SCIENTIFIC AMERICAN

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IMPROVED HAND FIRE ENGINE AND HOSE CARRIAGE.

In the accompanying engravings we illustrate an improved hand fire engine and hose carriage combined, which has been especially constructed with a view to meeting the requirements of towns and villages, and isolated factories which do not afford the facilities of steam or the advantages to be derived from a system of waterworks. Hand engines, as usually constructed, require a large gang of men to operate them, making them comparatively useless in localities where 40 to 50 men cannot be assembled at a moment's notice.

The engine herewith represented, we are informed, can be operated by from two to fourteen men, according to the amount of water and the distance the stream has to be thrown. Two men can readily draw it over all common grades. At present the manufacturers are building one size only, the entire equipment weighing only 500 lbs., the hose reel having capacity for 800 feet of 1¼ inch hose.

In readiness for fire, the engine is always mounted on the carriage, as shown in Fig. 1, while Fig. 2 shows the engine as detached from the hose carriage, with leading hose run out. Upon an alarm of fire being given, the first man or two at the engine house starts for the scene of action with the machine. Upon arrival the engine is disconnected from the carriage or hose reel by simply turning three clamp fingers, which drop into loops, at A. Two men then lift the engine from the carriage, it weighing alone only 325 lbs., by the handles, B, setting it upon its own ways, C, as shown in Fig. 2, leaving the hose carriage ready to unreel the hose. The hose being always coupled to the engine, no time is lost, as the first sweep of the brakes, after the suction, D, is dropped into the water, starts the stream. The engine is so light that it can be lifted and set over a well, cistern, or reservoir. It really needs no priming, although a priming bucket is provided at E, leading by a stop-cock into the pipe running from the suction to the cylinder. This would prove advantageous should the valves, through non use, become dry. The engine has, of course, two cylinders, the diameter of each being 4 inches, the throw being 6 inches, thus giving a powerful stroke, the brakes moving through a circle of 2 feet 9 inches.

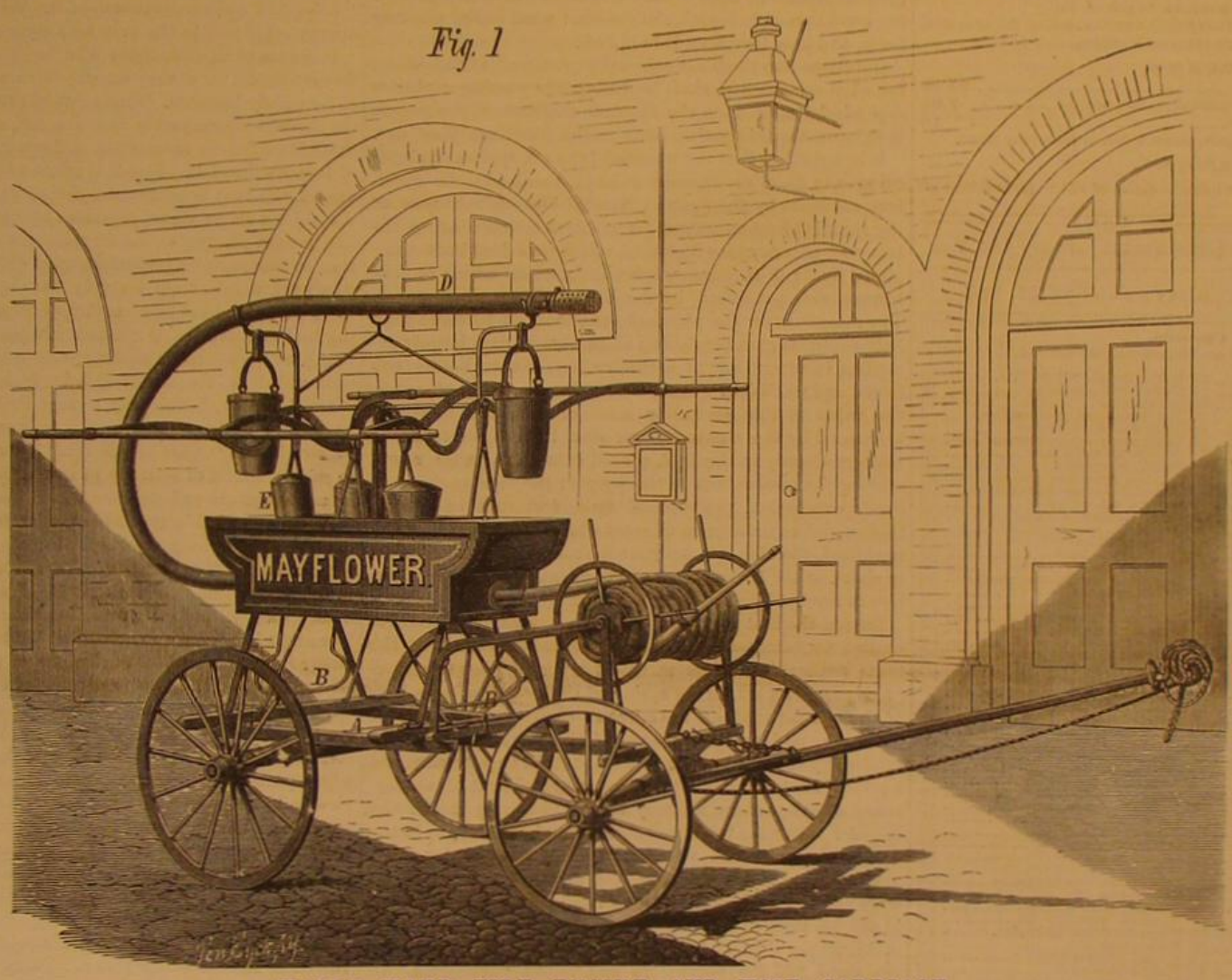
Both air chamber and water chamber are copper, and the valves are composition. The hind wheels are 36 inches high, the forward ones being 32 inches, and the latter swing under the reel, allowing the machine to be turned in its own length. Twelve feet of 2½ inch suction hose are provided, with which are used 1¼ inch leading hose with half inch nozzle.

We are informed that with fourteen men the machine has thrown a half inch stream 156 feet horizontally, drawing water perpendicularly 12 feet, and discharging through 100 feet of hose. This range of stream is, as will be seen, sufficient to cover any ordinary factory, warehouse, or dwelling, enabling fires on roofs to be extinguished by the machine stationed on the ground outside.

The makers furnish with the apparatus 12 feet of suction hose, brass strainer, draw rope, spanners for suction and leading hose couplings, two fire buckets, oil can, etc. The complete machine, in readiness for the application of leading hose, is sold for three hundred and fifty dollars at their manufactory.

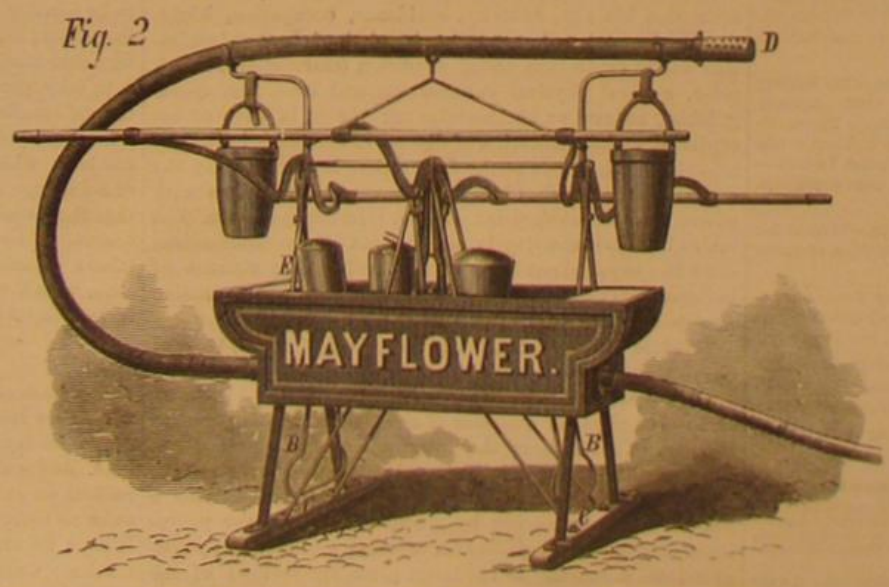
The owner of the patent is A. M. Hall, Malden, Mass., long and well known throughout the country; and the manufacturers are S. C. Forsaith & Co., Manchester, N. H., at whose works the machine can be seen and practically tested at any time. Letters of inquiry or orders should be addressed to either of the above.

Fig. 1



HALL'S HAND FIRE ENGINE AND HOSE CARRIAGE.

Fig. 2



Mineral Wool.—Curious Chemical Change.

The name of mineral wool has been given to a fibrous form of blast furnace slag formed by a jet of steam blown through it while in a liquid state. Professor Wolpert of Kaiserslantern says that it should only be employed with great caution in architecture for filling under floors and wainscoting, etc., for this slag at present always contains sulphide of calcium, which is converted, by the action of the carbonic acid in the air and the water which reaches it when the floors are scrubbed, into carbonate of lime and sulphuretted hydrogen. The latter, as we know, is a gas which is both unpleasant and injurious to health. Before using this slag it should be tested for sulphide of calcium by pouring water and vinegar upon it, when the well known odor of sulphuretted hydrogen, resembling rotten eggs, will be perceived if any sulphuret of lime is present.

Plateau's Soap Bubble Solution.

Terquem publishes the following improved process for making a solution suitable for Plateau's experiments with thin films, soap bubbles, etc.: Marseilles soap is shaved up into thin strips and placed in the sun or on a stove until perfectly dry. It is then put into a bottle with exactly 80 per cent alcohol (specific gravity 0·865) until saturated at 60° Fah., when the solution will mark 74° on the centesimal alcoholometer and have the density of 0·880. The solution must be made cold, for when hot the alcohol will dissolve a large quantity of soap and the liquid will become solid on cooling. A mixture of glycerin and water is made so as to stand at 17·1° Baumé, or have a density of 1·35 at 68° Fah., which corresponds to equal parts of each when the glycerin is most concentrated. It is well to heat the bottle containing this mixture in a water bath.

To prepare the final solution, take 100 parts by volume of the diluted glycerin and 25 parts of the alcoholic soap solution; the mixture frequently becomes turbid because the commercial glycerin contains gypsum and lime. It is boiled to expel the alcohol, when the temperature will rise above 212° Fah. It is now allowed to cool, and then poured into a graduated measure and enough water added to make it equal to 100 volumes. It is filtered several times to remove the oleate of lime formed. This filtration is difficult because at first it runs milky through the filter. It is best to filter through a funnel with a tuft of cotton in the neck, as the cotton can be pushed in loosely or tightly to regulate the flow of the liquid. Soap bubbles which are not more than four inches in diameter will keep for an hour if laid on a small tripod under a bell jar.—*Poggendorff's Annalen.*

Fireproof Dress.

Mr. Oestberg, a Swede, has been conducting some sensational experiments in various parts of the Continent with his fireproof suit. This is made in two layers, the inner one of india rubber, the outer of English leather, the head being protected by a helmet resembling that worn by divers. At the girdle is fixed a piece of hose, which serves both for air and water. The air pipe, fed from two blowers, is placed inside the water pipe, and brings the air, after being cooled by the surrounding water, into the inner part of the dress. The air inflates the costume, passing away through the two small openings made for eye pieces. The current of air not only keeps the inclosed body cool, but drives smoke and flame away from the eyes. At the back the water pipe divides, one branch serving as an extinguisher, the other passing into the outer coating of the dress, the stream being distributed over the whole outer surface. With the apparatus on, the experimenter stood in the middle of a pile of burning shavings and logs without taking the least harm. If a continued use of this apparatus shows similar results, it is likely to be a useful invention

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PHYSICAL MAN IN AMERICA.

From time to time every great mercantile or manufacturing firm slackens the work of making and selling to review its position and possessions: as the phrase runs, to take an account of stock. Just now the American people are similarly engaged in taking stock.

We have had a hundred years of general prosperity, a hundred years of rapid growth in numbers, wealth, and power: and very properly we celebrate our Centennial year in reviewing the results of the years that have gone, in trying to learn our relative standing among the nations. Not only in the great sample show of our natural and industrial resources at Philadelphia, but everywhere throughout the land, are manifestations of the same laudable desire to discover just what we are worth as a nation, what the past has done for us, and what the prospect is for the future.

There is danger however that, with our absorbing interest in the things we have invented, discovered, and made, in our mental and industrial achievements, we may forget the more important item of national stability, what we are: in other words, the character and conditions of our physical manhood. How do we compare bodily with the citizens of more homogenious nations? How big are we, on the average: what is our condition as to health and disease: what is our working force, and how long does it hold out?

Questions like these are especially pertinent at this time; for what our country shall be during the coming centuries depends far more upon the physical character of the people than upon the things they have or the machines they use.

It is fortunate that the material for such studies of physical man in America are ready at hand, thanks to the excellent use made by the Provost Marshal General's bureau of the records of examinations for military service during the late war, an elaborate digest of which has just been completed by Dr. J. H. Baxter, late chief medical officer of that bureau, and published by the United States Government. The records cover the physical examinations of more than half a million men, furnishing an amount of data largely exceeding in extent any of a similar nature ever before collected and published. And, as Dr. Baxter justly observes, the value of this enormous mass of statistical matter is hightened by the circumstances that it does not relate to soldiers already in the field, picked men in no wise representing the masses, but to the people: the men engaged in every occupation, professional men, and men of letters, traders and business men of every grade, laborers skilled and unskilled, the rich and the poor, the robust and the crippled: in short, to all the citizens of the country, whether of native or foreign birth.

During the first two years of the war, the armies were recruited by volunteer enlistments, under the control of the State authorities. This method proving inadequate, Congress passed an act, in the spring of 1863, creating a bureau of the war department to be known as the Provost Marshal General's, and to have charge of the recruitment of the armies, by enlistment or by draft as might be necessary. As a preliminary to the latter method, an enrolment of all persons liable to perform military service had to be made; and in order that none but able-bodied men should be put in the field, a thorough and systematic medical examination of all drafted men and volunteers was necessary. Four drafts were made, the whole furnishing records of the examination of 605,045 men, of whom 155,730 were exempted, or a ratio of 257·39 per thousand. During the same period there were examined 225,639 volunteers and 79,968 substitutes. Of the former 50,008, or a ratio of 221·63 per thousand, and of the latter 21,125, or a ratio of 264·17 per thousand, were rejected.

Of these and other records, covering the examination of over a million men, nearly half were found more or less incomplete and were thrown out; but as those which could be used seemed to be fair representatives of all, the omissions abridged the work rather than detracted from its value. The records made use of showed for each of the subjects of examination his age, nativity, residence, occupation, hight, complexion, color of eyes and hair, girth of chest at inspiration and at expiration, social condition (married or single), color, general physical constitution and condition, distinguishing natural or accidental mark if any, in case of acceptance, and specification of disease or disability in case of rejection. The scope of the final report is in the main the comparison of each of these elementary conditions with others, and a consideration of their relation to disease. The tables in which nativity is an element of the comparison show the physical condition of the foreign-born citizens of various nativities in relation to each other, and to native Americans, both white and colored.

The first fifteen tables, the anthropological series, treat of physical qualities without relation to disease; the remaining seven are pathological, treating of disease and its relation to the physical qualities of man, to occupation, and to locality. To facilitate the interpretation of the latter a series of charts have been prepared, presenting to the eye the more interesting results deduced from the tables: also a number of maps showing by gradations of color the prevalence of disqualifying diseases together and singly, by congressional districts. In the letter press, the reviews of the tables call attention to what is most interesting and significant of the lessons they teach, and furnish an amount of information with regard to American manhood, physically considered, the relative healthfulness of different parts of the Northern States, the relation of health to employment, and so on, that is truly wonderful.

Another exceedingly valuable portion of the work is the three or four hundred pages of Part III, containing reports of examining surgeons. In these is given, with other interesting matter, a connected and generally graphic account of each congressional district by a resident physician, covering its physical description, its prevalent diseases and their local causes, the general character of the inhabitants, their modes of life and occupations, the fitness of the different classes and nationalities for military service, and so on. From these, in connection with the tables and colored charts, it is our purpose to draw much curious and valuable information for the entertainment of our readers: to sum up, so to speak, our physical assets and liabilities as a nation.

SUMMER SCIENCE.

We have received a periodical bearing the name "Appalachia," a rather mystifying title until one peruses the pages sufficiently to learn that the magazine is intended to be the report of results accomplished, plans proposed, and information gathered by the Appalachian Mountain Club, the object of which association is the thorough geographical, geological, topographical, zoölogical, and botanical study of the mountains of New England and adjacent regions. The required knowledge is to be obtained by systematic exploration conducted by the members individually; and one cardinal aim and object is the publication at some future time of "a detailed and accurate map of the White Mountains, upon a large scale and in the very best style of workmanship."

It seems to us that those who have organized this club deserve credit for a very sensible idea, and one that merits to be widely imitated. Camp life in the summer, as witness the throngs which yearly visit the Adirondack region in this State, is extremely fascinating, and generally a grand restorer of impaired health. Beside it offers to the hunter and fisherman the best opportunities for sport. Now a club with the objects above stated combines all the benefits of outdoor life, besides placing before its members a definite and useful aim, so that each individual mingles with his holiday relaxation work which, from its very novelty and variety, ceases to be labor, and yet is of sufficient importance to stimulate the best endeavors. We cannot imagine anything more enticing to the scientific student than a summer spent with such a club as the Appalachian. If his tastes incline to natural history, he has only to read Professor Sterry Hunt's admirable letter of instruction to know, as Faraday expressed it, just "what to look for." There are floral materials to collect, limits of altitude of trees, plants, and animals to be noted, nature and distribution of rocks to be observed, rare and remarkable vegetable productions to search for, and so on through a long category. Does he desire a summer of practical surveying, Professor Hitchcock tells just what is to be done and how to go about it, gives a list of points to be determined, and even describes the needful instruments. The artist is offered an enchanting sketching tour, and Professor Fay explains how the knight of the brush and pencil can make himself scientifically useful. Professor Pourtales tells where original explorations are needed, and how they are to be conducted: lastly, Professor W. G. Nowell, for he benefit of those who do not care to be pioneers, suggests where paths may be made, record bottles placed, points of view to be cleared, and other improvements accomplished, which will facilitate the general work. It is original investigation conducted under the pleasantest conditions, and certainly well calculated to give those who undertake it a zest for discovery which may stimulate them to higher aims.

Beside, the task projected has a wider utility than is involved in its immediate result. There is a lamentable ignorance all over this country regarding our own territory, an ignorance which across the Atlantic becomes surprisingly dense, even among people otherwise highly educated. Our English contemporaries constantly quote American localities incorrectly; and to the minds of continental writers, our cities, counties, and States seem inextricably confused. In geography, as in all sciences, true knowledge has its foundation in details; and where those are clearly and accurately determined, we may look for generalizations based thereon to be equally correct. In the United States, the youth of the nation, and the fact that there are still portions of our immense territory wholly unexplored, are the obvious reasons why general information has been compiled without the substantial basis we have indicated; and many years will elapse before we shall have that intimate knowledge of our land which the marvelously minute topographical maps of Sweden, exhibited at the Centennial Exposition, prove that the Swedes have of theirs. Still we know of no better means of securing such useful information than by the labors of scientific students, associated as in the present club, which we trust may be but the precursor of others formed in other parts of the country.

