the roller with its face side to the brush, which will raise the nap so that the shear blades may cut it off. The cloth passes between the roller and brush, both being close enough together to raise a sufficient nap, which loosens the flock felted into the cloth. In ordinary shearing machines, these flocks collect into lumps and accumulate on the back of the cloth, so that the shears will cut holes where such lumps appear. The roller in this machine will keep the lumps back and off the cutters, besides creating less friction than the ordinary flat, sharp edged rest now in use.

BRUSH.—George Pirrung and Felix Pirrung, of Chicago, Ill.—This invention relates to that class of brushes where the bristles or other material are confined to a rectangular head by means of a groove or grooves therein, as clothes, shoe, whitewash brushes, etc. The head of the brush is grooved, and the bristles are doubled at the middle and confined in the groove by a piece of wood, metal, or other material, by means of screws, nails, or in any substantial manner. At the ends of the brush, the bristles are secured by metallic clasps attached to the head by nails or screws. The clusters of bristles forming the ends of the brush are likewise secured by wires fastened by the nails. The bristles for the sides of the brush may be put into the groove in clusters or sections, the bristles of each cluster being secured together by wires. The wires may connect the end clusters with the side clusters. The head is provided with holes to receive the bent handle.

BALE TIE.—Floyd G. Brown, of Brenham, Tex.—This invention is a new buckle or tie for holding the ends of the bands of cotton bales. It is formed with two arms or ends, both of which are doubled, forming thereby a hole in the tie for receiving one end of the band. The object of the invention is chiefly to prevent the loss of the buckle from the band while the latter is loose, and also to facilitate the fastening of the band to the bale. It is made of sheet metal of rectangular form, with two nearly square apertures near the ends and with a transverse slot in the middle. The buckle is formed from this plate by doubling the same in line with the slot. One end of the band, after being bent, is fitted through the aperture in the buckle so as to be held between the bars. The band is then laid around the bale to be bound and all the slack of the band is secured, when the operator makes fast the outer end of the band by doubling all the surplus of the same, so that it also can be hooked over the bars. This tie, it is claimed, will be absolutely secure, and will prevent the spontaneous working loose of the band under all circumstances, except breakage.

IRON COLUMN.—William A. Gunn, of Lexington, Ky.—This invention consists in an improved construction of metallic columns to give the strength of the double T beam in two directions, while the necessity for cutting and riveting is greatly lessened. Double T bars or beams of wrought iron or steel are used. Two of the bars or beams are placed with their sides against the edges of a third bar or beam, and are riveted to said bar or beam, the rivets passing through the flanges of the latter, and through the bodies of the first named bars or beams. The rivets should not be placed opposite each other in the different bars or beams, and may be further apart than in posts or columns constructed in the ordinary manner.

ANIMAL POKE.—Stephen C. Leonard, of Rushville, N. Y.—This is a new animal poke which is provided with a spring cushion concealing the prongs or pokes and with contrivances for adjusting the throat latch in suitable position and at suitable hight to fit larger or smaller animals. The top of the bow may be cushioned by means of leather wound around or applied against it.

CAR COUPLING.—Frederick A. Illingworth, of Waltham, Mass.—This is an improved arrangement of coupling hook and shackle on a car coupling, and has for its object to bring all the parts of a coupling under more perfect control, and, at the same time, insure greater reliability than can be found on the cars now in use. The invention consists first in providing the pivoted coupling hook with a prop or device whereby it can be held up clear of the link or shackle or let down at will. The invention also consists in the new arrangement of a pivoted connecting shackle, which has also a prop, whereby it can be held in a horizontal position ready for coupling. Furthermore, the invention consists in a general new arrangement of parts for the purpose specified, and by which ordinary coupling links can also be used for connecting cars having common drawheads with those provided with this improved coupling.

DOUBLE DERRICK.—Asa M. Tomb, of Owego, N. Y., assignor to himself and Charles M. Haywood, of same place.—This invention relates to a new machine for hoisting and lowering heavy weights and conveying the same from one place to another; and consists in a new arrangement of hoisting ropes, pulleys, and shafts. The frame of the derrick is on caster wheels, which support it on the ground and permit its convenient and speedy conveyance from one locality to another. A windlass is hung horizontally in bearings secured to the frame. The operating shaft is hung to the frame parallel to the windlass. A crank handle is affixed to the shaft, and a pinion on the same, the pinion meshing into a toothed wheel, which is mounted upon the windlass. The elevating ropes have one end attached to the windlass, and each is thence carried over a friction roller, and over a loose pulley, on a horizontal rod secured to the upper part of the frame. From this pulley the rope passes over a loose pulley, on a suspended shaft, and thence up again over another loose pulley, and back to a shaft, to which its end is fastened. Thus, the two ropes being applied to the ends of the shaft, the shaft is held suspended. The windlass, when turned to wind up or unwind the ropes, causes this shaft to be raised or lowered. Two or more loose pulleys on this shaft serve to hold chains from which the weight is held suspended. The pulleys can be brought more or less far apart according to the length of the thing to be hoisted and conveyed. In stone quarries and yards, and also for building and other purposes, this derrick will be of considerable value.

MILLSTONE DRESS.—Edmund Deer, of Annapolis, Ind.—This invention relates to improvements in dressing burr millstones for grinding grain; and consists in feather edge zigzag furrows in the runner and in feather edge furrows in the bed stone, arranged in a peculiar manner. The bed stone has three feather edge endless concentric furrows. Short furrows extend from the endless furrows to the eye circle. There may be more or less in number of these short feathered furrows, and more than three endless furrows in the bed stone. In the runner a series of feather edge furrows radiate from the edge of the eye, and extend to the periphery of the stone. Between these furrows are intermediate furrows, commencing at the periphery of the stone, connecting with each other and with the radial furrows by means of short furrows, which latter are at nearly right angles with the intermediate furrows. The intersection of these short furrows with each of the longer furrows at the particular point where the partially ground grain is driven around the endless furrow of the bed gives the short furrow ample opportunity to receive air and feed from the eye. The endless furrows in the bed diminish in size from the outer one inward. The advantages of the endless furrow are that, starting with the grain in the deep edge of the furrow, the grain is not driven directly up the slant of the furrow, but is driven round, gradually nearing the feather edge, and becoming more and more crushed and more nearly pulverized than it would be were it to pass directly across the furrow. Nothing remains at rest in these endless furrows, as the action of the air is too powerful to allow the partially crushed grain to remain at rest. The "land" of the skirt gives ample chance for the runner to act upon the unfinished flour, and there being no furrows in the skirt to receive the flour, it is thrown off by the runner fully ground. Furrowing of this description will, it is claimed, do more grinding, with less friction, and consequently with less power than the "drop" now in common use. Instead of making endless feather edge furrows in the bed stone, the furrow may be made in sections, or form a series of arcs of circles with their feather edges in the direction of the skirt of the stone. The inventor does not, therefore, confine himself strictly to endless or continuous furrows. The "land" in the bed stone may also be in sections so long as it forms, as a whole, a parallel with the skirt of the stone.

HEMMER FOR SEWING MACHINES.—S. B. Lawrence, of Scarsdale, N. Y.—This hemmer attachment consists of a presser having a slot and point, and a detachable scroll secured by a screw or its equivalent. It also consists in a notch formed in the slot of the presser to allow the adjustment of the point of the scroll.

PLOWS.—William H. H. Doty, of Sonora, Ohio.—This invention has for its object to furnish a plow, so constructed that it may be readily adjusted for use as a double shovel plow, a single shovel plow, or a covering plow. The handles may be readily adjusted higher and lower, according to the hight of the plowman. The construction also enables the plow to be taken apart and packed in very small space for convenience of storage or transportation. A longitudinally adjustable frame, combined with a pair of handles pivoted thereto, and supported by adjustable braces, so that the handles and beams can be simultaneously and correspondingly adjusted, constitutes the claim of the patentee.

HOUSE BELLS.—Amos L. Swan, of Cherry Valley, N. Y.—This improvement in apparatus for ringing house bells consists in a double rocking cam and two slotted plates which connect the cam with the bell hammer, and in the general construction, arrangement, and combination of the parts and devices whereby, it is claimed, the apparatus is made much more positive in its action, ringing the bell whether the cord be pulled quick or slow.