ARTIFICIAL GUANO.

The enormous value of the guano deposits of the Chincho and Lobos Islands naturally gave rise to an early and eager search for similar stores of agricultural wealth in other localities. And seeing that sea fowl were not less numerous and voracious on uninhabited islands the world over, there seemed to be no reason why the search might not be successful. But it soon became clear that climate had much to do in the matter. Only in rainless regions where the slowly accumulating layers of excrement, fish bones, dead fowls, and so on could remain undisturbed and undissolved was it possible for true guano to accumulate. The search for it, however, was not without good results. On many other islands, especially in the equatorial regions of the Pacific, there were found extensive beds of rock, which differed from the usual coral rock in that it contained a large percentage of phosphate of lime, the mineral base of Peruvian guano. At first it was supposed that, by some mysterious chemistry

of nature, the coral carbonate had been changed to phosphate of lime; but subsequent researches proved the phosphatic rocks to have had their origin in the air, not under water. They were simply the remains of what in a more arid climate would have been regular guano beds, their organic matter having been dissolved and washed away by rain.

To convert these phosphatic deposits into commercial fertilizers, it was simply necessary to restore the organic elements which had originally accompanied them, for which purpose nothing seemed so appropriate as the refuse of fish oil factories. All along our northern coast, enormous quantities of menhaden were annually taken for their oil; and the compressed fiber and bone remaining after the extraction of the oil afforded a vast quantity of nitrogenous matter, similar to that produced in the digestive organs of fish-eating sea fowl. The company which had undertaken to utilize the phosphatic deposits of the Pacific islands set up their works at Wood's Hole, Mass., at the heart of the menhaden fishery, and there the fish of the Atlantic were made to supply the wasted elements originally drawn from the fish of the Pacific.

A model of these works is shown in the Government Building, at Philadelphia; and in the company's special pavilion are models of their other works, with a full exhibit of the processes employed, the materials used, and the products obtained.

The exhaustion of the richer beds of Pacific phosphates (and only the richer would pay for transportation) led to a search for like deposits nearer home, resulting in the discovery of the extensive deposits of Great Swan Island, in the Caribbean Sea, about a hundred miles from the coast of Honduras. But this source was soon eclipsed in value and interest by the rich phosphatic deposits along the South Carolina coast. Though known for nearly a century, the fertilizing character of these beds was not detected until 1867, when Dr. Ravenal discovered that their characteristic nodules of supposed marl rock were really composed almost entirely of phosphate of lime, and immediately made arrangements for their collection and conversion into commercial fertilizers, in the place of the Swan Island phosphates he had hitherto been using.

Previously, the interest attaching to these beds had been chiefly scientific, arising from the strange revelations of ancient life made by their fossil remains—revelations of a time long anterior to the historical period, when our familiar domestic animals, once supposed to have originated with man in Asia, horses, sheep, bulls, and hogs—were living here with animals peculiarly American, as certain deer, musk rats, beavers, hares, opossums, and the South American tapir.

The phosphatic nodules in question are found along the water courses of the Sea Island region between Charleston and Savannah, the largest development occurring on Chisolin's Island, about midway between these two cities, at the junction of the rivers Coosaw and Bull. The island, about six miles long by two miles wide, is underlaid with strata of nodules varying in thickness from one to three feet. At the diggings of the Pacific Guano Company, to whom the island belongs, the phosphatic stratum lies from two to five feet below the surface, and is about three feet thick. Nodules are also found in quantities in the beds of adjacent creeks. Properly treated, they yield an average of phosphoric acid equal to sixty per cent of phosphate of lime. The Swan Island's phosphates are less rich, except in the deeper deposits, some of which yield as high as eighty per cent of lime phosphate.

In the conversion of these phosphatic rocks into soluble fertilizers, they are first dried and pulverized; then, after being reinforced by the richly nitrogenous fish fiber, the whole is digested with sulphuric acid, producing an artificial guano analogous in nature and composition to the purest Peruvian guano, and equally efficient for the nutrition of growing crops.

By this industry, one of the most abundant and uneatable of our coast fishes, the menhaden, is made one of the most valuable. During the past year, upwards of twenty-six hundred men, with three hundred and forty-three vessels, nine of them steamers, were employed in the menhaden fishery. The capital involved was nearly three million dollars, and over five hundred and sixty million fish were taken. Besides the 2,681,487 gallons of oil obtained for commercial purposes, these fish yielded over fifty thousand tuns of compressed fiber and bone, carrying more than seven and a half million pounds of ammonia in the best possible organic form, the equivalent of 26,000 tuns of Chincha Island guano, and over 1,000,000 lbs. of phosphate of lime, readily convertible into agricultural products.

THE STRUCTURE AND AGE OF THE ROCKY MOUNTAINS.

From the Missouri river westward, the whole country gradually rises, at an average grade of barely ten feet to the mile, until about the meridian of 105½° W. is reached, and then the Rocky Mountains rise abruptly from the plain. Thence to somewhat beyond 108° W. the country is traversed by numerous mountain ranges, separable into two series. The first series comprises two complex axes of elevation, the front or eastern and the Sangre de Christo, whose trend is from N. 10° W. to N. 30° W. The second series is made up of the San Juan, Los Piños, La Plata, and San Miguel ranges, which have a trend of N. 30° W. to N. 45° W. Each series shows a parallelism in its ranges, and the whole system terminates *en échelon* southward, most of the axes ending in Colorado.

The eastern range, which consists of several closely packed parallel axes, and rises sharply from the plain, is composed of metamorphic rocks, badly fissured by dykes of lava, and not unfrequently capped by lava overflows. The schists are much torn and faulted, and side throws of mineral veins are not uncommon. Along the median line of the axis, exposed here and there by deep cuts, a compact granite, more or less syenitic, appears to prevail. The sedimentary rocks occur as "hog backs" along the eastern base, and curve round the southern terminations of the several axes.

The second range, provisionally named the Sangre de Christo by Dr. Stevenson—to whom (Report of Engineer Department, Wheeler Expedition, 1875) we are indebted for these particulars—is in the main almost parallel with the eastern range, but is much more complex in its structure. Its width is about twenty-five miles in the northern part, diminishing to twelve miles at Sangre de Christo Pass. With its extension, the Spanish range, it is, in Dr. Stephenson's opinion, but the southern portion of a magnificent group which once covered the whole region from East River to South Park. It remains for future explorations to solve the many problems which its complicated structure involves. In the main portion no rocks have been found of later date than the carboniferous.

The third great axis is the San Juan, for the most part buried under a great mass of volcanic rocks, which almost conceal those of sedimentary origin. Wherever exposed, a marked unconformability is seen between the carboniferous and the overlying rocks. The older formations are inclined at a very high angle, while the cretaceous and (doubtfully) the triassic, which are conformable to each other, have a very small dip.

The next great axis toward the west is the one termed by Dr. Newberry the Los Piños, in part the divide between the Rio de los Piños and the Rio Piedra. The only rocks involved are the carboniferous and (probably) the Silurian. On each side of the range, which is not more than five or six miles wide, the cretaceous rocks are seen forming mesas and dipping only two or three degrees.

The next axis, the La Plata (Newberry) forms in part the divide between the Rio de la Plata and Rio de los Animas. The course of the uplift is almost northwest, and the dip is very gentle where the strata have not been locally disturbed by lava dykes. The only rocks involved are the palæozoic, against which the triassic and the cretaceous abut at a slight angle.

The San Miguel axis is still farther westward, and, like the La Plata, involves only palæozoic rocks, those of mesozoic times forming mesas around it. Beyond, to the westward, extends a cretaceous plateau separating the Rocky Mountains from the Great Basin.

From his admittedly partial explorations, Dr. Stevenson finds it sufficiently evident that the Rocky Mountains are not the result of a single grand upheaval, and that the several axes are not wholly synchronous in origin. The general diminution of disturbance westward, as shown by the diminishing steepness of dip, together with the general trend of the several axes, shows that the disturbing force was propagated from the east or east of northeast.

The relations of the strata of the several periods make it easy to determine the era and the comparative energy of the successive upheavals. The first was at the close of the carboniferous period. The Silurian and the carboniferous are everywhere conformable, showing that, during the time of their deposition, there must have been either comparative quiet or continued subsidence. The line of continuous action thereafter seems to have been that now occupied by the eastern range. In this region there was a subsidence during the trias, which but slightly, if at all, affected the interior

The second epoch of elevation began toward the close of the triassic, and was marked by an exceedingly energetic action along the eastern line, accompanied by a grand eruption of igneous rocks. The conformability of the trias and the cretaceous in the San Juan area shows that the energy of the convulsions diminished westward and southwestward from the main line of disturbance. After the second upheaval there was an extensive subsidence, the record of which appears in the prevalence of cretaceous deposits over the whole Rocky Mountain area.

The third epoch of elevation followed hard upon the cretaceous period. The action is generally violent, in some parts terrific, resulting in a perfect maze of cross faulting. Everywhere north and east of the Rio Grande, the volcanic disturbance was excessive, a vast area being buried under a sheet of lava from two thousand to three thousand feet thick; and enormous dykes, stretching from the Sangre de Christo southeastward far out into the plain, remain to attest the widespread effects of the disturbance.

During the tertiary age, another but much slighter elevation took place, giving the rocks of that age a dip of five degrees. Of the four upheavals, the first and third were much the most general in their effects. The first was synchronous with that during which the Appalachian chain was completed.

INCENDIARY LOCOMOTIVES.

Conflagrations produced by sparks and fire from locomotives are by no means of unusual occurrence. It only necessary to observe after nightfall the fiery shower, with which every engine not supplied with proper spark arresting devices liberally besprinkles the track and its immediate vicinity, to discover why wooden buildings, oil in tanks, and hay ricks are constantly being destroyed, and in autumn to feel some wonderment that the adjacent fields of ripe grain or sun-dried prairie grass are not more frequently kindled. It cannot be doubted that many a fire is ignited in cities, as well as in country villages through which an express train rushes at fifty miles per hour, the unknown cause of which is the locomotive, scores of miles away before the fire breaks forth.

We are exceptionally patient people, however, and individually at least prefer suffering the loss of a burnt barn than to become involved in legal proceedings *versus* a huge and wealthy corporation. But on the other hand, immunity on the part of the railroads in this respect begets carelessness likewise on their part, notably in the provision of the devices, easily obtainable, which will prevent their locomotives being perambulating incendiaries. The consequence is an increase of the evil; so that not only has a loser a private end to gain in seeking prompt redress from the railroad company, but he has a public duty to perform in enforcing his right. The railroad, it should be remembered, enjoys its privileges by the sufferance of the people, and it is conditioned not only to serve the public in certain ways but to exercise diligence not to work injury to the public. It is therefore responsible for its negligence; and generally it is incumbent on the railroad to show conclusively that the person injured actively contributed by his individual neglect to effect the result, if it would save itself from being cast in damages. The tendency on the part of courts and juries is to hold all corporations with great strictness to their duties; and in this rigid enforcement of the law is found the safeguard of the people against the abnormal exactions which great controlling monopolies would otherwise too often be in position to demand.

The manner in which the law regards fires produced by locomotives is cogently stated in a decision recently reached by our highest tribunal, the Supreme Court of the United States. The case was that of R. M. Richardson *vs.* the Grand Trunk Railway Company of Canada. Certain buildings for freight purposes and for his individual benefit had, by Richardson, been erected, with the company's permission, on land owned by the railroad. These were destroyed by fire from a locomotive, and the action was brought to recover. In its opinion, the court said that the issue to be determined was whether the defendants had been guilty of negligence—that is, whether they had failed to exercise that caution and diligence which the circumstances demanded, and which prudent men ordinarily exercise. Hence the standard by which their conduct was to be measured was not the conduct of other railroad companies in the vicinity, certainly not their usual conduct. Besides, the degree of care which the law requires, in order to guard against injury to others, varies greatly according to the circumstances of the case. When the fire which caused the destruction to the plaintiffs' buildings occurred, it was a dry time, and there was a high wind. At such a time greater vigilance was demanded than might ordinarily be required. The usual practice of other companies in that section of the country sheds no light upon the duty of the defendants when running locomotives over long wooden bridges in near proximity to frame buildings, where danger is more than commonly imminent. Evidence was held admissible as tending to prove the possibility and a consequent probability that some locomotive caused the fire, and as tending to show a negligent habit of the officers and agents of the railroad company. It was further held that it made no difference that a large part of the property destroyed was wrongfully on the railway, the court sustaining the ruling in a case cited that the company in such a case was bound to exercise ordinary care to avoid injury, even to a trespasser.

The Arrival of Professor Huxley.

Professor Huxley, the celebrated English scientist, has arrived in this country. He is at present traveling privately, and will devote the greater part of his brief visit to the Centennial Exposition. It was not his intention to deliver any lectures here, but he has lately reconsidered his determination, and has consented to give three discourses during the latter part of September, in this city. The topics are not yet announced, but this is immaterial, as there is sufficient curiosity to see an investigator, whose name and works are as familiar to us as to his own countrymen, to fill the largest hall New York possesses. Meanwhile, until our people shall have the promised opportunity of collectively greeting the eminent gentleman, we take the liveliest pleasure in extending to him, on the part of the scientific workers, the inventors, and the mechanics of this country, a most cordial and hearty welcome.

Preventive of Hydrophobia.

In a letter published in a recent number of Professor Gubler's *Journal de Thérapeutique*, another addition is made to the already formidable list of prophylactics against hydrophobia. Dr. Graymala, of Krivoe Ozeroe, Podolie, reports that during the last ten years he has treated at least 100 cases—in human subjects as well as beasts—of bites by hydrophobic animals with the powdered leaves of *xanthium spinosum*, with success in every case except one, although cases of bites inflicted at the same time, but treated in other ways, had terminated in death. The drug is described as possessing sudorific, sialagogue, and slightly diuretic properties, but less pronounced than those of jaborandi. The dose for an adult is 9 grains of dry powder of the leaves, repeated three times a day and continued during three weeks; to children under 12 years, half the quantity is given.

TO BLEACH SPONGE.—Soak it well in dilute muriatic acid for twelve hours. Wash well with water, to remove the lime, then immerse it in a solution of hyposulphate of soda, to which dilute muriatic acid has been added a moment before. After it is bleached sufficiently, remove it, wash again, and dry it. It may thus be bleached almost snow white.

BREECH-LOADING FIREARMS.

It has been stated by Bayard Taylor and other travelers that a revolving pistol, with one barrel and a cylinder to be loaded in several chambers, is to be found in a collection of ancient armor, in Warwick Castle, England, and that another, of similar design, is to be found among the relics exhibited in the Tower of London. But these remarkable curiosities can scarcely be considered to depreciate the value of the modern breech-loading rifle, the details of which have probably been the subject of as many patents as those of any other appliance. We publish herewith the first of a series of engravings of the many improvements effected during the last few years, which we extract from Mr. E. H. Knight's "American Mechanical Dictionary."*

The Martini gun, A, is the invention of a Swiss. The breech block is pivoted at its upper rear portion, being moved up and down by a lever at the rear of the trigger guard. The firing is by a spiral spring, which actuates a firing pin. The cartridge shell extractor works on a pivot below and behind, the barrel being operated by the descent of the front end of the breech block upon one arm of the bell crank lever.

The Chassepot gun, B, is the French arm, and is named after its inventor. It is what we term a bolt gun, an opening on the right hand of the chamber admitting the insertion of the cartridge. The forward thrust of a knob drives the cartridge into the breech, and a partial rotation of the knob locks the breech piece. The firing is by a needle.

The Prussian needle gun, C, is also a bolt gun, having an inner bolt which forms the firing pin, a sleeve around it, and an outer cylinder, the parts are shown with the needle in its fired position. In preparing to reload, the rear knob is withdrawn, and the axial bolt retained by a catch which engages a projection, withdrawing the needle. The chamber is then unlocked by the knob and slid back, the cartridge inserted and driven into the breech by the chamber, which is locked by a partial rotation. The firing is done by releasing the needle bolt.

In Maynard's rifle, D, the barrel is pivoted to the front end of the stock, and its rear end tips upwardly, exposing the chamber for the cartridge, when the barrel is tipped down against a solid breech piece and locked. The Maynard primer consists of pellets of fulminate placed at regular intervals between narrow strips of paper. This is coiled in a chamber in the lock plate, and is fed forward by a wheel operated by a hammer, so as to bring a pellet on top of the nipple at each discharge.

The Merrill gun, E, was constructed for a paper cartridge. The breech was closed by a sliding plug locked in place by a combination of levers. The charge was exploded by a copper cap, placed upon the nipple in the ordinary manner.

The Spencer rifle, F, is both a magazine and a single breech-loader, seven cartridges being placed in a magazine in the butt, and being thrown forward to the chamber as required. The breech block is a sector pivoted beneath the level of the barrel, and retreating backward and downward to expose the rear of the bore for the insertion of the cartridge. The trigger guard forms the lever for moving the breech block.

The Laidley gun, G, has a breech block pivoted beneath the barrel and rotating backward and downward to open the chamber. When in position for firing, it is fastened by a locking brace which is operated by a spring and vibrates on the same axis as the hammer. The breech block is unlocked by a cam and thrown back by a pawl attached to the locking brace and actuated by the hammer.

The Westley-Richards gun, H, is an English arm, having a pivoted breech block whose front end is depressed by the action of a lever pivoted to the stock beneath the rear of the barrel.

The Snider gun, I, built at Enfield, England, is similar to our Springfield converted rifle, which we shall describe in a future issue. The breech block is hinged behind and above the barrel, the block throwing upward and forward, exposing a chamber behind. Into this the cartridge is dropped, pushed into the bore, the block brought down and locked by a latch in the rear. The firing pin passes obliquely through the block, and is struck by the ordinary hammer.

The Berdan form of this type is shown at J, and has a breech block in two sections hinged together.

K is the Peabody gun, which has a falling breech block, hinged at the rear and depressed by the guard lever, whose short arm engages in a recess of the block and controls its movements. When the block is down, the cartridge is slipped into the bore, and the piece is fired by the fall of the hammer upon a firing pin sliding in a groove in the side of the block. In opening to reload, the block drops upon an elbow lever and withdraws the spent cartridge shell.

The Roberts gun, L, has a breech block pivoted at the rear, operated by a lever which extends backwardly over the small of the stock; the forward end of the breech block being depressed, the center of its motion and its abutment in firing being a concave solid brass centering on the exact prolongation of the axis of the barrel. The breech parts are four in number, articulated without pins or screws. The firing pin passes centrally through the breech block, and is driven forward on the center of the cartridge by a blow of the hammer.