BUNG INSERTER.—James Gillies, of Glasgow, Great Britain.—This invention consists in the construction of a device for inserting and removing screw threaded metallic bushes for the bung holes of casks and other like holes in other vessels. The tool is formed of a main round spindle, with a square head at top (for being turned by a powerful ordinary straight two armed wrench or lever, with the hole in the center, such as used for turning screw taps and wideners), having a toothed or serrated conical boss or segmental piece, mounted loosely and eccentrically on its lower end, where it is prevented from coming off by a screw nut. The spindle has a complementary segmental eccentric piece (of and opposite to the serrated eccentric piece) formed on it as a duplex cam, the two part cam fitting and filling the conical interior of the bush, so that when inserted in it the turning of the spindle in the eye of the eccentric of the boss by the wrench at the top, causes one or the other of the wings to act as an eccentric wedge or cam and press the teeth of the griping boss into the inner service of the bush, the griping action of the teeth increasing in proportion to the force required to turn or tighten and fix the bush, just also as the bush is getting further into the wood, which strengthens and sustains it for the necessary outward pressure of the cam tool, which can then get a stronger tap on the head to insure the non-slipping of the teeth within the bush. Both the spindle and griping boss are preferred to be made of the best steel and tempered especially at the acting parts, so as thus to maintain or lengthen the time of the wearing efficiency of the tool.

BLIND STOPS.—Perry A. Burgess, of Butler, Mo.—This invention is an improvement in the class of blind slat adjusters in which a bar is connected with the slats at one end thereof. The slats are provided with a pivot at each end near the rear edge, by which they are pivoted to the stiles, and they have another pivot at one end, near the inner edge, by which they are pivoted to the adjusting bar, which is fitted in a recess or rabbet in the inner edge of the style extending from one cross piece to the other. The pivots are placed as near to the outer edge of the adjusting bar as they may be with safety, and the bottom of the recess is near the pins so that the slats may close completely. A spiral spring is connected to the upper end of the adjusting bar and to the top of the blind, and adjusted to pull the bar up and close the slats when let free. A groove is formed in the blind frame for this spring, and a grooved plate fastened therein for attaching the spring and preventing the latter from wearing the wood. It is grooved to let the spring and the adjusting bar flush with the surface of the blind. A grooved catch plate with a series of holes is let into the frame at the lower end, and a catch with a thumb bit is jointed to the lower end of the bar to engage with the said holes and hold the blinds more or less open, as required. A spring on the lower end of the catch bar bearing on the catch keeps it in connection with the catch plate.

BASE BURNING COOKING STOVE.—William Clark, of Shelburne, Vt.—This invention relates to a new cooking stove, which is provided with a circular fireplace and rotary interior lining thereto, and with a feed cylinder for the automatic supply of coal, and other new arrangements of parts, whereby it is claimed to be an important improvement on the cooking stoves now in use. The invention consists chiefly in the arrangement of the aforementioned rotary firebox, which can be set or turned at will to regulate the draft, and which contains a removable cross partition to have but half a supply of coal, which can be brought under either portion of the top plate or under the oven, as may be desired. The invention also consists in a new arrangement of draft door, grate, oven, and water reservoir.

HOMINY MILLS.—Theodore Hudnut, of Terre Haute, Ind.—A long iron or steel shaft of suitable length and size is used for the purpose, and a wood shaft is fitted upon it, said shaft being as much shorter than the iron shaft as is necessary to have the latter project at each end to form the journals and receive the gearing for turning it. The wood shaft is secured by means of collars keyed to the iron shaft and bolted to the wood shaft, and it has four or more plain sides, according to the number of rows of cutters it is to carry, each side having a metal plate attached to it. These metal plates have lugs attached to them at intervals of the same distance apart it is required to have the cutters, the said lugs being arranged lengthwise transversely of the plates; and those of one row are placed a short distance laterally from those of the next rows either way, in such order that they form broken spiral rows around the shaft. The cutters consist of steel plates with the inner point of the cutting edges projecting over a true circle struck from the axis of the shaft, and are bolted to the arms between them. These arms are bolted to the lugs on the plates, being laid across said plates tangentially, so that they are confined against turning on the bolts by said plates. The collars are provided with broad plano-convex disks which keep the grain away from the bearings and in contact with the cutters. This arrangement of the arms or holders of the cutters permits of their being readily removed for repairing or removing the cutters.

LIQUID METER.—David W. Huntington and William A. Hempstead, of South Coventry, Conn.—The first part of this invention consists in an arrangement of valves and ports whereby, in a double cylinder meter, the piston of one cylinder actuates the valve for the other, and *vice versa*. The second part consists in an improved arrangement of valves for balancing them. The third part consists in a device for steadying the piston rods during the time of their greatest extension from the stuffing box of the cylinder; and the fourth part consists in the combination, with a water meter, of a mud and sand trap.