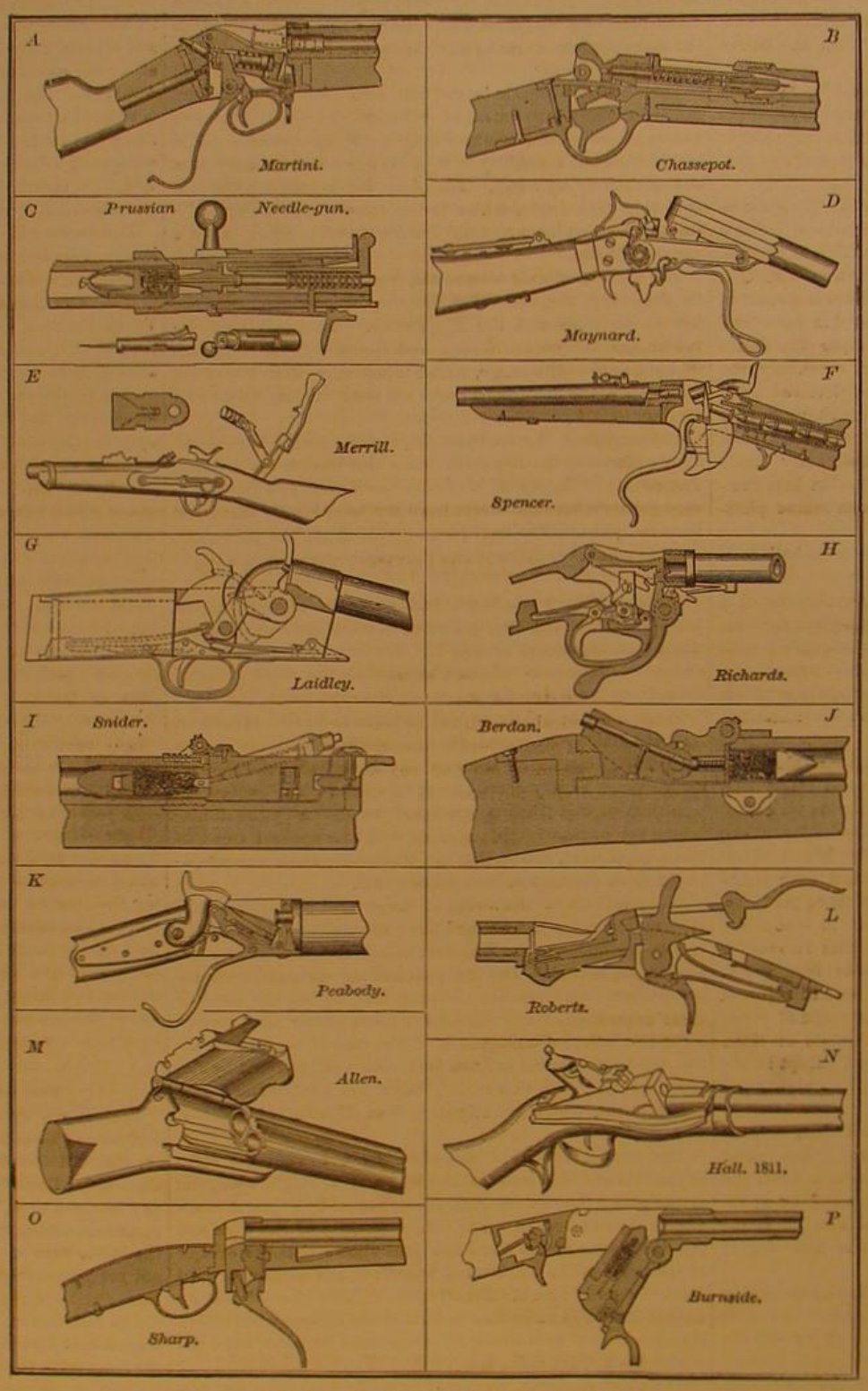
Allen's gun, M, is double barreled, and the breech block is hinged at the side, swinging upwardly and laterally. It carries both firing pins, and is locked shut by a latch.

The first patent in the United States for a breech-loading firearm was to Thornton & Hall, of North Yarmouth, Mass., May 21, 1811. This gun is represented at N in our engraving, and had a breech block, which was hinged on an axial pin at the rear, and tipped upwardly at front to expose the front end of the charge chamber. The flint lock and powder pan were attached to the vibrating breech block.

Sharps' rifle, O, has the barrel rigidly attached to the stock, the rear being opened or closed by a vertically sliding breech block, which slides up and down in a mortise operated by the trigger guard, which is pivoted at the front end, or by a lever. The primer consists of small pellets of fulminate inclosed in a copper casing so as to be waterproof. These are placed in a pile in a hole in the lock plate, forced upward by a spiral spring, the upper one fed forward by a plunger, caught by the cup of the hammer, and carried down upon the nipple. The cartridge is in cloth, the end covered with tissue paper saturated with saltpeter, through which the fulminate will ignite the powder.

Burnside's rifle, P, has the barrel attached to the stock, the breech piece being pivoted beneath the barrel, so as to swing downward and expose the chamber in the front end of the breech piece for the insertion of the cartridge.

Other forms of breech-loading rifles will be illustrated in forthcoming issues of this journal.



BREECH-LOADING FIREARMS.

*Published in numbers by Messrs. Hurd & Houghton, New York city.

To make a good organ pipe metal, take equal quantities of tin and lead, cast into sheets, and plane smooth.

Imitation Marble.

Carl Boschau says that if a statue, made of plaster of Paris or *papier maché*, be coated with thick white dammar varnish, and then dusted with pulverized glass, it will have, when dry, the appearance of alabaster. If it be afterwards varnished a second time, and dusted with coarsely pulverized white glass or mica (*marienglas*) and again dried, it will be a very successful imitation of Carrara marble, especially if the marble veins be first traced on it with some delicate blue pigment. This method of preparation follows that of Nature, for alabaster consists of very small crystals of sulphate of lime, and Carrara marble of somewhat larger crystals of carbonate of lime, which in reflected light glisten like white sugar. This effect is obtained with perfect deception by the brilliant white glass in coarse powder.

An Oil Pipe Three Hundred Miles Long.

The Pennsylvania Transportation Company, of which Mr Henry Harley is president, has been chartered by the State of Pennsylvania for the purpose of transporting oil from the oil regions to the principal Atlantic seaboard cities. The plan proposed is to run the oil through a four inch pipe laid on the surface; the forcing power will be 900 lbs. to the square inch; there are to be stations at distances of fifteen miles, at each end of which an engine of a 100 horse power will be erected to work a pump to continue the flow from point to point. The company having decided upon the construction of the work, the president sought the services of General Herman Haupt. He pronounced the scheme, after a thorough examination, to be entirely practicable, and is now acting as engineer-in-chief. In view of the enormous product of oil in this country—30,000 barrels per day—and the rank it now holds among the leading articles of export, coupled with the exorbitant charges for railroad carriage from the wells to the seaboard, by the completion of the enterprise and its successful operation a complete revolution will be accomplished in the handling of this article. As a proof of how valuable this traffic has been to the several railroads over which the oil has been borne, it is only necessary to say that up to the present time the railroad charges aggregate $79,000,000. The minimum cost of transporting oil by rail is 50 cents per barrel, and the minimum cost by the pipe process is 16 cents. The average charge by rail is $1.25.

The estimated cost of the entire work, including fixtures, etc., is $1,250,000; and considering the difference in cost between this method and that by rail, upon the hypothesis that the company will discount at least 25 cents a barrel on rail rates, it will readily be seen that, with all the expenses of operating, the first year's earnings will pay the first cost of the work. The Pennsylvania Company is the parent company, but there is also the Baltimore Transportation Company, chartered by the State of Maryland, and some five other companies are expecting to unite. The first objective point or terminus will be Baltimore, as being the most feasible and direct route for the pipes. Following which other termini will be established in Philadelphia, New York, etc.

The pipes being laid on the surface, and there being no obstacle in the way of forcing the oil to any hight, the line will literally be an air line, and the distance from the oil regions to Baltimore is 300 miles. The oil will be distributed from the pipes into immense reservoirs, with refining establishments adjacent. Of course the whole railroad system will oppose it, for it is taking from them a traffic from the very nature of which there could be no competition; but the advantage to the oil producers, who will have the entire control, will be immense, and the advantages which will accrue from such facilities to this important branch of our export commerce will be incalculable.

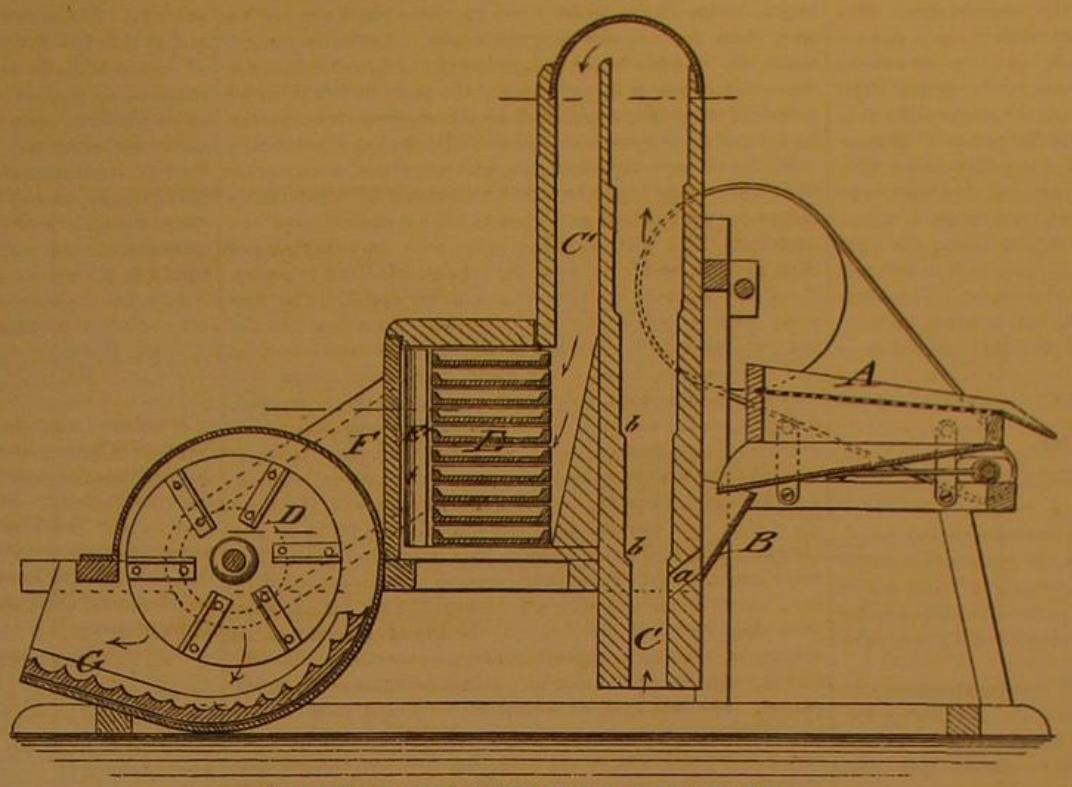
The feasibility of this enterprise, so far as the passage of the oil through pipes is concerned, has been fully established by the present system in operation in the oil regions, where the aggregate length of the pipes conveying the oil from the several wells to the reservoirs is nearly 250 miles. —*Boston Traveler.*

Prizes for a New Bleaching Agent.

A Vienna industrial league offers a silver medal to any one who will discover a method of bleaching every kind of silk perfectly white without the use of sulphur or other chemical injurious to silver. In embroidery and silver lace, where silk and silver are used together, the silver is blackened by the sulphur in the silk. A similar prize is offered for the most beautiful and solid domestic article for weighting light-colored silks.

IMPROVED AMALGAMATING APPARATUS.

The improved apparatus illustrated herewith is for separating gold from sand and other impurities by means of a suction blast. A represents a reciprocating screen, on which the gold-bearing sand is placed. The bottom of the screen is inclined in opposite direction to the perforated part, and conveys the material into a hopper, B, of the upright suction tube, C, from where it passes through an aperture, *a*, into the lower part of the same to be acted upon directly by a suction blast from below, the blast being created by a suction fan, D. The air enters through the open bottom end of the suction tube, which is made with inclined steps, *b*, that produce the gradual widening of the tube toward the top end. These steps serve to throw the sand, dirt, or other substances that slide down at the side of the tube back into the current of air, to be acted upon and carried in upward direction. The heavier gold particles drop down into a suitable receptacle below the bottom opening of the suction tube, while the lighter ones pass with the sand along the semicircular top part of the tube, and over the partition wall into the downward extending tube, C′, that conveys the sand, in connection with a steeply inclined bottom, to a series of amalgamating pans, E, that are filled with quicksilver, and placed so closely together that the total width of the narrow spaces or interstices between the pans is equal to the width of the entrance opening of the suction tube. The gold-bearing sand is thus carried with considerable power through the spaces between the pans, the fine gold particles being absorbed by the passage in close proximity, and the affinity to the quicksilver



IRVIN'S AMALGAMATING APPARATUS.

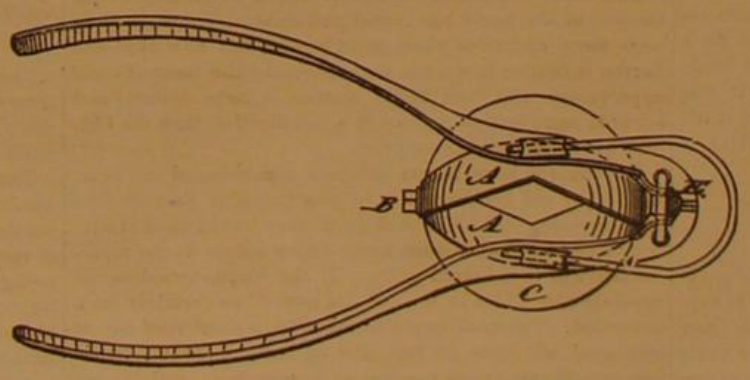
A central tapering partition, E′, at the opposite side of the pans, divides the current and conveys the sand sidewise through the side ducts, F, to the center of the suction fan, from where the same is thrown by centrifugal power on a curved and tangential fluted pan, G, at the bottom of the fan casing. The remaining particles of gold are amalgamated in the fluted pan, and the light impurities thrown to the outside of the casing. Thus the gold particles are separated in their course through the apparatus, the heavier ones being dropped in the suction tube, while the lighter ones are amalgamated in the pans, and the remaining ones, that are mechanically carried along, in the fluted pan at the mouth of the fan casing.

This machine was patented through the Scientific American Patent Agency, July 4, 1876, by Mr. Thomas W. Irwin, of Port Madison, Wash. Ter.

NEW LAMPWICK TRIMMERS.

Mr. John Bannihr, of Hempstead, N. Y. has patented (July 4, 1876) through the Scientific American Patent Agency, a novel improvement in lamp wick trimmers, which is represented in the accompanying engraving.

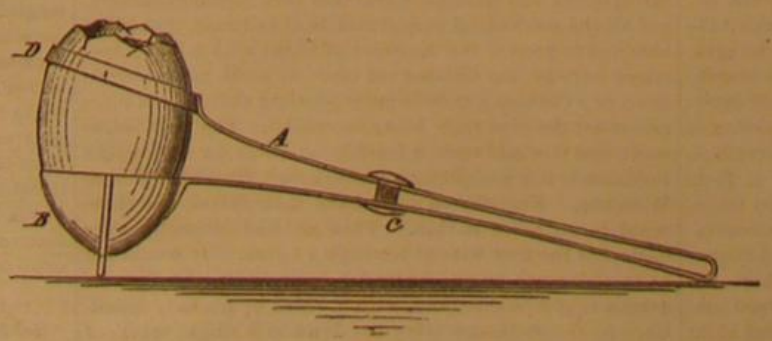
The shear cutters, A, are contrived to cut alike and at the same time from both edges of the wick to the center, whereby the wick is trimmed better and more uniformly than when cut across from one edge to the other. The cutters, which are curved for trimming the wick in form for an oval burner, are extended down at the ends a suitable distance below the point of cutting, and pivoted together at both ends, B, and also to a supporting ring, C, that rests on the burner some distance below the top for a steadying support, and for a gage to govern the hight of the cutting above the top of the burner The levers for working the cutters are pivoted to the standard, E, mounted on the ring, C, and are connected to the cutters at the center between the pivots, B. The edges of the cutters are shaped in the form of two sides of a triangle, the apex of which is at the center of the cutters lengthwise, thus enabling them to shear-cut the wick from its edges to its center.



BANNIHR'S LAMPWICK TRIMMER.

A NEW EGG HOLDER.

The annexed engraving represents a simple egg holder, devised by Mr. Henri Guilbeault, of New York city, and to him patented through the Scientific American Patent Agency, July 4, 1876. It consists of a cup, B, of suitable form, with a ring, D, and spring tongs, A. The parts are combined, as shown. in such manner that an egg placed in the cup may be securely held by bringing the ring down upon the egg by sliding a double button, C, whi h connects the jaws of the tongs, through slots made in them for that purpose. The egg is thus held while it is being eaten from the shell.



GUILBEAULT'S EGG HOLDER

A New Chicago Rolling Mill.

The Joseph H. Brown Iron and Steel Company, of Chicago, are nearly ready to begin operations in their merchant mill. All finishing trains, except the 22 inch beam mill, are ready to operate, except making steam connections. The puddling and heating furnaces are ready to work and the boilers in place. The bar mill and 9 inch train are in position, as well as the top and bottom mill. They are building a blast furnace 18 feet by 80 feet. This will be, when completed, one of the most complete establishments in the West. It has six double puddling furnaces (Siemens) with a daily capacity of eight tuns each on double turn; two scrap furnaces (Siemens) with a capacity of 20 tuns each per day; and five Siemens' heating furnaces, 32 gas producers, a 22 inch beam mill to roll 90 feet long; 16 inch bar, with six stands of rolls; 9 inch guide; 20 inch top and bottom mill; 20 inch muck train · all these are three high. There are sixteen 40-inch boilers, with 40 3-inch flues in each. They also have drawings for a complete Bessemer plant.—*Iron Age*

Purifying Carbon Disulphide.

Recent chemical investigations seem to have included the whole range of photographic materials, and, in addition to those already named, we find our notes call attention to a mode of purifying the most useful material for dissolving india rubber—carbon disulphide. In the state most commonly presented, it possesses such an intensely fœtid odor as to make its use unbearable; the new process promises a product in a very pure condition. The method of purification consists in mixing fuming nitric acid with a sample of the disulphide distilled off palm oil, and then adding distilled water, filtering, and distilling between 50° and 60°. A peculiar violet compound produced at one part of the process has been traced to the iodine well known to be almost always contained in commercial nitric acid.

The Jetties.

The progress of work on the Mississippi River jetties has gone so far that Captain Eads was recently enabled to close up Grand Bayou, a channel that has heretofore drawn off about one third of the water of the South Pass. The closing of this bayou so increased the current through the Pass that in less than two days the channel was deepened more than a foot through the greatly increased scour. Captain Eads thinks that this will soon tell on the main bar; and in fact the pilots say its effect is already so marked that they can take over the main bar any vessel drawing twenty feet of water. If this be the case, the work on the jetties has already accomplished much more for the South Pass than many years of laborious and expensive dredging have been able to do for the Southwest Pass.—*Philadelphia Ledger.*

The Resources of Animals.

Animals, even of the least important species, sometimes resort to shifts and expedients, to defend and support their existence, so curious as to astonish even those observers who are most familiar with their habits. The little gossamer spider, having no wings, still finds its home in the upper air. Weaving a tiny kite of web and flying it aloft by unwinding a thin kite string from its spinneret, it finally fastens the lower end to a twig, and climbs fearlessly up the filament, till at last it sits far above the earth and catches midges upon its floating raft in the air. This little forager has been found sailing in the air nearly a mile high by balloonists!