CLOVER HULLER AND CLEANER.—Thomas Church, Lewisburg, Pa.—This invention relates to a hulling cylinder constructed of cast iron staves attached to a wooden core, said staves having roughened exterior surfaces, and having also knobs or raised parts standing out from the periphery in circular rows, the case in which the cylinder works having a roughened interior surface with transverse grooves, in the same, which the raised parts of the cylinder traverse.

[OFFICIAL.]

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Combing machine, E. Tavernier 122,678
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Composition for destroying vermin, P. Müller 122,582
Composition for lining water coolers, A. Mahler 122,628
Corn popper, W. F. Collier, (reissue) 4,703
Cultivator, cotton, M. B. Camp 122,515
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Drill, ratchet, J. J. Switzer 122,677
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Electromagnetic safe protector, W. Duncan, (reissue) 4,704
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Engine, dummy, T. C. Robinson 122,534
Engine, rotary, A. O'Leary 122,641
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Eye glass suspender, S. F. Merritt 122,629
Fare box, H. Baranger 122,549
Fastener, shutter, N. V. Merrill 122,628
Fish plate, fastening for, R. Anthony 122,547
Fluting machine, J. F. Hayen 122,607
Food or pearl wheat, article of, J. E. Weaver 122,543
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Fuel, artificial, Febrey and Smith 122,590
Furnace, annealing, T. F. Hammer 122,604
Furnace, hot air, L. B. Tupper .... 122,6·4
Furnace, steam boiler, E. F. Griffin 122,521
Furnace for manufacture of iron, A. Reese 122,651
Gas apparatus, H. S. Maxim 122,625
Gas purifier, P. Munzinger, (reissue) 4,707
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Grading and ditching scraper, C. D. and M. C. Meigs 122,627
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Harvester, Q. F. Messinger 122,630
Harvester, corn, J. Burke 122,561
Harvester cutters, rifle for sharpening, W. H. Daniels 122,573
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Hose, manufacture of rubber, J. Quin 122,649
Huller and cleaner, clover, T. Church 122,568
Implement, compound, Devoe, Rogers, and Beals 122,577
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Iron, manufacture of, J. J. Johnston 122,524
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Meter, water, T. R. Timby 122,683
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Mill, grist, E. Harrison 122,605
Mill, smut, J. Wernwag 122,691
Mines, device for raising tailings from, W. A. Rogers 122,657
Movement, mechanical, J. H. McCamy 122,580
Nut lock, H. C. Stouffer 122,676
Packing, piston, J. J. Clause 122,570
Packing for piston rods, &c., metallic, D. Devore 122,578
Padlock, A. Berger 122,666
Paper, manufacture of, S. D. Baldwin 122,548
Paper bag machine, L. D. Benner 122,510
Parer, corer, and slicer combined, apple, G. Bergner 122,553
Pavement, concrete, S. Filbert 122,591
Piano, S. P. Brooks 122,557
Pipe coupling, W. Kearney 122,614
Pitcher, ice, J. Dewson 122,576
Plane, carpenter's, H. A. Holt 122,609
Planing machine, J. S. Graham 122,599
Planter, walking, M. W. Stevenson 122,679
Plow, J. Dodge 122,582
Powder kegs, safety conductor for, M. Ward 122,688
Powders, box for seidlitz, C. A. and I. S. Browne 122,558
Power at railway stations, utilizing, W. J. Plecker 122,648
Projectile for small arms, C. Maduell 122,620
Pruning knife, D. Morris 122,633
Pruning shears, R. Hall 122,603
Pulp, machine for the manufacture of wood, H. Dodge 122,581
Pulverizer, soil, D. Osborn 122,643
Railway, elevated, J. E. Serrell 122,667
Railway frog, W. Morris 122,634
Railways, construction of, T. R. Timby 122,682
Railways, hose jumper for street, J. Rue 122,660
Remedy, pile, L. Heins 122,608
Roofing, metallic, J. Siddons 122,670, 122,671
Rope walks, strand twisting machine for, J. Rinek 122,653
Row lock, A. E. Brockett 122,556
Saddle tree, S. E. Tompkins, (reissue) 4,709
Sandal, R. Johnston 122,525
Sash holder, G. W. Warren 122,689
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Screen, coal, T. Farron 122,589
Screening apparatus, D. Kahnweiler 122,612
Seeder, plow, and roller, combined, O. B. Cheatham 122,567
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Sewing machine, C. F. Bosworth 122,555
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Sewing machines, tuck marker for, G. McFadden 122,626
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Spark arrester, W. G. Grassler 122,600
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Stamping varnished surfaces, T. H. Müller 122,636
Stove, base burning, J. R. Hawkins, (reissue) 4,705
Stove platform, I. Miller 122,631
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Telegraph pole, T. Rogers 122,656
Telegraph printing apparatus, H. Van Hoevenbergh 122,687
Tenoning spokes and boring fellies, machine for, J. Bauman 122,551
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Toy, J. W. Beatty 122,552
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Truck, Van Hsagen and Cooper 122,686
Tube joint, steam boiler, heater and condenser, J. Harrison, Jr. 122,606
Type, pointed, Miner and Moody 122,531
Valve, steam, Chapman and Spaulding 122,566
Valve, tank, J. H. Dorst 122,583
Valve for steam and air cylinders, exhaust, G. Westinghouse, Jr. 122,544
Vehicle, pleasure, C. W. Saladee 122,536
Vehicles, torsion spring for, C. W. Saladee 122,537
Vessels, propulsion of, T. B. Raymond 122,650
Vessels, propulsion of, H. Niles 122,640
Vessels, propulsion of, E. Matteson 122,624
Wagon, dumping, W. W. Carré 122,565
Washing machine, D. W. George 122,596
Watch frame, cover for, A. Combs 122,571
Watches and clocks, cleaning, W. W. Thompson 122,681
Water wheel, W. H. Elmer 122,588
Weather strip, J. M. Dils 122,580
Wrench, pipe, C. Neames 122,638
Wringing machine, J. G. Roth 122,658, 122,659