The male spider has usually a very poor show for liberty or even for life. Small and lean, weak and cowardly, a mere speck by the side of his big blushing sweetheart, she generally catches him when he first comes courting, spears him with her fierce mandibles, gnaws the quivering flesh off his bones, and flings his polished skeleton into the sewer. She is heartless and ferocious—a coquette and a warrior. Woman's rights are carried to an extreme. The husband is not allowed to vote or to govern his own family. Before his brood of 1,000 children have climbed merrily upon their mother's back, she has generally made a breakfast off him, and his bones bleach in the back yard.

Then there is the hermit crab, the pugnacious crustacean that can seldom succeed in preserving its own life at all except by finding the shell of some large snail or whelk to crawl into. Having a bulky and soft abdomen, it is peculiarly vulnerable to attack from predacious fishes and crabs, and its only safety is in covering its salient extremity. If it finds an eligible snail shell empty, it immediately takes possession by backing its exposed body in and fastening the shell on by the posterior hooks, leaving its head and legs outside. Then it drags the shell around till it is outgrown, when it seeks another. If it finds none unoccupied it frequently kills a living snail, eats him, and unceremoniously takes possession of his house. Or it attacks a tenant crab, the winner of the combat retaining the premises. The loss of an eye or a claw is by no means a mortal injury, or even a permanent crippling, as the mutilation heals, and the eye or limb reappears as good as ever.

Speaking of crustaceans, did you ever see a long or soft-shell clam in his native wilds? Do you know what that exposed proboscis is which you call the neck? It is a double-acting muscular pump, with two pipes and valves, through one of which salt water is drawn and through the other expelled. It drenches the gills, which retain as food any bit of nutriment that may float in, when the filtered water is passed out through the other valve. And that dark lump in the clam, which you have often rejected, madam, as the stomach, is not the receptacle of food at all, but merely an excellent enlarged liver, which epicures might, without torturing the humble bivalve, make into a *paté de foie gras.*

Most animals that are in danger from predacious foes are of a natural tint, resembling the hues of the earth or trees upon which they live. Partridges, quails, and other sand and heath birds are brown, like their dwelling place, and the color serves to conceal and protect them. Some butterflies and locusts are exactly the shape of the leaves of the tree upon which they cling, so that they are not visible in their true character. Where a hundred have settled you cannot see one, only the leaves clinging to the branches and swaying in the wind. Not only the color of the leaves is imitated, but the venation, to the most minute particular; and it is only when you strike the bush with a stick that the "leaves" rise and flutter away. Some of these leaf insects, as they are called, change their colors with the season of the year—green in spring, brighter in summer, and brown in autumn, like the true leaf. Even the imperfections of the leaves are mimicked—those characteristic markings and erasions of the leaf which result from the attacks of minute insects. The decay o. dying leaves is so imitated that, as Mr. Wallace remarks, "it is impossible to avoid thinking, at first sight, that the butterflies themselves have been attacked by real fungi."

In the turbulent brooks of Connecticut, and probably of other States, is found an ingenious little insect, that the rural people know as a bundle bug, an inch or two long, which protects itself

from predacious fishes by gluing to his sides small sticks, somewhat longer than his body, until he is encased in an irregular wooden cylinder—a jagged and clumsy boat in which he alternately floats and crawls. This carpenter worm leaves an orifice for his head and legs, and his artificial shell seems a thorough shield.

The medusa or jelly fish of our seacoast is well known to all sea bathers; and its phosphorescence often reveals its whereabouts to steamboat travelers. It is as large as a tea plate, flat, gelatinous, and translucent; with the convex portion forward, it pushes its way through the water as if it were a small parasol—a white fringe a yard long, waving backward from the edge, assisting the resemblance. This creature has hardly any life; it seems to have only one organ, which receives and ejects food, and its movement through the water is by a series of convulsive jerks. Lift it out of the water and it drops through the fingers like thin jelly. But in its native element it has the power of sharply stinging with its fringe, from which it is called nettle fish. This fringe, when microscopically examined, is found to be filled with minute sacks, each of which contain a microscopic arrow ready to discharge. Friction bursts the cells and causes the discharge of myriads of arrows into any soft flesh that may be the cause of the disturbance. The harm is not great to any robust organism, but it must be sufficient to shock and paralyze some of the inferior fishes.—*Graphic.*

Correspondence.

How to Straighten a Shaft.

We frequently receive letters from our subscribers detailing some experiment they have made, or some new wrinkle in the detail of manufacture, or concerning a novel device they have found to answer for some particular purpose; for all such communications our correspondents have our thanks.

Although the large number of such communications precludes the possibility of our answering or publishing all, yet we convert as many as possible to the benefit of our readers. We are sometimes surprised to observe how completely the information forwarded to us on a given subject will answer an inquiry made on the same subject by some other correspondent. For example, A. F. writes: "You will do me a great favor if you will tell me how to straighten an iron shaft, 2¼ inches in diameter, that is slightly bent, and will not work without binding in the bearings."

The same mail brought a letter from J. J. H., who writes:

To the Editor of the Scientific American:

"The following is a good way to straighten shafts that have been sprung by heat or otherwise. Lay the shaft on bearings at each end, with the arched side up, about 1 foot from the ground; then build a fire (wood will answer) under the part or parts to be straightened. When hot, chill the the top side, which is to be straightened, with water, which can be best done with a swab; continue the heating and chilling till the work is complete. Allow the heat to come back to the top side between each chilling, to quicken the process, and to ascertain when complete. After the shaft is hot, a very little fire will be required to continue the heat. I think that any kind or size of metal shafting can be straightened by this process. I made the experiment on a wrought iron shaft 5 inches in diameter and 12 feet long, that was sprung 3 inches by being burnt in a mill. It was was only 2 hours from the time I built the fire under it till it was perfectly straight. J. J. HILL.

Hayden's Ferry, Arizona, July 1, 1876.

[For the Scientific American.]

THE DEVELOPMENT OF SPEECH.

As the seventeenth century was preëminently one of revolutions, the present is one of evolution. Everything is supposed to have been evolved from something else, man from monkeys, articulate speech from inarticulate cries, writing from hieroglyphics, etc. A few weeks since the American Philological Society met in New York city, and among their discussions were some of much interest. Professor Harkness read a paper in which he stated that comparative philology had proved that all the known languages and dialects have been evolved from one parent tongue, whether by differentiation, natural selection, and survival of the fittest, or by other processes. Darwin, in his "Descent of Man," draws some of his most forcible arguments from the resemblance of the human fetus to the full grown ape and other animals. The unspoken language, the inarticulate cries of infants, has not, so far as we are aware, been carefully studied, and compared to the cries of birds and animals. H. Taine has recently directed attention to this subject by an article on "Lingual Development in Babyhood," published in the *Revue Philosophique*. But M. Taine passes over the multitude of different cries and exclamations, consisting, as he says, exclusively of vowel sounds, and expects articulate speech. Some of his observations are, however, valuable and interesting, as being the first that have been accurately made and intelligently recorded. We hope that these observations will be repeated by others, so that in time the mass of facts will be large enough to enable us to generalize upon them, and eliminate the personal factors which vitiate the conclusions drawn from too limited a number of facts. Idiosyncrasies in children are probably as common as elsewhere; abnormal development must not be mistaken for a normal condition; one child will differ so greatly from some other child that we shall at first incline to think there is no common ground between them; but as observations increase, the facts will gradually fall into system, and order come out of chaos.

From a study of the speech of babyhood we shall learn not only how language is formed, but shall see in it the gradual unfolding of the intellect. Babies' selections of words are instructive to the biologist; the order in which they acquire the power of pronouncing the consonants is an interesting study for the phonetic scholar. Why, for instance, can every infant pronounce the word no, for several months before it can say yes? That the English sounds of th are difficult for our children is not surprising, but why are our sounds of j and ch, which few foreigners ever succeed in uttering correctly, easier for a child to pronounce than w, or f, or g? Yet we have heard a boy of three years say jay for way, chun for fun, and jajy for wagon. Again, an American child, who has heard no language but English, will sometimes introduce into our words the most difficult vowel sounds of other languages, such as the unpronounceable German ö and ü, or French eu and u, which he has never heard.

M. Taine says that the little girl on whom his observations were made began to attach a meaning to certain words before she pronounced any word to which she attached any meaning. This will, we think, agree with the experience of most parents, and is not strange, for animals learn to understand our language which they can never speak. The first word pronounced by her was papa, but for a time she did not comprehend its meaning. At the age of fourteen months and three weeks, he says, she could pronounce mama, tété (nurse), oua-oua (dog), koko (hen, cock), dada (horse wagon), mia (cat), kaka, and tem. To the latter word she gave a very extensive signification, such as give, take, see, look; it seemed to be a word coined to express her principal desires. Another child, observed by the writer, began with the word no, which was spoken very emphatically in reply to any question, and without a definite idea attaching to it. The same may be said of another common expression used by her, "don't do it;" she soon after learned to say mama, bow-wow (dog), and dink (drink). At the age of fifteen months she began to imitate, repeating almost everything she was told to, and here the habit of generalization was again apparent. She was told, on seeing an ice wagon pass, to say ice. She can pronounce it nicely, and says it every time she sees a horse and wagon, showing that she has extended its meaning to all wagons, and probably to horses also. Another curious case came under our notice sometime since of a little boy who applied the term dady to every man he saw, and also to chickens, dogs, horses, etc., much to the annoyance of his mother.

In a paper read at the Bristol meeting of the British Association, D. A. Spalding advanced the idea that the progress of the infant is but the unfolding of inherited powers. He makes no application of this principle to the power of speech, although he might have done so, and we are inclined to believe that, just as a child learns to walk as soon as his limbs are strong enough to safely support him, so he will learn to talk as soon as the brain is sufficiently developed to evolve ideas requiring expression, subject, of course, to the law that perfection is only gained by practice. E. J. H.

[For the Scientific American.]

THE FIRST CHINESE RAILWAY.

The Japanese have readily taken to the mechanical, scientific, and other improvements to which intercourse with the rest of the world has introduced them. For ages they were more exclusive than the Chinese; but now that the barrier is broken down, the Japanese make the most of their opportunity; and they really seemed to have learned and adopted more foreign notions in a few decades than the Chinese have acquired in centuries.

But the iron horse has at last been domesticated in China; and if the old conservatives of the Celestial Empire ever read anything but Chinese classics, they would class the locomotive with that wooden horse which stands as the representative of treacherous gifts. If the locomotive does not revolutionize China in the end, its power has certainly been overrated. The trial trip was taken on a short road out of Shanghai, on June 30 last, and on July 3 regular travel commenced, six trains running each way daily, and the receipts being highly satisfactory. Six daily trains over a road only five miles long is not a very heavy day's work; but with the Chinese, in making innovations, it is wise to make haste slowly.

The first railroad in China, from Shanghai to Woosung, is ten miles long; but the road was only completed to Kangwan, half the distance, when it was opened with much ceremony, the pleasantest part of the programme being on the second day, when the natives were allowed to travel free, and appear to have received that proposition as heartily as any dead heads among the outside barbarians could have done. It is three years or more since the British and continental ironmasters, in session at Liége, took China into their calculations as a possible market for iron, locomotives, cars, and all the mechanical paraphernalia of railways. The first idea was to present the Emperor of China with a small specimen railway; but Chinese red tape—as much more complicated as a Chinese puzzle is more puzzling than any other—prevented the plan from being successful. The next movement, and it would seem a feasible one, was for the foreign residents to buy ground for a carriage road, from Shanghai to Woosung. Englishmen must have their drives, and there could be no harm in that. Then railroad estimates were made; but the first were at too high a figure. It would not do to risk much on an enterprise upon which the Chinese dragon might pounce, and, with a whisk of his tail, demolish. So the estimates were cut down to a single track, of very narrow gage, 2 feet 6 inches, very light rail, 27 lbs.; a toy locomotive, weighing only 1½ tuns, running at a maximum speed of only 15 miles per hour. The road was commenced in January, and in the months which have elapsed the projectors have gained in confidence. They have built for the road two engines, the "Flowery Land" and the "Celestial Empire," weighing each 9 tuns; they have eight inch cylinders and ten inches stroke, have each six wheels, and side tanks.

With a sagacious eye to the consequences of an explosion upon the Chinese temperament, the boilers were tested to 200 lbs. to the square inch. And, for a little while at any rate, the speed will be kept down, and the chances of collision or track jumping will be studiously guarded against. Even to cut off a Chinaman's queue would be fatal to the enterprise; and at this late day in the history of railroads, the problem of safety is made prominent above that of speed. It were much to be wished, for the sake of the public, that Britons and Americans were so far Chinese that to kill one would be a disaster worth consideration, as well financially as morally. If we learn safety in railway traffic from the first Chinese railway, it will be a first class investment for the traveling world. And if, from this small beginning, the iron interests should receive a much needed impetus, that, too, would be a welcome event.

THE IMPACT OF LIGHT.

ABSTRACT OF A LECTURE BY CAPTAIN ABNEY, R. E., F. R. S., AT THE LOAN COLLECTION, SOUTH KENSINGTON.

Astronomy was the religion of the world's infancy, and it can hardly be a matter of surprise that untutored yet inquiring minds, unaided by any distinct revelation, should have attributed to the glorious orb, the center of our solar system, the possession of divine attributes, and, as they gazed upon the wondrous effects of his magical painting, that they should have offered to him their adoration and worship, and carefully noted any phenomena due to him Thus probably

THE FIRST PHOTOGRAPHIC ACTION

noticed would be at a very early period of human existence, when the exposure of the epidermis to his rays caused what is known to us as tan, whilst the parts of the body covered would remain of their pristine whiteness. A photographic action which would be remarked at a later date would be the fading of colors in the sunlight. Ribbons, silks, curtains, and similar fabrics of a colored nature undergo a change in tint when exposed to it.

RIBBONS CHANGED BY LIGHT.

I have here a specimen of a pink trimming used by the fair sex, and the lady who presented me with it informed me that it was "a most abominable take-in," as the color "goes" after two days' wear. Her ideas on the subject and my own somewhat differed, for to me it presented a capital opportunity of using the material as a means for obtaining a photographic print in a moderate time. I have here two results of the exposure of this stuff to the sunlight. One was exposed beneath a negative of an anatomical subject, and we have the image represented as white upon a pink ground. The other subject is a map. An ordinary map was superposed over a square piece of the stuff, and placed in sunlight whilst in contact. We have in this case the lines of the map represented as pink on a white ground, from which the color had faded.

CHEMICAL CHANGES CAUSED BY LIGHT.

The general opinion is, I believe, that the color is given off somewhat similarly to the scent from a rose. Were this entirely the case, the light would not act as it does, but, beneath the negative or map, the color would bleach uniformly.

The bleaching seems to be a really chemical change in the dye, due to the impact of light. There are many other bodies besides dyes which change in light, and some of them are of the most unlikely nature. I had intended to show you to-night the change that takes place in glass by exposure to light for long periods. My friend, Mr. Dalimeyer, has in his possession specimens of brown and flint glass, which have markedly changed color in those halves of the prisms purposely exposed to solar influences. In some cases there is a "yellowing" of the body, and in others a decided "purpling."

WHAT LIGHT IS.

It is, however, only those bodies which change rapidly in the light that are utilized in photography. The most common amongst these are various compounds of silver, for they are peculiarly sensitive to the action of light. Nearly every silver compound is more or less changed by it, and when I say changed I mean altered in chemical composition When we reflect what light is we can better understand its action. Light, as experiment, confirmed by mathematical investigation, tells us, is caused by a series of waves issuing from the luminous source, not, indeed, trembling in our tangible atmosphere, but in a subtler and infinitely less dense medium, which pervades all space, and which exists even in the interior of the densest solids and liquids. These waves of ether, as this medium is called, batter against and try to insinuate themselves amongst the molecules of any body exposed to their action, a good many millions of millions of them impinging every second against it. Surely it is not surprising to think, small though the lengths of these waves be, that this persistent battering should in some instances be able to drive away from each of the molecules some one of the atoms of which they are composed.

HOW LIGHT ACTS UPON SILVER CHLORIDE

Take as a type that salt of silver which was, perhaps, the first known to change in the presence of light-silver chloride. For our purpose we may represent each of its molecules as

made up of two atoms of silver locked up with two atoms of chlorine. Let us consider the action of the light on only one molecule. The waves strike against it energetically and persistently; the swing that the molecule can take up is not in accord with the swing of the ether. It is shaken and battered till it finally gives up one atom of chlorine; the vibration of the remaining two atoms of silver and one of chlorine are of a different period, and are not sufficiently in discord to cause a further elimination of an atom. The molecule which contains the two atoms of silver and one of chlorine is called a sub-chloride of silver or argentous chloride, and is of a gray violet color. If, then, I place silver chloride (held in position by a piece of paper) beneath a body, part of which is opaque and part transparent, and expose it to sunlight, I shall find that, where the opaque parts cover it, there the white chloride will remain unchanged, whilst on the portions beneath the transparent parts, the dark silver sub-chloride will have been formed. Of course were the paper, after removal of the body, to be further exposed to light, the image obtained would disappear, as a blackening over the whole surface would ensue. In this state, then, the print is not permanent. Fortunately for photography, a steady solvent of silver chloride was found by Sir John Herschel in sodium hyposulphite. On applying this salt to the ima e, it was removed, and also one atom of silver and one of chlorine from the sub-chloride molecule, leaving the atom of metallic silver behind. The chemical change that takes place on the silver chloride can be very distinctly shown by exposing it perfectly pure beneath water. The presence of the sub-chloride is shown by the color, and that of the chlorine can be exhibited by the usual chemical tests.

ACTION OF LIGHT ON ALBUMINATE OF SILVER.

In making an ordinary silver print on paper, we have, however, something more present than silver chloride; we have an organic salt known as the albuminate of silver, that is, a combination between albumen and silver. I have in this test tube a little dilute albumen—the solid constituent of the white of an egg. Into it I drop a little silver nitrate: a flocculent precipitate is at once apparent. The silver from the nitrate has combined with the albumen, and on burning a piece of magnesium wire before it the outer surface shows a darkening; evidently, then, the albuminate of silver is decomposed by light. For silver printing purposes, paper is coated on one surface with a solution of albumen and sodium chloride, and the production of the silver chloride and albuminate is effected by floating that surface on a solution of silver nitrate. When dry, the paper, which is now sensitive to light, is ready for exposure beneath a negative. Here we have two prints produced on paper so prepared. If now I take one of them and dissolve away the insoluble salts in sodium hyposulphite, you see that the color is of a disagreeable foxy red tint. To show you how this want of a pleasing tone may be overcome, the other print is immersed in a weak solution of gold, and by a well known chemical action the metallic gold is deposited on the darkened portions of the picture. Now when gold is precipitated, it has not the well known yellow color, but is a bluish purple; thus the deposited gold mixes its peculiar tint with that of the silver, and after immersion in the hyposulphite we obtain a print whose beauty cannot be surpassed

THE MAGIC PHOTOGRAPH

I daresay that many of you may have been charmed with the production of magic photographs, as they were called. Some few years ago the sale of such was enormous, but now the curiosity of the public seems to be satiated. The magic, as you may be aware, consisted in being able to produce on a white piece of paper a photograph of some unknown object. These mysterious pieces of paper were generally supplied in packets containing with them a piece of blotting paper. The directions stated that the blotting paper was to be damped, and while moist, to be applied to the surface of one of the accompanying pieces of blank paper, and then a photograph would shoot out. I will endeavor to show you one method of their production. Here I have an ordinary photographic print which has not been treated with gold, but merely immersed in sodium hyposulphite and then washed. I immerse it in a solution of mercurous chloride which I have in this dish, and immediately a bleaching action is set up. The action continues, and the paper is apparently blank. What has happened? Simply a white compound of silver and mercury has been formed, which is indistinguishable from the paper. If I wash the paper and dry it, it is in the state of the paper supplied in the packets. I have one here washed and dried, and I immerse it in the sodium hyposulphite. The image immediately reappears, a combination has taken place between the constituents of the hyposulphite, the mercury, and the silver

Need I say that the blotting paper supplied is impregnated with the same sodium salt? In damping it the molecules of the latter are so separated and mobile that they are free to combine with the white image. By similar treatment the picture may be made to again disappear and once more reappear

LIGHT AND FERRIC CHLORIDE.

Besides silver there are various other metals which will give a photographic image. This paper, which has a slightly yellow tint, has been brushed over with ferric chloride, more commonly known as perchloride of iron, in which we have the maximum number of colors of chlorine combined with metallic iron. Allowing ordinary white light to act upon it, the waves cause a disturbance between the iron and the chlorine atoms, and one of the latter is shaken off, leaving ordinary ferrous chloride, or muriate of iron, behind. A piece of paper, similarly prepared, has been exposed beneath a negative, and the reduction of the ferric chloride to the ferrous state can be demonstrated by floating it on a solution of potassium ferricyanide. The combination between the lowest type of the iron salt and this salt results in the formation of a deep blue precipitate, known as Turnbull's blue. You see, after applying it, we have the lines of this map, of which this is the negative, of an intense blue. Instead of demonstrating the change of the iron salt by this means, I may float it on a weak solution of silver nitrate. The ferrous salt of iron will reduce the silver, while the ferric salts are wholly inoperative to produce the same effect. Here we have such a print.

The principal investigator of the action of light on iron compounds was Sir John Herschel, and he employed a variety of different combinations. Perhaps one of the most interesting exhibits in the photographic section is that old list of Fellows of the Royal Society, on which were pasted, by the hand of that distinguished philosopher, the actual solar spectrum prints made during his researches on these and other metallic salts.

URANIUM LIGHT-SENSITIVE SALTS.

Uranium salts are also capable of being reduced to less complex forms by the action of light. I will not enter into a detailed description of the decomposition, but will simply exhibit the method of producing a print with the salt. The paper has been coated with uranic nitrate and exposed to light, beneath the same negative before shown to you. The image is made visible by a solution of potassium ferricyanide as in the case of the iron salt.

In the cases of photographs are shown some interesting specimens of iron and uranium prints, made by Niepce de St. Victor. I believe they were presented to Sir Charles Wheatstone by that ardent experimentalist. The subdued brown tones of the latter were probably obtained by the admixture of a little iron with the uranium.

PLATINUM PICTURES.

Within the last couple of years the salts of iron have been put to practical photographic printing purposes by Mr. W. Willis, jr., of Birmingham, and a valuable process resulted from his labors. The sensitive salt employed is an organic salt of iron known as ferric oxalate, and Mr. Willis made the discovery that among other metals platinum could be reduced to the metallic state from a double chloride of potassium and platinum, by ferrous oxalate in the presence of a potassic oxalate. A piece of paper is floated on a weak solution of silver nitrate and dried; and over the surface is brushed a mixture of the platinum salt and the ferric oxalate. After exposure to light (which produces the ferrous salts) beneath a negative, the paper is floated on a solution of neutral potassium oxalate, when the image at once appears formed of platinum black, a substance at once durable and incapable of being acted upon by atmospheric influence. Such an exposed paper I have here; and floating it on oxalate solution, you see the image is immediately developed. The unreduced iron salt can be eliminated by soaking the print in the oxalate solution, and a rinse and hyposulphite removes all traces of silver nitrate. After a few changes of water, the print may be dried, and is permanent. I should explain that the paper is first coated with silver nitrate in order to cause the platinum to adhere firmly to the surface of the paper. When omitted, the fine black powder formed is apt to precipitate in the bath.

VANADIUM.

Before dwelling upon that metallic compound which in photography is next in importance to silver, I must call your attention to the first vanadium print ever produced. Professor Roscoe, who has already delighted an audience in this room with an admirable lecture on Dalton's apparatus and what he did with it, has made a classical investigation of the compounds of this metal, and among other interesting facts has noticed that the vanadium salts are reduced by light in a somewhat similar manner to uranium salts.

LIGHT AND POTASSIUM DICHROMATE.

We now have to consider the printing processes which are due to the action of light on the dichromates of the alkalies in the presence of organic matter. For our purpose to-night we may take as a type potassium dichromate, a salt which readily parts with its oxygen to those compounds that have an avidity for it, more especially to certain carbon compounds under the influence of the ether waves.

To show that this salt is thus easily reducible by light in the presence of organic matter, I have here a piece of paper which has been brushed over with it, and exposed beneath a print. For a moment I float it on a weak solution of silver nitrate. The brilliant crimson color of the part not exposed to light tells us that silver dichromate has been formed; but where the solar rays have acted, the color remains unchanged. A slight modification of this process now exhibited to you is known as the chromatype, the offspring of Mr. Robert Hunt, so well known in the scientific world for his researches on light

THE WONDERFUL ANILINE PROCESS

While experimenting with the chromatype process, Mr. W. Willis, the father of the gentleman I have already mentioned, discovered what is known as the aniline process. It is based on the fact that an acid in the presence of potassium dichromate strikes a blackish green or red color when brought in contact with aniline. You will see the *modus operandi* when I say that paper is floated with potassium dichromate and a trace of phosphoric acid. Aniline is dissolved in spirits of wine, and the mixed vapors allowed to come in contact with the sensitive paper that has been exposed beneath a positive print, such as a map or plan. The impact of the light has so changed the potassium salt that the aniline vapor causes but little coloration, while, where the paper has been protected from it, the dark color indicates that the dichromate is unchanged. The formation of this black color is familiar to the manufacturers of aniline colors, being, I believe, similar in composition to the residue left after the formation of aniline purple by Mr. Perkin's method.

It should be noted that, for copying engineers' tracings and drawings this process is extremely valuable, as there is no occasion to take a negative on glass before obtaining a print. All that is requisite is that the original should be fairly penetrable by light. A piece of paper prepared as indicated, a sheet of glass to place over the plan, and a box in which to place the exposed print to the aniline vapor, are the only necessary plant for the reproduction of a design.

What is an Ingrain Carpet?

The two-ply ingrain known to the trade is a fabric composed of two webs, or "plies" of cloth, made with different colored yarns—say one "ply" green, the other red—of equal consistence or texture, u nited at the edges or selvages of each by the selvage threads, and ingrained or united at different parts of the cloth, wherever called for by the design or pattern. If the red "ply" represents the ground color of the design, then the green will be the figure color; and whenever the green figuring "ply" appears over the red ground "ply," that is ingraining. The more general this ingraining or mixing up of the two webs or "plies," the better the fabric is ingrained, and the longer it will wear. The three-ply ingrain is made and ingrained after the same manner.

A two-ply carpet, woven on the same loom and "mounted" in the same manner as a two-ply ingrain if woven plain, without any design or pattern, would be a seamless bag; a three-ply, under the same condition, a double bag, or two bags joined together by one side of each.

The old Scotch two-ply ingrain weighed about 24 ounces to the yard. The weft yarns were heavier than those now used, and the warp threads were three-cord worsted, and much stronger and heavier than the two-cord now in general use. Two things are gained by the substitution of the two-cord warp for the three-cord, though the fabric is rendered less durable. One is the saving of worsted, the most expensive of the two materials which compose the fabric; the other is that the warp being finer, it permits a wider scope in shading the weft colors. This will be understood even by the unskilled reader, if he will place an unequal number of coarse and fine black threads on two pieces of scarlet or white cloth or paper of equal width. The finer the black threads are, the brighter the colors underneath will appear.

Ingrain carpets are frequently called Scotch carpets, and by others Kidderminster. The difference in the nomenclature of this fabric, we presume, is due to the fact that, until 1821, Kidderminster had nearly a monopoly in making ingrain. In the memorable strike of that year, which commenced in March and continued into August, it lost nearly all its ingrain trade, which mostly fell into the hands of Scotch manufacturers.—*Textile Manufacturer.*

Glass Circle for the Measurement of Angles.

Mr. Lewis M. Rutherfurd, whose ruled diffraction plates, as substitutes for prisms in certain classes of spectroscopic work, have gained him a very extended reputation, in 1870, proposed a glass scale for the measurement of the angles of astronomical photographs. It was to be read by a micrometer microscope, and fitted with a gravity slide with one V and one flat slide. He has now carried out the idea by constructing a glass circle about 10 inches in diameter, divided to 10 minutes of arc, adapting it to a spectrometer similar to the one used by Mascart, and described in his paper on the measurement of wave lengths. The measurements were read by two microscopes each magnifying 75 diameters. This arrangement is one of the most delicate mechanical refinements that has come under our notice.

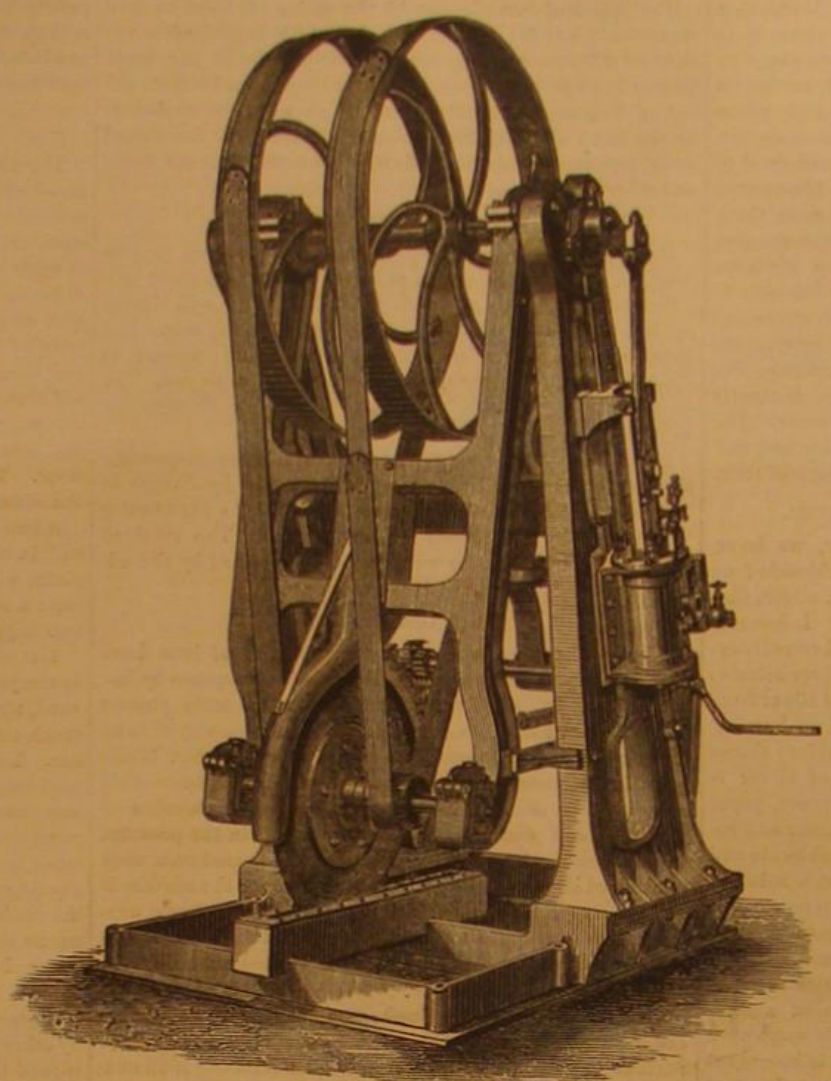
New Compensating Pendulum.

Professor J. Lawrence Smith has recently invented a new compensating pendulum, in which he avails himself of the great expansibility of ebonite, which, between 32° and 158° Fah., approaches that of mercury. The pendulum rod is of steel, with an adjusting screw at the lower end; and a round rod of vulcanite, with a hole in the center, is passed on to the steel rod fitting it loosely and being held in place by the adjusting screw. The bob of the pendulum consists of a heavy piece of brass, with a hole through the center large enough to admit the vulcanite, over which it passes, and, by a properly arranged stop, rests on the end of the vulcanite furthest from the lower end of the pendulum, so that any expansion of the vulcanite elevates the brass bob, thus compensating for the downward expansion of the steel rod and brass bob. Professor Smith says that four months' use of this pendulum on an astronomical clock has given very satisfactory results. It can be adapted, at a cost of 20 cents, to the ordinary mantlepiece clock, the pendulum of which usually beats in half seconds.

MADDER ORANGE.—Madder red, if exposed in a chest to the fumes of nitrous acid No. 3, yields a fine orange, which is not damaged by boiling soap lye. The red may be produced either by dyeing or steaming, and it is indifferent whether the cotton is oiled or not. The action of the fumes is to be continued for five minutes. If it is shorter the orange is converted into a brown by diluted alkalies or by soap.—*Reimann.*

NEW RAIL SAW AT THE LANDORE STEEL WORKS.

This saw is made by Messrs. Kitson & Co., Airedale Foundery, Leeds, England. Instead of the rail being brought up to the saw, the latter, mounted in a swing frame which oscillates on the main shaft, advances to the rail. Our engraving is prepared from a photograph of the actual machine, but does not show an ingenious self-acting clutch arrangement, which has since been added, for holding the rail firm while being sawn. The saw is placed sufficiently far from the rolls to admit of a 65 feet length being rolled, to be afterwards cut into rails of the required dimensions. On the occasion of a recent visit, some Great Western Railway bridge rails, 86 lbs. to the yard, were being rolled, and afterwards sawn into two 32 feet lengths. The production of the rail mill at these works is from 600 to 700 tuns a week, the largest output in any one week having been about 850 tuns, though 160 or 170 tuns are frequently got out in the twenty-four hours.—*The Engineer.*



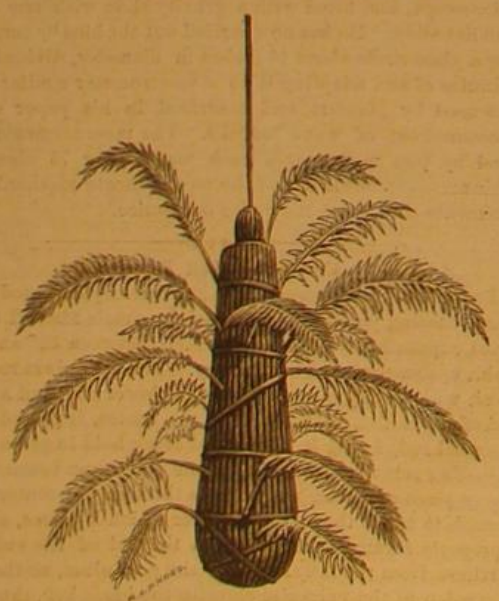
SAW FOR CUTTING HOT STEEL RAILS.

Dental Gardening.

Miss Adelia L., aged 28, nervous temperament, very healthy and robust, consulted me on May 10, 1876, in reference to trouble with left superior second bicuspid. I found, upon examination, a large cavity upon posterior surface, high up under the gum, with exposed pulp and considerable inflammation, attended with severe pain. The cavity being extremely difficult of access, and the patient preferring not to take the chance of possible trouble after a painful operation, I extracted. A moment after, I proposed to her, partly in jest, to fill and replace it. She agreed, and after excavating, etc., I filled the pulp canal with oxychloride and cotton fiber, and the other cavity with amalgam, and then, carefully rinsing the socket first, the tooth was carried up gradually into the alveolus, carrying with it a piece of silk, which was laid longitudinally along the root, in such a manner that, when the tooth was nearly in place, the gradual drawing out of the silk furnished a vent for the escape of air or water confined above the root. Previous to replacing, about one sixteenth inch of the tip of the root was excised, as it was curved considerably. Pain followed for five minutes, after which the lady closed the teeth forcibly, and with a snap, without any feeling of discomfort. She was directed to avoid using it for a day or two, and then report. Ten days after, May 20, she came in and stated that for a couple of days there was some soreness, since which time she had eaten on that side of the mouth without trouble, and at the time of examination the tooth was as firm as the contiguous ones. No ligatures were used to keep it in place at first, as reliance was placed upon the antagonists in the lower jaw.—*W. E. Hyde, Danielsonville, Conn., in Dental Cosmos.*

A JAPANESE FLOWER BASKET.

In the Japanese Building at the Centennial Exposition is to be found a variety of hanging baskets, containing ornamental plants. One of the most graceful designs is shown



in the annexed engraving, the basket being made of the roots of trees, laid parallel and encircled by hoops. Ferns and other plants, judiciously selected, are placed with their roots inside the basket, the flowers and foliage hanging down outside. It would be difficult to imagine a prettier ornament for the parlor or conservatory.

Patents for Seeders and Planters.

Another very useful summary and digest of all patents in a particular class of inventions is announced. It will include the drawings, briefs, and claims of all patents for seeders and planters, from 1836 up to and including July, 1876. The range covered by the class is a very extensive one, including fertilizers, liquid manure machines, land markers, etc. The book will contain from 400 to 600 pages, illustrated by about 3,500 drawings. It will be well bound, and sold for $25 per copy, by the author, Mr. James T. Allen, room 116, Patent Office, Washington, D. C.

New Engraving Process.

Messrs. Leitch & Co., it is said, are now successfully practising a new process, which has not hitherto been carried on here. The drawing is done on glass, covered with a thin etching ground, which is of a pale green color, and so thin that it can be removed with the finest etching point, thus allowing of the most delicate lines being drawn. By placing a sheet of black paper underneath, the artist can perceive at once the progress and effect of his work, the lines of which appear in their natural black. This plate, when finished, is treated as a negative, and a photograph obtained from it, say on zinc, from which a surface block is got in the ordinary way. The great advantage is the possibility of seeing how the work proceeds, for in several processes this cannot be done, and the artist finds, when he has finished his drawing, that it looks very different from what he expected or intended.

The San Fernando Tunnel.

The San Fernando tunnel, through the San Fernando mountains, on the Southern Pacific Railroad, California, is the largest one on the Pacific coast. Its length is 6,966 feet, or 1 mile and 1,686 feet. The work of construction was remarkably rapid; it is not two years since the first borings were made. Many difficulties were encountered. San Fernando is the petroleum region of Los Angeles, and there were fears lest in tunneling the mountain the workmen might come upon reservoirs of petroleum or other noxious fluids and gases. The great obstacle has been the character of the rock, and the enormous pressure upon the timbers placed as supports. The tunnel will be lined with masonry of great strength. The longest tunnel on the Central Pacific, in crossing the Sierras, is only about 1,200 feet, not one fifth the length of the San Fernando.

Poisoning by Virginian Creeper.