EXTENSIONS GRANTED.

18,966.—Improvement in Locomotive Engine Wheels, granted to George S. Griggs, December 29, 1857.

18,874.—Improvement in Bagasse Furnaces, granted to Moses Thompson, December 15, 1857.

DESIGNS PATENTED.

5,462.—Carpet Pattern.—John H. Bromley, Philadelphia, Pa., assignor to John Bromley & Sons, same place.

5,463.—Car Seat End Frame.—Thomas W. Brown, Belmont, Mass.

5,464.—Drawer Pull.—Albert D. Judd, New Haven, Conn.

5,465.—Trellis.—Joseph G. Konvalinka, Astoria, N. Y.

5,466.—Rim of Vases, etc.—Jonathan Moore, Brooklyn, N. Y., assignor to himself and Abram Horton, same place.

5,467.—Floor Oil Cloth Pattern.—Joseph Robley, Brooklyn, N. Y., assignor to William M. Brasher & Co., same place.

5,468.—Carpet Pattern.—John Howie Smith, Enfield, assignor to Hartford Carpet Company, Hartford, Conn.

5,469.—Circular Register.—Edward A. Tuttle, New York city.

5,470.—Hot Air and Ventilating Register.—Edward A. Tuttle, New York city.

5,471.—Hot Air and Ventilating Register.—Edward A. Tuttle, New York city.

TRADE MARKS REGISTERED.

626.—Whisky.—Barkhouse Brothers & Company, Louisville, Ky.

627.—Plows.—Bouton, Whitehead & Co., Naperville, Ill.

628.—Lamp Chimneys.—Charles F. A. Hinrichs, New York city.

629.—Disinfectants, etc.—Marcelin, Warren & Co., New York and Brooklyn, N. Y.

630.—Aqueous Solution of Balsamic Gums.—Oscar Oldberg, Washington, D. C.

631.—Sewing Machines.—The Finkle & Lyon Manufacturing Company, Middletown, Conn.

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

19,206.—Hydrants.—Granted to Washburne Race and S. P. C. Mathews, January 26, 1858; reissued July 18, 1871. Hearing January 10, 1872.

19,347.—India Rubber Door Mats.—Granted to Edwin M. Chaffee, February 16, 1858. Hearing January 31, 1872.

19,490.—Metallic Ties for Cotton Bales.—Granted to Frederic Cook, March 2, 1858. Hearing February 14, 1872.