The details of two cases of poisoning by the well known Virginian creeper or American ivy (*ampelopsis hederacea*) have been communicated to the medical papers by Mr. Bernays, of Chatham, England. The sufferers were two children, aged respectively two and a half and five years, who had chewed some leaves of the plant, swallowing only the juice. They were quickly seized with violent vomiting and purging, with considerable tenesmus, then collapse, sweating, and faint pulse, followed by deep sleep for two hours, from which they were aroused by a return of the vomiting and purging. Milk, with some rum mixed in it, was freely administered, under which treatment the children soon recovered; but four hours after the commencement of the attack there was considerable dilation of the pupil.

The pressure in lbs. per square inch produced by centrifugal fans equals the square of the velocity of the tips of the fan in feet per second divided by 97,300.

Hops as a Photo Preservative.

Notwithstanding the great improvements that have been recently made in the various emulsion processes, and the degree of perfection that has been attained in the preparation of the emulsions, many photographers, even amateurs, are conservative enough to stick to their baths, simply because they have long been accustomed to work in that way, and because in the various bath processes there is more latitude in the road leading to success than there is with emulsion work.

It is far from our intention to undervalue the advantages of the several emulsion processes, because they require, for their most successful working, a degree of nicety and care much greater than most of the processes with the bath; but we cannot shut our eyes to the fact that there are many who, from long experience of the older methods of working, get very fine results with it, and who have neither inclination nor time to battle with the difficulties of anything that to them is new. Taking it for granted, then, that for some time at least dry plates will still be sensitized in the bath, we gladly chronicle any advance that may be made or any improvement that may be effected.

We have recently made numerous experiments, and think the desideratum has been found in ordinary hops—preferably the variety known as Bavarian, which seems stronger in certain qualities than the English hop.

Two ounces of hops are infused for one hour in twenty ounces of water at a temperature of 176° Fah., and the whole then turned into a cloth, and the liquid pressed out. When cold, twenty grains of pyrogallic acid and the albumen of two eggs are added, and the mixture is well shaken for ten minutes. It is then filtered into a dish and used in the ordinary way; or if only a few plates are to be prepared, a smaller quantity may be made, and poured off and on several times. Plates preserved with this solution, dry perfectly hard, have a fine gloss, and yield negatives of very high quality. The color is a rich greenish brown, and so non-actinic that over-development must be carefully guarded against. Although the solution can be easily made, it is desirable that, if possible, it should be made to deep, and therefore we have added carbolic acid and salicylic acid to separate quantities, and shall note the result on a future occasion.

Meantime we consider the hop preservative as above indicated, a decided improvement on the beer and albumen. It possesses all its good without any of its bad qualities, the principal of which are the stickiness already referred to, the varying qualities of beer in different localities, and, especially, the irregular proportions of chlorides which more or less are always present, and to get rid of which many workers are in the habit of adding silver nitrate, which always introduces an additional element of uncertainty.—*British Journal of Photography.*

A SWEDISH CENTENNIAL EXHIBIT.

Our engraving represents a very neatly executed device for exhibiting the various sizes and shapes of nails manufactured by one of the Swedish ironworks. It is the figure of a reindeer, the hide of which is formed of the nails, the forms and dimensions of which are so selected that the *contour* of the animal is unimpaired, the proportions and form being exactly preserved. The figure is to be found in the



Main Building, near the north entrance; and it attracts large numbers of visitors, who cannot but admire the fidelity and ingenuity with which the design is carried out.

New Blue Color.

Girard has taken out an English patent for the following process: He heats 1 part of methyl, ethyl, or amyl diphenylamin with two parts of oxalic acid for 10 to 15 hours to 239° Fah., and washes in water, alcohol, or petroleum. The residual powder is dried and heated for some hours to 330° Fah., which renders it soluble. To prepare methyldiphenylamin 100 parts of diphenylamin, 68 of muriatic acid, and 24 of wood spirit are digested for 15 hours at 536° Fah., at a pressure of 12 atmospheres

A MARINE AQUARIUM.

An aquarium, says Mr. R. M. Shurtleff in *Forest and Stream*, from the pages of which we select the engraving, though a very simple matter, was never understood till recently. Persons who keep gold fish in globes find it necessary to change the water frequently, and even then the fish do not remain in a healthy condition. If the tank be properly arranged, the water need never be changed at all. All animals breathe oxygen, and throw off carbon, while plants breathe carbon, and throw of oxygen. If we establish in our aquarium a proper balance of animal and plant life, both will thrive as in their natural homes.

Supposing that our tank has been selected, we should first place in it enough clean pebbles to cover the bottom to a depth of two inches. Above these we may arrange larger rock forms, and if done with taste and judgment it will add much to the beauty of our aquarium, and also furnish hiding places for the fish.

One of the best plants for the salt water aquarium is *ulva litissima*, which may be found in large fronds cast upon the beach after a strong wind has been blowing from the sea. Its color is rich dark green, and when in a healthy condition it is firm and crisp to the touch. Another very handsome plant that thrives well in the aquarium is *catromorpha*. It is found in deep water, and can only be got by dredging. It resembles a mass of fine green threads, which, when untangled, are sometimes found to be thirty feet in length. *Entromorpha compressa* is a beautiful green plant found on nearly every shore at low tide. It grows in long grass-like leaves, that move in most graceful lines with every motion of the water. We have never found it very hardy in the tank. The plants of a brown color, though very beautiful for a time, will soon decay in the aquarium. Some of the red algæ do very well and are a great addition. The *Grinnella Americana* is one of the best. *Chondrus crispus* (Irish moss) will sometimes do well; and *solaria*, if found growing to a bit of stone, will live in confinement, but should not be exposed in much light. There are innumerable beautiful plants to be found at low water mark, that will always tempt us to try, and, if watched closely and removed if found decaying, will do no harm.

Our illustration shows many of the most interesting animals that are adapted to the marine aquarium. In the central part of the picture is a fully expanded sea anemone. Seen in this condition one can readily see why it has received the name of that beautiful flower. At times it appears a mere mass of jelly, and the fishermen along the coast have called it halibut slime, supposing it merely a mass of slime from that fish. The body of the anemone may be described as a double gelatinous sac; the inner sac is the stomach, the space between it and the outer membrane is divided by vertical partitions, each compartment being connected at the upper part with a hollow tentacle. The tentacles serve to catch, and convey to its mouth, such animals as happen within its reach. The anemone is reproduced by eggs that are thrown out in different degrees of development, sometimes as perfectly formed anemones. They also multiply by self-division: a portion of the animal, usually near the base, gradually separates from the main body. If closely observed for a few days a single row of tentacles will make their appearance, and increase in number with the growth. Though a low form of life, the anemones are among the most beautiful and interesting objects in Nature. In color, they vary from a light brown to a deep chocolate. They are found on the coast north of New York, very abundantly in the vicinity of Newport. To the left of them are three of a bright red color that were brought from Bermuda. They differ from the others in having less power of expansion to the body, and have fewer tentacles, but make up for the lack of grace in form by their gorgeous color. The general scientific name for them is *actinia*. Just above is shown a bunch of *serpula contortuplicata*. They belong to the *annelida* or worms proper. They breathe through the skin by sacs or gills. In the present genus the respiration is by gills which are elegant in form and brilliant in color, The body of the serpula is short, the hard tube in which it lives in the sand being many times the length of the animal. Projecting from the tube may be seen a fan-like appendage most beautifully tinted with bands of red and white. This fan is the serpula's gills, and aid it in procuring its food. If viewed with a magnifying glass, it will be seen that the exterior of the gill tufts is covered with wonderfully delicate filaments or cilia which are constantly waving in regular ripples: by this movement a current is produced



A MARINE AQUARIUM

that brings in a multitude of minute animals upon which the worm feeds. The serpula is furnished with an arrangement for stopping its tube when it wishes to retire; this is a conical appendage developed from one of the little antennæ, which hangs from the tube and is called the operculum. One specimen in a tank has two kinds of plants growing from its operculum. When first placed in the tank the serpulæ are very sensitive, and pop into their tubes at the least jar. Near the serpula is shown the common shrimp, which is regarded as an excellent scavenger of the tank. The shrimps are so transparent that the food can be seen in the stomach, and we can almost trace the process of digestion.

Attached to the lower part of the rock work are more of the brown, and some of the beautiful little white, anemones. It is almost impossible to describe their form, as they are so changeable. At times hanging from the rock to which they are attached, the tentacles drooping like the petals of a withered flower, again the body stands erect, the tentacles extended to their utmost limit, and in constant motion. Suddenly a part of the body will be contracted as if a string had been drawn tightly around it, and sometimes there will be two or three of these constrictions at the same time. Again, they will assume the form of a rose, and one never tires of watching them. Some days they appear of an opaque white or cream color; an hour later we find them so nearly transparent that the interior divisions of the body can be clearly seen.

At the lower left hand corner is shown a mussel (*modiola plicatula*), and above it the soft clam (*mya arenaria*). The black mussel (*mytilus edulis*) is not shown in the drawing, but is a useful member of the aquarium family, as it lives upon the little animalculæ that sometimes become so plentiful in the tank as to obstruct the view. The star fishes are curious and interesting, but are hardly safe for the aquarium, as they are ravenous eaters, and will probably destroy the shell fish we most wish to preserve. They have a singular way of feeding. Placing themselves upon the animal they wish to devour, the digestive sac is turned inside out so as to enclose their prey, and the animal is sucked from its shell.

The hermit crab (*pagurus longicarpus*) is shown inhabiting the shell of a *tritia trivitata*. These curious little crabs have no armor of their own, and so take possession of any mollusk's shell that happens to fit them—usually one of the *buccinum* family. The rock crab should not be introduced, unless it is a very small specimen, as they over turn the rock work, and are blessed with an appetite that is never satisfied. The spider crab (*Jabinica canaliculata*) is interesting and less destructive. It loves to dress itself with bits of plant, or anything that comes handy, and then parades with as much evident satisfaction as any dandy.

At the extreme right of the picture is shown a bunch of *tubularia*. This plant-like object is formed of a number of tubes branching in all directions; the end of the tube appears a flower, its petals opening and closing constantly. These heads live a few days, then drop from the stem to be replaced by a new head that may be seen slowly traveling up the tube. The sea horse (*hippocampus Hudsonius*) is another strange little animal that we should possess if possible. Its natural food is the *serpulæ* which it sucks from the tubes, but it will feed upon the soft part of a shrimp or clam. At the top of the illustration is shown a branch *sertularia*. In a picture of this kind only a faint idea can be given, as the beautiful little animals that have formed it are scarcely discernible with the naked eye.

Nearly all the animals we have named can be found on our own coast. Those who prefer to do so can purchase them of dealers. In conclusion we would say that the care of a marine aquarium can be only a source of pleasure to any one who loves Nature. These animals have been drawn from a glass jar holding about twelve quarts of water. For many months it has supported twenty or thirty anemones, besides many other animals, and has always been in a perfectly healthy condition. The only care required was now and then the addition of a little fresh water to replace that evaporated.

A Purple Cyanide as a Dyestuff or Pigment.

When cyanide of potassium is added to an acid solution of a copper salt, a red color is produced which has already been mentioned by different observers. The substance formed is very changeable, at least in the liquid where it is formed. It is decomposed by acids, alkalies, cyanide of potassium, and even decomposed spontaneously, the color changing to yellow. It is precipitated by insoluble cyanides; hence when a dilute acid is added to the red solution, the dye is at once thrown down along with the cyanide of copper. If the precipitate thus obtained is treated with sulphuretted hydrogen, it is decomposed and the substance set free. This substance can combine with iron, like cyanogen, so as to conceal the properties of the iron. This compound is very permanent, and has lately been studied by G. Bong, who gives the following directions for its preparation:

Cyanide of potassium is added in excess to an acid solution of a copper salt until the red color at first formed has disappeared, when a ferric salt is at once added. On the addition of the iron salt, of course, a copious precipitation of Prussian blue takes place, and the liquid again turns to a dark purple-red. To separate the coloring substance from the alkaline salts in the liquid, a dilute acid is added which precipitates it and the cyanide of copper. This precipitate is combined with the Prussian blue, which also contains a considerable quantity of the coloring substance, and then treated with a boiling solution of carbonate of ammonia, in which it dissolves. As the cyanide of copper also goes into solution, it is separated by again precipitating it with an acid and treating the precipitate with sulphuretted hydrogen. The coloring substance thus liberated now contains a certain amount of hydroferrocyanic acid, which is removed after neutralization by acetate of lead. It is now filtered, and the purification completed by precipitating with a silver salt and treating the precipitate with sulphuretted hydrogen.

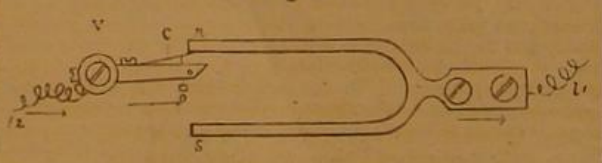
This purple-colored compound crystallizes very indistinctly. To determine its composition Bong precipitated it with acetate of copper. When dried at 212° Fah., the rose-colored precipitate had the following composition: Carbon 24·31, nitrogen 28·04, hydrogen 1·88, iron 13·66, copper 17·67, oxygen 14·44. Total, 100·00. These numbers correspond to the formula $Cu, Fe Cy_4 (HO)_4$.

This substance is likewise precipitated by salts of zinc, mercury, and silver. All these precipitates are pink or purple, very beautiful, and of remarkable brilliancy. They are soluble in alkalies. Iron salts yield no precipitate, nor do lead salts except in the presence of ammonia, when a blue-violet precipitate is formed. When treated with sulphuretted hydrogen, these precipitates yield purple-red and acid liquids, which undergo change in the air, especially if warm, forming Prussian blue. When these liquids are neutralized with alkali, purple compounds are formed, which are permanent in the air, soluble in water, slightly so in alcohol, and insoluble in ether. Their coloring is exceptionally great. These pigments will unite with ferrocyanides, and in its preparation such a compound is produced in considerable quantity; it is likewise of a purple color, and gives a rose-colored precipitate with acetate of lead. Both alone and in this compound it is very permanent; it resists the action of sulphurous acid, concentrated and boiling alkalies, and dilute acids, but is rapidly destroyed by chlorine and nitric acid. If this pigment could be prepared cheaply enough, it would probably be used with advantage in the arts, on account of its resistance to chemical re-agents and light, the variety of its shades, and its brilliancy. It does not color fibers directly, but can readily be fixed on them from slightly acid solutions, if they are previously mordanted with metallic oxides

MUSICAL TELEGRAPHY IN PARIS.

It is now proposed to utilize the La Cour system of musical telegraphy in Paris, in connection with the project of M. Bourbouze of sending telegraphic messages without wires. M. Bourbouze conceived the idea, during the siege of Paris in 1870, that the river Seine might be used as a conductor, so that the beleagured city could hold communication with the provinces without the enemy suspecting the fact. Tests actually proved that the plan was feasible, but before it could be carried into practical effect, the armistice was declared, and so the device became unnecessary. M. Bourbouze has recently again brought forward his idea, and proposes to use the water in the mains and pipes of the city as a conductor. Every one having the necessary simple apparatus could

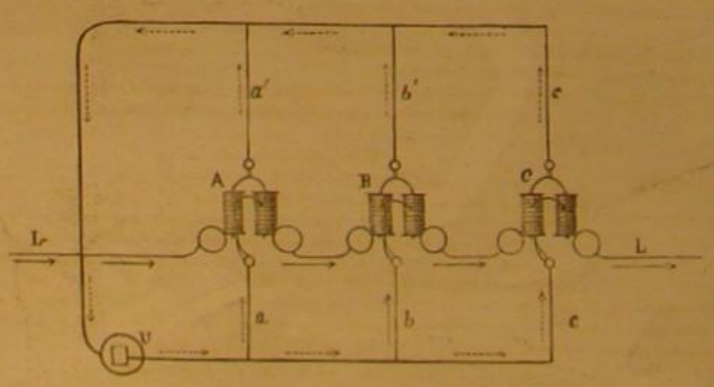
Fig. 1.



then learn to telegraph for himself. Each house would be a station, and any citizen could converse with friends scattered in all parts of the city without stirring from his own domicile To this somewhat sanguine scheme there is one fatal objection; it is that the result would be a new Babel; for hundreds would telegraph simultaneously, and unless each despatch had some easily distinguishable characteristic, inextricable confusion would follow.

As stated in the beginning, it is suggested that M. La Cour's musical telegraph may furnish a means of transmitting distinguishable despatches. The invention was described recently in the SCIENTIFIC AMERICAN SUPPLEMENT, but the annexed engravings, which we take from *La Nature*, will serve to render its mode of operation more clearly comprehensible

Fig. 2.



When the most common phenomena of acoustics are recalled, for example, the transmission of a melody played by an orchestra which is perceived by an entire audience at long distances from the players, it is not easy to analyze the effect. Physics tell us that the sounds produced by each instrument have their own tonality and their distinct measure; in other words, the notes from a violin, a flute, or a trombone correspond to different vibrations, transmitted through the atmosphere and characteristic for each note. Besides, the rhythm in the succession of notes, which makes the measure in music, produces the cadence, constituting, with the tonality and the timbre of the instruments, the *ensemble* of the air which affects us. The transmission is so precise that the ear, from the medley of sounds, instantly distinguishes a discordant or untimely note.

Suppose now a series of three tuning forks vibrating continuously and producing, respectively, 100, 300, and 500 vibrations per second. It is easy to perceive that each fork may interrupt and establish an electric current with intermissions regulated by the number of its vibrations. If, then, there be three other forks identical with the first, each set being located at an extremity of the conductor between them, the trio at one end will affect those at the other; and further, if one fork be impressed with a cadence which does not coincide with its regular vibrations, then its corresponding fork will likewise emit the same discordant sounds.

The above very briefly states the principle of the invention, but it is sufficient to show that the indefinite multiplication of despatches over the same conductor is feasible, each current, moreover, being distinctly individualized.

Fig. 1 represents the device for transmitting the vibrations of the fork to the conductor. The arm, *n*, of the fork vibrates in contact with the platinum tongue, *c*, the position of which is regulated by the screw, *v*. A current entering at l^2 is closed, when the extremity, *n*, touches the plate, *c*, and is open when contact is broken. Nothing further is needed than the opposite wire, *l*, connected with the fork as shown.

Fig. 2 shows how the character of an intermittent current is recognized. L L is the main line traversing the station. A B C are three forks similar to those at the point of transmission. The fork, B, for example, which is in unison with the current, will be thrown into vibration while the rest will remain silent. This fork, B, will then touch the platinum plate, *c*, Fig. 1, and will establish in the circuit, $b\,b^1$, a local current of the battery, U, the poles of which are respectively applied at $a\,b\,c$ and $a^1\,b^1\,c^1$. The local current will likewise be intermittent, according to the measure of the fork, but by reason of the velocity of the pulsations it will manifest itself in many cases as a constant current, either by operating a chemical decomposition, or by deviating a magnetized needle, or by exciting an electro-magnet.

The New Hampshire Greenstones.

The greenstone formation of New Hamp-hire covers a large area in the northern part of the State, and is referred by Professor Hitchcock to the Huronian age; the rocks are generally green, with remarkable uniformity in their composition. Yet they are inter-stratified, apparently not by volcanic eruption, as they appear to have accumulated in quiet waters.