19,222.—Seed Planters.—Granted to James D. Willoughby, January 26, 1858. Hearing January 10, 1872.

19,191.—Making Blades for Pencil Sharpeners.—Granted to Walter K. Foster, January 26, 1858. Hearing January 10, 1872.

19,328.—Cane Guns.—Granted to J. F. Thomas, February 9, 1858. Hearing January 24, 1872.

19,252.—Plate Frames for Photographic Cameras.—Granted to William Lewis and William H. Lewis, February 2, 1858. Hearing January 17, 1872.

19,200.—Straw Cutters.—Granted to Jacob H. Mumma, January 26, 1858; reissued September 6, 1859, March 29, 1864, and March 7, 1865. Hearing January 10, 1872. Postponed to January 20, 1872.

19,465.—Carpet Beating Machine.—Granted to Joseph Harris, Jr., and Daniel Holmes, February 23, 1858; reissued May 13, 1862. Hearing February 7, 1872.

19,258.—Flasks for Casting Wheels.—Granted to Frederick Nishwitz, February 2, 1858. Hearing January 17, 1872.

19,321.—Plows.—Granted to George Watt, February 9, 1858; additional improvements August 2, 1859; reissued August 4, 1868. Hearing January 24, 1872.

19,696.—Grinding Attachment to Pug Mills.—Granted to David H. Gage, March 23, 1858. Hearing March 6, 1872.

19,318.—Lap Joints for Belting.—Granted to Henry Underwood, February 9, 1858; reissued January 1, 1867. Hearing January 24, 1872.

19,384.—Bank Check Canceler.—Granted to William M. Simpson, February 16, 1858. Hearing January 31, 1872.

19,370.—Knitting Machines.—Granted to Joseph K. Kilbourn and Edward E. Kilbourn, February 16, 1858. Hearing January 31, 1872.

19,346.—Propelling Canal Boats.—Granted to Herman Camp, February 16, 1858. Hearing January 31, 1872.

19,398.—Hydraulic Valves.—Granted to Calvin Woodward and George M. Woodward, February 16, 1858. Hearing January 31, 1872.

19,377.—Harvesters.—Granted to Frederick Nishwitz, February 16, 1858; reissued March 5, 1861, and again reissued in two divisions, April 13, 1869. Hearing January 31, 1872.

19,349.—Shingle Machines.—Granted to George Craine, February 16, 1858. Hearing January 31, 1872.

19,420.—Horse Rakes.—Granted to William Horning February 23, 1858. Hearing February 7, 1872.

19,462.—Straw Cutters.—Granted to Thomas H. Willson and Daniel T. Willson, February 23, 1858. Hearing February 7, 1872.

19,412.—Shovel Plow or Cultivator.—Granted to Paul Dennis, February 23, 1858; reissued August 4, 1863. Hearing February 7, 1872.

19,417.—Cotton Gins.—Granted to Benjamin D. Gullett, February 23, 1858. Hearing February 7, 1872.

19,461.—Shoe Peg Machine.—Granted to Abijah Woodward, February 23 1858. Hearing February 7, 1872.

19,555.—Splice for Joints of Railroad Rails.—Granted to Mark Fisher, March 9, 1858. Hearing February 21, 1872.

19,979.—Sewing Machines.—Granted to Charles F. Bosworth, April 20, 1858. Hearing April 4, 1872.

19,487.—Continuous Metallic Lathing.—Granted to Birdsall Cornell, March 2, 1858. Hearing February 14, 1872.

19,517.—Machine for Forming Sheet Metal Pans.—Granted to E. A. Smead, March 2, 1858. Hearing February 14, 1872.

19,483.—Harvesters.—Granted to Jesse S. Butterfield, March 2, 1858; reissued in two divisions January 15, 1867. Hearing February 14, 1872.

19,572.—Machines for Packing Flour.—Granted to J. Mattison, March 9, 1858. Hearing February 21, 1872.

19,510.—Raising Dough.—Granted to James Perry and Elisha Fitzgerald March 9, 1858. Hearing February 21, 1872.

19,638.—Combined Floating Anchors and Life Preservers.—Granted to to Joseph Humphries, March 16, 1858. Hearing February 28, 1872.

19,719.—Stop Motion for Hair Cloth Looms.—Granted to Rufus J. Stafford, March 23, 1858. Hearing February 6, 1872.