Of the group of greenstones, the most prominent member is metamorphic dioryte, which varies in its texture in different localities, some of the specimens being so coarse as to enable the crystals to be mechanically separated. A hydrous rock, metamorphic diabase, is also very common, in which chlorite is a prominent ingredient, imparting a light green color. In this rock, organic remains, such as a tabulated coral resembling a *chætetes*, are found, and Mr. George W. Hawes states that there is little doubt but that it is a fragment of a rhizopod mass or foraminifer. The presence of rhizopods is additional evidence of the sedimentary origin of these rocks, and it suggests a source for the lime of the labradorite and other mineral constituents. Chlorite schist is also found in these greenstones; it is of a light green color, and gives off water when heated. Twelve per cent of this mineral consists of various oxides of iron. Dolerite and argyllite are also found in the formation, the former containing: Silica 40·25, iron oxides 15·82, lime 10·31, titanic acid 6·53. In the latter, silica 60·49, alumina 19·35, iron oxides 6·46, and magnesia 2·89 were found.

Bat Guano.

That a little creature, not very common in the North, could congregate, in sufficient numbers to make extensive deposits of excrement which have a commercial value, seems almost incredible; but in numerous caves, from Virginia to Texas, are found deposits of this material sometimes reaching 20,000 tuns in extent, and yearly increasing. During the war it was thought to extract niter from it for powder making; but though the manufacture was somewhat successful, the nitric acid was present in such small quantities as to render it so expensive as to be abandoned at the close of the war. The material has been used as a fertilizer to a slight extent, and is found to exert considerable influence on the crops treated. The attention of Mr. McMurtrie, chemist to the Department of Agriculture, having been called to the matter, analyses have been made of samples collected. These are all of a similar light to dark brown color, according to the moisture, except those containing much insoluble matters, which resemble soil, of which they probably largely consist. The physical condition when air-dried is excellent, both for handling and application, being finely pulverulent. The analyses fairly represent the average composition, which, according to the valuations of Professor Goessmann, the Massachusetts State Inspector of Fertilizers, adopted by the department, show them to possess a value of from $15 to $55 per tun for use as fertilizers. The values compare favorably with those of fish fertilizers, and even of Peruvian guano. Microscopical examination shows the material to consist largely of the hard parts of insects upon which the bats feed. Mr

McMurtrie wisely concludes: "With these facts before us, we may readily recognize the importance of the development of these deposits in the South, where fertilizing materials are so much needed and are so costly, and especially when they may be obtained for the mere cost of removal."

Naval Items.

NAVAL ENGINEER CORPS GAZETTE.

Chief Engineer George Sewell, Wm. G. Buehler, and Ezra J. Whittaker, Passed Assistant Engineers J. P. Kelley, H. L. Slosson, John D. Ford, E. T. Philippi, and Richard Inch, and Assistant Engineers William Rowbotham and George Cowie, have been detached from duty and placed on waiting orders.

August 9. Passed Assistant Engineer John F. Bingham's orders to the Tuscarora, North Pacific Station, have been revoked, and he has been ordered temporarily to the Navy Yard at Mare Island, Cal.

To Remove Nitrate of Silver Stains.

The following method of removing indelible ink and other silver stains, without the use of cyanide of potassium, is given by Grimm in the *Polytechnisches Notizblatt*: Chloride of copper is first applied to the tissue; it is next washed with hyposulphite of soda solution, and afterwards with water. It is said that this may be employed on colored woven cotton tissues. For white cottons and linens, dilute solutions of permanganate of potash and hydrochloric acid, followed by the hyposulphite of soda and clear water, is preferable. For cleaning the hands, we use iodine dissolved either in iodide of potassium or in alcohol, following by aqua ammonia.

Hypochlorite of Alumina in Bleaching.

Dr. E Jacobsen proposes to use hypochlorite of alumina for purifying bone grease, a gentle heat being employed. This salt is prepared by the mutual decomposition of alum or sulphate of alumina and bleaching powder. A saturated solution is made of the former, and to it is added a corresponding quantity of chloride of lime as a milky liquid. The bleaching is performed, not by the chloride, but by the oxygen liberated as ozone, and the coloring substances are precipitated as lakes by the alumina.

The following is said to be a Texan practice for training sheep dogs: A pup is taken from its mother before its eyes are opened, and put to a ewe to suckle. After a few times, the ewe becomes reconciled to the pup, which follows her like a lamb, grows up among, and remains with the flock, and no wolf, man, or strange dog can come near the sheep; and the dog will bring the flock to the fold regularly at half past seven o'clock, if he is habitually fed at that hour.

NEW BOOKS AND PUBLICATIONS.

THE HOUSEKEEPER'S FRIEND, a Practical Cook Book. Compiled by a Lady of Zanesville, Ohio, and Sold for the Benefit of the Home for the Friendless. Price $1.50. Zanesville, Ohio: Sullivan and Parsons, 87 Main street. New York city: Wiley & Sons, 13 Astor place.

This is a collection of recipes, selected with discretion from a great variety of sources. It is a handy and useful volume, and is sold at a very moderate price; so that purchasers will receive value for their money, and will also aid a charitable institution, the nature of which should enlist the sympathies of all classes and creeds.

THE AMERICAN IRON TRADE IN 1876 POLITICALLY, HISTORICALLY, AND STATISTICALLY CONSIDERED. By James M. Swank, Secretary of the American Iron and Steel Association. Philadelphia, Pa.: The American Iron and Steel Association, 265 South Fourth street.

We took up this book of 300 pages, in the hope of finding some account of improvement in the condition of the prostrate iron industry, some probability of its thousands of toilers receiving fair wages, and some ground for believing that 30 years of political bolstering has not finally extinguished the trade. We find nothing of these things; but instead, there are 114 pages of censure on the government of Great Britain for its conduct (in bygone times) in dealing with its own interests, and also for its illiberal conduct in now admitting American manufactures duty free. We think that our producers who are now seeking a market in England will hardly concur with Mr. Swank and his fellow theorists in believing that every interest is to be sacrificed to the greed of the particular ring which he represents.

STRUBLE'S WEBFOOT MAGAZINE, devoted to Literature, Science and Art, Commerce, etc. Price $2 a year. Portland, Oregon: Wallace R. Struble.

This new comer into the world of periodical literature draws on a variety of authorities for his articles, one of which, "Suspended Animation as a Preserving Agent," is selected from our own pages, no credit being given for the same.

LOUISIANA AS IT IS: its Typography, Resources, etc. By Daniel Dennett. New Orleans, La.: Eureka Press, 33 Natchez street.

A well compiled handbook of the chief features, agricultural, mineral, and climatic, of all parts of the State of Louisiana.

Recent American and Foreign Patents.

NEW HOUSEHOLD INVENTIONS.

IMPROVED DOOR LOCK.

Charles Guild, Piedmont, Wyoming Ter.—This invention is a lock having a series of vertically sliding tumblers with beveled ends, the same being adapted to coincide with a notched rib attached to the bolt. It also relates to the construction of the key with removable interchangeable wards secured by a clamp.

IMPROVED CHAIR.

Aaron Rice, Fitchburg, Mass., assignor to Walter Heywood Chair Company, same place.—The object of this invention is to improve the construction of the backs of chairs, especially those known in the trade as ladies' crown dining chairs and York dining chairs, in such a way as to make them less liable to come apart, and thus stronger and better. It consists in an improved chair, in which the upper ends of the back posts are connected with the ends of the back top with a tongue and groove joint. The construction prevents the back posts and the back top from working loose and coming apart, and thus makes the chairs stronger and more durable, without increasing the cost of manufacture.

HOSE ATTACHMENT TO WASH BASIN CONNECTIONS.

Daniel G. Trembley, Brooklyn, N. Y.—The object of this invention is to provide a simple means for attaching fire hose to the wash-stand pipe or faucet, so that, in case fire breaks out in a room having water from the street main, water can be quickly applied for stopping it. The connection is perfectly made with the faucet, but it may be made with the pipe below the basin. By this attachment, fires may often be prevented which would otherwise get too strong to be extinguished by the ordinary appliances before they can be brought to bear. The hose connection may be connected to the pipe below the basin.

IMPROVED FOLDING CHAIR.

George W. Parker, Gardner, Mass.—The object of this invention is to furnish an improved chair, so constructed that it may be easily folded into a compact form for storage or transportation, and which, when opened out for use, shall be strong and firm. With this construction, in folding the chair, the arms and the seat are turned up. The front posts and the rockers are then turned up forward into position, and the chair is folded. The chair is unfolded by reversing this operation.

IMPROVED PETROLEUM COOKING STOVE.

Frederick Hildebrandt, New York city.—This is a petroleum cooking stove that rests directly on the lamp, and produces the complete consumption of the gases of combustion of the flame, by an increased supply of air, preventing the smelling of the stove, and furnishes an economical cooking stove. It consists of a perforated sheet metal body resting directly on the lamp, and supporting an interior chimney that is connected at the top by an inverted conical diaphragm with the body, and provided at the base with a burner-encircling cone inside of the chimney to conduct the air both at the inside and outside of the cone to the flame of the burner. The combustion takes place within the chimney and above the base cone, so as to draw the heat upward away from burner and lamp, keeping the body of the stove cool, and admitting the direct position of the stove over the lamp without requiring an insulating air space or cooling water chambers.

IMPROVED LOCK FOR DOORS.

Theodore Hendricks, New York city, assignor to himself and William E. Price, Brooklyn, N. Y.—This invention consists in providing the split or double spring of a tubular lock with hook ends that differ in length, to be applied in connection with the catch plate. The split spring is attached to the side of the bolt by a stud, and is raised by the key without raising the bolt to engage and disengage the hooks with the catch slots for fastening the bolt. This spring is made in two parts, one of which has a longer hook or catch than the other, to be raised by a bit, and there is a stud on the bolt to prevent it from being raised by a key not having the ward. Shoulders in the side of the bolt constitute forward and backward stops, and act against a stud which bears against the side of the bolt to keep it in its place.

IMPROVED WASHBOARD.

Westly Todd, Wauseon, Ohio, assignor to himself and H. H. Williams, same place.—This invention furnishes a washboard which shall be so constructed that the gritty water from the soiled clothes may run off at once, which will facilitate the washing, and will produce a stronger and more durable board than those constructed in the usual way. This washboard has on its back a zinc facing, provided with parallel corrugations, beginning at each side and meeting at an angle in the middle, a groove being arranged at said angle.

IMPROVED FIREPLACE.

Molesworth B. King, Chicago, Ill.—This is an air-heating contrivance with a fire grate for heating upper rooms; and consists of a fire grate, below which is an ash sifter over the ash pit, for sifting the cinders from the ashes as they fall into the pit, and having a rod extending out at the front or side of one of the joints for working it. There is a blower, in which a damper admits air to prevent the blaze from striking the enameled front of the fireplace, and for admitting a regulated supply of air over the fire bed. A pipe admits fresh air from outside to the space under the fire grate, for supplying air for combustion. The inventor also proposes to make a hollow handle to the blower, with perforations, to allow the air to circulate through it and keep it cool.

IMPROVED IRONING APPARATUS.

Daniel Bennett, Chillicothe, Ohio.—This invention consists of a reciporating iron, with contrivance for heating it by steam, which is admitted to and exhausted from it, while running, by pipes having an extension joint, with stuffing box working correspondingly with the iron; and also of a work table having vertical and lateral reciproeating movements, in combination with the reciprocating iron, to present the work to the iron. The work table is mounted on a support, which is adjustable laterally in the support by a lever, to allow the goods to be shifted along the iron as the work progresses; and it is mounted thereon by springs which yield to the inequalities of the goods, and press them up to the iron by an elastic pressure calculated to enable the iron to work easily and pass the goods uniformly.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WEATHER BOARDING.

Thomas Reynolds, East New York, N. Y., assignor to himself and Jacob W. Erreger, of the same place.—This invention consists of the siding, roof boarding, and other outside clapboarding of buildings, tongued and grooved in the lap to make tighter and more efficient joints, for preventing the air from blowing in and out, and also to prevent dampness from working through. Siding has been rabbet jointed, but such joints, this inventor claims, are not sufficiently effectual for excluding damp air and strong winds; and he proposes to employ this method in roof boarding as well as siding.

IMPROVED SCROLL SAW.

Peter G. Giroud, Brooklyn, N. Y., assignor to himself and Theodore L. Jabine, of same place.—The object of this invention is to provide an improved scroll saw for sawing the minutest work in wood, iron, and other materials, by providing a steady tension that keeps the saw blade at an even strain during its whole stroke, without interfering in the least with the driving power. This is effected by a saw blade, clamped securely in such manner that it may be put in or removed with great facility. The back of the saw blade is steadied along the table to work with great accuracy.

IMPROVED SAW-FILING MACHINE.

Gershom Wiborn, Manistee, Mich.—This invention consists of a head in which a frame is supported, in which the reciprocating file-carrying rod works, the said head being a solid block, with a bifurcated extension of one side forming a couple of legs, which straddle the saw, and fasten the head to it by set screws, and one leg carries an adjustable rod, which holds a gage, by which the position of the head is gaged from the collar of the saw arbor. The pivot connection of the reciprocating rod-holding frame is adjustable in the head, to regulate the inclination of the file to bevel the top of the tooth, and said frame is adjustable, to adjust the file for the bevel of the front of the tooth, so that the file may be fixed for making both of these angles without changing either of its inclinations.

IMPROVED MACHINE FOR DRESSING STAVES.

Adam Luckhaupt, Columbus, O.—This invention relates to a machine for manufacturing staves for beer kegs and barrels of all kinds, in such a manner that the wood is cut transversely to the grain, and not in the direction of the same, the wood being readily and without danger inserted into the machine, and quickly cut to the shape required. It consists of two series of cutters that are secured to shafts revolving in opposite directions, and adjusted at such distance as to cut the shape of the stave. The stave is secured to the clamps, prongs, or jaws of a weighted and swinging frame that runs in arc-shaped guides, being locked in vertical position, in connection with a sliding table or guard plate, and fed to the knives by releasing the locking device, and swinging the frame into horizontal position to expose the wood to the action of the knives. The finished stave is then released from the clamps and dropped, the frame being carried back to take up the next piece of wood.

NEW AGRICULTURAL INVENTIONS.

IMPROVED ANIMAL MUZZLES.

Rufus K. Blodgett, Morrison, Ill., assignor to himself and Henry M. Myers, of same place.—The first of these two inventions is an improved muzzle for calves and other animals, to prevent them from sucking other animals or themselves. It consists in the combination, with each other, of a part provided with a knobbed arm, and having a short perforated tenon upon its outer end, and a long tenon with two or more holes upon its inner end, the part provided with a knobbed arm, and having a hole or socket through its base, the open rings or links, and the plate having its upper edge turned over. The second invention furnishes a device for preventing calves from sucking cows, and for preventing cows and other stock from sucking themselves or each other. It consists of a muzzle formed of a suspended plate, hinged loops and a wire spring clamp. With this construction the muzzle will prevent the animal to which it may be applied from sucking itself or another, will allow the animal to eat and drink freely, and may be worn without pain or inconvenience.

IMPROVED CULTIVATOR PLOW AND HARROW.

Jacob Haynes, Basnettsville, W. Va.—The object of this invention is to furnish a machine for loosening up the soil and cultivating corn and other crops planted in hills and drills, and which shall be simple in construction and easily guided and controlled. The machine seems to be well adapted to the purposes for which it is designed, but it is too complicated to admit of description without engravings.

IMPROVED SEED PLANTER.

Henry O'Neal, Concord, Tenn.—The object of this invention is to furnish a planter, for planting cotton, corn, peas, and other seeds, so constructed as to enable the planting to be done in perfect check row, without previously marking the land. The machine which appears to be well adapted to the purpose for which it is intended, is too complicated for explanation without engravings.

IMPROVED STACK COVER.

George E. Tuck, Herbert Dorn, and James Steinson, Ridgway, Ia.—This invention consists in a conical stack cover, provided with a lifting ring at its apex. A cap of canvas or other approved material is constructed in conical form, and having a rope or cord around the base, with rings on it for hitching on the stay ropes to keep the cap in place, and stay the stack against the wind. The cap may be made of waterproof material; but probably ordinary canvas, with a coating of waterproof paint, will generally be used. A ring or loop is placed at the apex of the conical cap, so that the latter may be conveniently lifted with a rod or pole having a fork at one end, and then dropped over the grain or hay without the trouble of climbing, by ladder or otherwise, upon the stack.

IMPROVED PLOW FOR LAYING OFF LAND FOR TOBACCO

John Preston and Charles W. Tennis, Millford, Ky.—This invention is an improved plow for laying off land and making the hills for tobacco, cabbages, and other plants cultivated by transplanting, so constructed as to open a furrow, roll the land, and mark the places for the hills. It consists in a wheel having diamond-shaped blocks attached to its face, in combination with a beam or frame and the plow, and in combination with guide arms, sliding band, and adjusting lever, the beam or the frame, and the plow.

IMPROVED PLOW.

Jacob Heckendorn, Ann Arbor, Mich.—In this plow, a skiver, jointer, or colter, is connected with the plow in such a way that its position will not be changed by the lateral adjustment of the beam, that it will leave space for the ready escape of rubbish, that it may be adjusted to work deeper or shallower in the ground, and will throw the rubbish into such a position that it will be covered by the furrow slice. With this construction, a skiver cuts a smooth, clean groove or channel, and throws the soil and rubbish in front of the turning furrow slice, so that it will be covered by said slice; and the plow beam may be adjusted without affecting the position of the skiver, and a large space will be left beneath to allow rubbish to pass off freely.

IMPROVED ANIMAL TRAP.

John H. Morris, Seward, Neb.—This invention is an improved trap for catching animals, for the entrance of stock yards, for the chutes through which cattle are loaded upon cars, and for other similar uses, which shall be so constructed as to remain open except when an animal may attempt to go out, and which will again open as soon as he desists from his attempt. It consists in the combination of the hinged gate and the tilting platform, with the end or ends of a passage, and in the combination of the second passage, the box, and the drop gate with the main passage, provided at one or both ends with a hinged gate and a tilting platform.

IMPROVED RIDING HARROW.

Isaac N. Harris and William H. Bowne, Pavilion, Ill.—This invention is an improved riding harrow, simple in construction, effective in operation, convenient in use, easily guided and controlled, and of light draft. The wheels revolve upon the journals of the axle. The axle is made long, so that the harrow frame may be received between the wheels. To the middle part of the axle is attached a frame which consists of two side bars, connected at their ends by two end bars. The tongue, to which the draft is applied, by which the harrow is guided, is attached to the axle and to the front cross bar of the frame. The harrow frame is made in two parts, halves or sections, each section consisting of six, more or less, parallel cross bars, to which the teeth are attached, and to which, near the ends of their upper sides, are attached two longitudinal bars. To the forward end of the longitudinal bars of each part of the frame are attached the lower ends of two chains which cross each other, and are hooked upon hooks attached to the middle and outer parts of the long cross bar attached to the front bar of the frame, consisting of the side bars. To the rear ends of the longitudinal bars of each part of the frame are attached the lower ends of two chains, the upper ends of which are attached to the middle and outer parts of the axle. By this arrangement of the draft chains the parts of the harrow frame are free to adjust themselves to the surface of the ground, however uneven it may be, and at the same time will be kept in their proper relative positions.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED KEY BOARD FOR TYPE WRITER.