19,741.—Railroad Car Axle Boxes.—Granted to R. N. Allen, March 23 1858; reissued December 20, 1864. Hearing February 6, 1872.

19,548.—Mode of Tightening and Securing the Keys of Journal Boxes of Connecting Rods or Pitmen.—Granted to Levi Dederick, March 9 1858. Hearing February 21, 1872.

19,619.—Machine for Planing Blind Slats.—Granted to Charles Carlisle and Leonard Worcester, March 16, 1858. Hearing February 28, 1872.

20,235.—Fly Nets.—Granted to Robert Wilson, May 11, 1858. Hearing April 24, 1872.

20,238.—Sash Fasteners.—Granted to Frederick W. Brocksieper and Joseph B. Sargent, May 11, 1858. Hearing April 24, 1872.

19,594.—Valves for Steam Engines.—Granted to Isaac Van Doren, March 9, 1858.—Hearing February 21, 1872.

19,787.—Windlasses.—Granted to Joseph P. Manton, March 30, 1858. Hearing March 13, 1872.

19,806.—Rotary Cutters for Tongueing and Grooving.—Granted to James A. Woodbury, March 30, 1858.—Hearing March 13, 1872.

19,637.—Grain Separators and Cleaners.—Granted to Simeon Howes and Gardner E. Throop, March 16, 1858. Hearing February 28, 1872.

19,654.—Machines for Trimming Books.—Granted to A. C. Semple, March 16, 1858. Hearing February 28, 1872.

19,626.—Photo-Lithography.—Granted to James A. Cutting and L. H. Bradford, March 16, 1858; reissued July 31, 1860. Hearing February 28, 1872.

19,683.—Hot Air Furnaces.—Granted to John Child, March 23, 1858. Hearing March 6, 1872.

19,747.—Wire Staples.—Granted to Byron Boardman, March 30, 1858; reissued March 6, 1866. Hearing March 13, 1872.

19,819.—Lightning Conductors.—Granted to Oren White, March 30, 1858. Hearing March 13, 1872.

19,820.—Hubs of Carriage Wheels.—Granted to James M. Whitney, March 30, 1858. Hearing March 13, 1872.

19,644.—Sawing Machines.—Granted to Henry H. Low, March 16, 1858. Hearing February 28, 1872.

19,718.—Turning and Sliding Tables for Railroads.—Granted to William Sellers, March 23, 1858; reissued August 10, 1858. Hearing March 6, 1872.

20,078.—Mode of Protecting Gilding on Glass.—Granted to Peter V. Mathews, April 27, 1858. Hearing April 10, 1872.

19,783.—Combination of Lead Pencil and Eraser.—Granted to Hymen L. Lipman, March 30, 1858. Hearing March 13, 1872.

19,767.—Machine for Testing and Measuring the Strength of Car Springs.—Granted to Perry G. Gardiner, March 30, 1858. Hearing March 13, 1872.

19,770.—Constructing Doll Heads.—Granted to Ludwig Greiner, March 30, 1858. Hearing March 13, 1872.

19,786.—Lathe Chucks.—Granted to John L. Mason, March 30, 1858. Hearing March 13, 1872.

20,192.—Method of Seating the Movable Cutters in Expansive Bits.—Granted to William A. Clark, May 11, 1858; reissued June 22, 1869. Hearing April 24, 1872.

19,855.—Ice Pitchers.—Granted to Ernest Kaufmann, April 6, 1858. Hearing March 20, 1872.

19,824.—Apparatus for Supplying and Measuring Syrups in Soda Water.—Granted to Edmund Bigelow, April 6, 1858; reissued May 4, 1858, and December 4, 1866. Hearing March 20, 1872.

Inventions Patented in England by Americans.

From December 12 to December 18, 1871, inclusive.

[Compiled from the Commissioners of Patents' Journal.]

Blending Inks.—T. L. McCready (of New York city), London, England.
Centrifugal Machine.—S. S. Hepworth, New York city.
Coupling.—J. R. Taber (of Fairhaven, Mass.), London, England.
Galvanic Battery.—J. Smith, New York city.
Generating Gas.—W. Elmer, New York city.
Hoisting Apparatus, etc.—C. R. & N. P. Otis, Yonkers, N.Y.
Watch Protector.—W. B. Farwell (of New York city), London, England.

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