Philander Deming, Albany, N. Y.—The object of this invention is to improve writing machines where a stenotypic key is employed; and it consists in using a divisor bar with key board, so as to permit the instant working of the key from any part of the board, the said bar being weighted and pivoted or spring-carried, so as to rise and fall like a key, and arranged diagonally, midway, around, or otherwise with respect to the keys. It is also to be connected with the stenotypic key, either permanently or by a swing button.

IMPROVED APPARATUS FOR LOADING WAGONS.

Anderson Taylor, Fairville, Mo.—This invention relates to that class of elevators which are used to raise heavy articles for loading wagons; and it consists in a lever supported on suitable frame work, to the shorter end of which a platform is suspended, and the longer end engages with a ratchet, the whole so arranged that a heavy article placed on the platform may be raised to the required hight, when it will be retained by the ratchet.

IMPROVED GRATE FOR BRICK KILN.

Alfred Hall, Perth Amboy, N. J.—This invention consists in a hinged front section of a grate, which takes the place of the ordinary dead plate and door, so arranged as to be capable of being lowered into a horizontal position when the kiln is charged, but may be readily raised into an inclined position, so as to partially close the mouth of the kiln. The advantage claimed for the invention is that the fire may be readily cleaned without lowering the grate, thus avoiding the admission of a volume of cold air, also obviating the exposure of the fireman to the intense heat—a thing which is inevitable when doors are used. Another advantage is that the quantity of air admitted to the kiln through and above the grate is such as to permit the kiln to burn evenly from front to rear, effecting a saving in time and fuel, and producing brick of a uniform color and quality.

IMPROVED LOCKWORK ATTACHMENT FOR CLOCK.

John W. Williams, New York city.—The object of this invention is to improve the construction of the works of striking clocks in such a way that the hands may be turned back to set the clock without injuring the works. It consists in the stop pin, attached to the frame, in combination with the lever and the cam that trip the striking mechanism. To the frame is attached a stop pin for the lever to rest against to prevent its forward end from being pressed inward toward a post when a cam is passing over it, and which would prevent it from being again operated to release the striking mechanism.

IMPROVED CRATE FOR SEWING MACHINE.

Andrew J. Callahan, Palmyra, Ill.—This invention consists of a cage or crate for sewing machines and the like, constructed to be taken apart and packed in compact form for return, and having braces and binding screws to maintain it in the shape for containing the machine.

IMPROVED CAR COUPLING.

William L. Nuckols, Millville, Mo.—This coupling is an improvement in the class known as automatic; and the feature of novelty is the means for holding the link at various angles, to adapt it to enter the drawheads of other cars of the same or different hight, and engage with a pivoted coupling pin or other equivalent device, and thus couple two cars together. The bumper heads have long tapering cavities, and a double incline is formed on or attached to the floor thereof. The L-shaped coupling pin has trunnions and is held in place by dogs. When in the vertical position, the pin abuts the end walls of the slots in the top portion and floor of the drawheads, and is thus enabled to withstand the strain to which it is necessarily subjected by applied traction. In the rear corner of the coupling pin is formed a notch, for convenience in raising it in uncoupling the cars; or a ring may be attached to it, to receive a chain or rod for uncoupling.

IMPROVED MOTIVE POWER.

Adam Graner, New Orleans, La.—This invention consists in combining a drive shaft, counter shaft, and saw shaft, the latter provided with a roll arranged thereunder. The crank for turning the driving shaft by hand has a handle, to which is attached a connecting rod which, at the lower end, connects with a foot treadle, so that the operator may work with both. It is also proposed to apply these drivers to both ends of the driving shaft in practice.

IMPROVED FEED WATER HEATER AND FILTER.

Samuel A. Shoaff, Pennville, Ind.—This invention relates to a feed water heater and filter, in which the water is first thoroughly heated up by steam while passing in a tortuous course through the heater, so as to deposit the lime and then convey the water to the filtering receptacle below, where the water is conducted through the compartments without being agitated by the steam. It consists of a feed water heater arranged above a filter, the heater being made of inclined sections, with lateral steam tubes or passages that extend alternately from one side to some distance of the other side, to conduct the water around the same. The water is conveyed through a connecting pipe to the filter, that is provided with entrance and exit chambers and filtering compartments, separated by vertical partitions having alternate openings at the top or bottom.

IMPROVED CAR AXLE BOX.

George W. Miltimore, Janesville, Wis.—This invention relates to improvements in that class of car axles in which a stationary inner and a revolutionary outer wheel, carrying axle or sleeve, are employed, so that the lubrication of the journal box from the oil reservoir is accomplished, to the exclusion of dust, the drip oil collected, and the journal box allowed to oscillate on the stationary axle to conform itself to a true bearing throughout, according to the spring of the axle produced by the weight of the car. The lubrication of the car axle is accomplished in an economical manner, and the wearing out of the journal box is diminished by distributing the friction throughout the length and circumference of the box, in consequence of the oscillating motion of the journal boxes.

IMPROVED RAILWAY SIGNAL.

James E. McCarty, Cold Spring, N. Y.—This invention is an improved signaling device for railroad tracks, by which the track tender or the automatic action of the train can readily set a torpedo signal to warn the trains in either direction of the danger ahead, and make them proceed cautiously, or stop until the cause of danger is ascertained and removed. It consists of a torpedo-setting and signaling device that is operated by wire connection with suitable ratchet and pawl devices at some distance from the danger signal, or at intermediate points, or by suitable mechanism worked by the train itself.

IMPROVED FANNING MILL.

Charles Saunders, Cape Vincent, N. Y.—The chief features of this invention are an improved feed apparatus, and arrangement of chaffing, screening, and separating shoes independently of each other, for regulating each according to its needs, and for working them so as to counteract the shocks of one by the other; and also of adjusting contrivances for regulating the inclination of the screens.

IMPROVED COMBINED LIQUID PUMP AND FUNNEL.

Henry A. Guignon, Corry, Pa.—This invention is an improved pump and funnel, by which the liquids may readily be drawn out of the barrel and the waste liquid returned back to the same; and it consists of a pump passing through a bung into the barrel, the bung being recessed and connected by a pipe with a funnel and grate for conveying the waste liquid back into the barrel. The pump may be readily detached from the bung, when desired to be used without the funnel, for pumping the contents of one barrel into another, and for other purposes.

IMPROVED COMPOSITION RUBBER FOR MILLSTONES.

John H. Miller, Mount Union, Pa.—This improved burr millstone rubber consists of soft fire clay, about 9 parts; silver sand, 1 part; and ground emery, 4-100 parts, prepared as follows: The fire clay is first ground; the silver sand and emery are then added, and a sufficient quantity of water to mix and prepare the mass for molding; it is molded into the form required, and dried and baked. The object is to make a rubber for smoothing and truing the face and working out the furrows of millstones that will be more efficient and less liable to glaze than the burr rubbers commonly used.

IMPROVED GAS REGULATOR.

Charles C. Place, Somerville, Mass.—This invention is intended to furnish an improved device for attachment to a gas pipe to check the pressure of the gas and purify it before it is allowed to pass to the burners. It consists in the combination of a T pipe, provided with the cap and the filtering box, with the lower part of a gas regulator for purifying the gas introduced into said regulator, and in the gas regulator formed by the combination with each other of the lower part, provided with the shoulder, the middle part provided with the V-shaped ring flange to receive quicksilver, the cap, the lower plate, the weighted plate, and the valve and its adjusting rod.

IMPROVED CAR REPLACER.

Henry C. Hosier and John L. Watkins, Sugar Notch, Pa.—The object of this invention is to replace engines, box cars, freight cars, etc., upon a track in cases of wreck and other accidents. A bar has the forward part made with a base something like the base of an ordinary rail, and the rear part is made without a base, so that it may lie close to the rail, and with its rear end overlapping the said rail. A hook clamp is so formed as to hook over the head of a rail, and have one end or arm rest upon the base of said rail. The clamp is swiveled to the end of the bar so that it may be turned to adapt the bar to be placed upon the outer side of either rail of the track. The bar is made about ten feet long, and is inclined or beveled off, to enable the wheels to pass upon it readily. The rear part of the bar is connected with the rail by rods, the inner ends of which have hooks formed upon them, to hook upon the head of the rail. The outer ends of the rods pass through holes in the bar, and have holes formed through them to receive keys by which the said bar is secured in place upon the said rods. Another bar is placed between the rails of the track. This bar is made about six feet long, has its forward end beveled off or inclined, and is connected with the rail by hook rods and keys. When the engine or car is entirely off the track, a latch or false frog is used. The latch is an iron bar of suitable length and strength, the ends of which are beveled off upon their upper sides, and have U clamps attached to their lower sides. The latch is placed upon the rail diagonally. The U clamp of the outer end of the latch is hooked upon the end of a piece of rail in the same way. In this case, the first mentioned bar should be lengthened by another piece of rail. It is not possible to give a clear idea of the operation of this device without engravings.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED COAL BASKET.

Charles Hager, Watertown, assignor to Albert H. Bullard, Lewis, N. Y.—This invention consists in constructing a portion of each end of a coal basket of sheet metal, and in the substitution thereof for a portion of the splints of which these baskets are now made, the object being to make those parts which are subject to most wear and are exposed to the fire, and thus liable to burn out when the baskets are used for feeding furnaces, more durable, and it also makes them freer to discharge the coal, as it slides off the metal easier than from the wooden splints. The common baskets give out in the splint parts by wear, or by burning out when the baskets are used for feeding fires, while the other parts are still good, making a considerable amount of waste, which is avoided by this improvement, which makes the baskets as durable in that part as in any other.

IMPROVED MUCILAGE HOLDER.

Joseph Vincent Browne, New York city, assignor to himself and George W. Ross, Magog, Canada.—This is a mucilage bottle having a sponge on the top of the cork, and a hole through the cork for supplying the sponge with mucilage, to use the sponge for applying it; and it consists of a cap for the cork and sponge, having a vent in the top to be used for forcing the mucilage into the sponge when a large supply is wanted, by closing the vent by the finger placed over it, or other means, and compressing air in the bottle by quickly putting on the cap, and then opening the vent to let the air escape, when it forces some of the mucilage along with it into the sponge. The cork has a shoulder fitting on the top of the bottle, to prevent it from being pressed into the bottle too far, and to facilitate the removal of it for refilling the bottle. The bottle is designed to lay on the side to prevent the mucilage from draining back into the bottle, and it has a round bottom to prevent it from sitting upright.

IMPROVED LUBRICATING COMPOUND.

Jasper G. Upper, St. Thomas, Canada.—The object of this invention is to furnish an improved lubricator for the journals of cars, steamboats, and machinery, to keep them from heating and to cool them when hot. It consists in the lubricator, formed of tallow, rosin, salt, sulphur, and plumbago, in certain proportions and combined in a certain manner.

IMPROVED HALTER.

John Cronin, Boston, Mass.—This is a contrivance for making a halter for horses more simple and adjustable, and without so many rings, loops, and buckles, etc., as common halters have. The invention consists of cheek straps, arranged in a ring, forming a loop for the nose, instead of connecting with a ring at each cheek, to which the nose piece also connects, making the halter much cheaper, and so that, by taking up or letting out the straps, they and the nose piece will be adjusted alike for large or small horses.

IMPROVED DESSERT COMPOSITION.

Leopold Schepp, New York city.—The object of this invention is to prepare an article of food from cocoa nuts, to be used as a dessert. It relates more specially to such a composition for cocoa-nut drops, by which they will preserve the flavor and richness of the nut for an indefinite time without being liable to become rancid and stale, as do the present cocoa nut preparations. It consists of a mixture of purified or desiccated cocoa nut and cocoa nut oil, with the substances commonly used in the manufacture of cocoa nut articles.

IMPROVED METHOD OF FILLING TEETH.

Romalders Noble, Brunswick, Ga.—This invention consists of capping a filling of amalgam, or other material which is soft when put in the cavity and hardens readily, by a cap of fine rolled gold, having notched or dental or headed pins, or other anchorages, which is pressed into the filling while in a soft state, so as to be secured when the filling hardens, and thus securely hold the cap.

IMPROVED SLEEVE BUTTON.

Thomas W. F. Smitten, Brooklyn, N. Y.—This invention consists in bending the shank of a disk sleeve button to one side, and joining to the end thereof a latch provided with a toe extending rearwardly beyond its pivot. The pivoted latch has a short arm beyond the pivot, to act as a toe on the cuff to prevent it from swinging open, said protection being sufficiently short to allow the latch to swing open by a little pressure when the button is to be taken out.

IMPROVED FRUIT DRYER.

Samuel W. Hope, Dover, Del.—This invention relates to a drying chamber having two compartments, each provided with an elevator or hoisting apparatus, and communicating, by means of an opening in the partition, through which trays of fruit may be slid from one elevator on to the other, and thus passed from the first compartment, in which the moisture is mainly eliminated from the fruit, to the second compartment, where the drying process is perfected. The invention further relates to the construction of the elevators in detachable sections. The trays of fruit are first placed in the left hand compartment, and when the moisture has been mainly eliminated they are slid into the second or right hand compartment, where the drying process is carried to completion, in an atmosphere containing far less moisture than the first.

IMPROVED SHOE.

Martin R. Bodkin, Jersey City, N. J.—Heretofore the practice has been to provide such shoes with a single row of buttons and a single folding flap, having a corresponding number of buttonholes, or with two rows of buttons and two folding flaps. In both cases, however, the edge of the flaps is subject to rapid wear by reason of friction with the bottom of the pants, and is also liable to be torn in the operation of buttoning, and to be otherwise abraded or injured. According to this invention, a single row of buttons is attached to the tongue or center piece of the shoe, and each of the two flaps is provided with buttonholes, and likewise so formed and attached to the shoe as to adapt it to be buttoned under or over the other flap. Hence, when the edge of one flap is worn, abraded, or otherwise injured, it may be buttoned under the other flap, which, not having been subject to wear, is fresh and new in appearance.

IMPROVED HARNESS PAD.

Mirom V. Lomgsworth, Delphos, O.—The object of this invention is to save labor and lessen the cost in making harness pads, while, at the same time, producing neat, strong, and durable pads. The upper side of the pad is covered with a leather plate. Two metal plates are interposed between the saddle strap and the leather plate, and extend from the lower end of said plate, or from near said lower end, nearly to the water hook. The side edges of the plates may be bent upward at the side edges of the strap to keep the said strap from being drawn out of place. To the lower ends of the plates are attached, or upon them are formed, loops or rings to which are attached the straps to which the belly band straps and the straps that support the traces are connected, so that the movements of the traces cannot cause the pad to work upon and chafe the horse's back.

IMPROVED FAUCET.

Hilar Ohnmacht and Robert Weiss, New Orleans, La.—This is an improved faucet for beer and other barrels, by which they may be tapped with great facility without loss of liquid, and by which the driving in of the faucets and consequent damage to the barrel heads, and the use of the casks, will be dispensed with. It consists of a solid plug screwed into the bushing of the faucet hole, and provided with a smaller turning plug, having a curved exit channel that communicates with a similar channel of the cylindrical plug, so as to connect and disconnect the channels, and thereby close or open the faucet.

IMPROVED HAWSER CLAMP.

William H. McGill and Frederick Bowen, Angelica, Pa.—This invention relates to an improved rope socket of strong and substantial construction, and consists of wedge-shaped clamp pieces binding on the rope, and of wedge keys and pins that lock the clamp pieces in the socket. The clamp pieces are firmly locked by the wedge keys, firmly driven in between the socket and clamp pieces, and fastened by lateral pins passed through guide holes of the sockets. The rope is thus rigidly fastened to the socket without danger of getting detached therefrom.

IMPROVED CARTRIDGE-LOADING IMPLEMENT.

William W. Arnold, Rushville, Ind.—This invention relates to that class of instruments which are used in loading and capping metallic cartridges, and it consists of a lever combined with other devices, making a convenient instrument for loading and capping metallic cartridges, and for removing cartridges from the gun; also, for removing the spent cap from the cartridge. The manner of using the instrument is as follows: In filling cartridges, the head is used to force the powder and wads home Caps are placed on the cartridge by placing the cartridge shell in a ring, putting the cap on the anvil of the cartridge, and forcing it down with the lever. After a cartridge has been discharged, it may be removed from the gun by placing the hooks on the flange at the end of the shell, and drawing it out by the ring or lever. The spent cap is removed from the cartridge shell by forcing the pin against it from the inside of the shell, the head serving as a guide, insuring its entrance at the cap aperture.

NEW TEXTILE MACHINERY.

IMPROVED PAPER COP TUBES.

John McCausland, Providence, R. I.—This invention consists as a new article of manufacture in the particular construction of a paper cop tube, made in the form of a cylinder of uniform diameter, and having a bushing of wood located in the upper end, directly at the edges and flush with the same.

IMPROVED CARDING MACHINE.

James C. Ryan, Amesbury, Mass.—This invention consists of an attachment to carding machines, for making nubbed and clouded or imitation printed yarn, the same being intermittent feed rollers, a knife for holding back the yarn or silver, and a wipe roll, by which the yarn is supplied to the doffer of the carding machine, and there combined with the stock, forming the groundwork of the yarn. This machine will make nubbed yarn with the webs any distance apart, provided it be geared so that the speed may be varied, the silver being fed in full size when the knife is raised, and checked back and stretched when the knife is closed on the feed roller. It will also make clouded or imitation printed yarn of different colors, as many different colors as may be desired being employed, and being separated from each other by passing through different guide eyes. For making clouded yarn, the knife will be taken out when the attachment is not wanted.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Agricultural Implements and Industrial Machinery for Export and Domestic Use. R.H.Allen & Co., N.Y.

Walrus Leather, Walrus Wheels, and Polishing Material. Greene, Tweed & Co., 18 Park Place, N. Y.

Blake's Belt Studs, Belting, Packing, Hose and Manufacturers' Supplies generally. Greene, Tweed & Co., 18 Park Place, New York.

Want to Sell Letters Patent for Rubber Shoe Heel Supporter, or take royalty. Martin Bock, Berwick, Pa.

For 2d Hand Portable and Stationary Boilers and Engines, address Junius Harris, Titusville, Pa.

Models for Inventors. H. B. Morris, Ithaca, N.Y.

Wanted to Buy Patents of Saleable Articles in Iron or Brass. Address, with particulars, "Star," 245 North 8th St., Philadelphia, Pa.

Jethro Wood.—If any of our readers can send or refer us to any publication containing a portrait of Jethro Wood, the plow inventor, we should be obliged Munn & Co.

Yacht and Stationary Engines, sizes 2, 4, 6 and 8 H. P. Best for price. N. W. Twiss, New Haven, Conn.

Removal — Shearman's Machinery Depot has been removed from 45 Courtlandt to 46 Courtlandt St., New York, where we will be pleased to see our former patrons.

Screw-Cutting Foot Lathes. W.E.Lewis, Cl'v'd, O.

For the cheapest and best Small Portable Engine manufactured. address Peter Walrath, Chittenango, N.Y

Hotchkiss Air Spring Forge Hammer, best in the market Prices low. D. Frisbie & Co., New Haven, Ct.

Patent Scroll and Band Saws, best and cheapest in use. Cordesman, Egan & Co., Cincinnati, Ohio.

M. Shaw, Manufacturer of Insulated Wire for galvanic and telegraph purposes, &c., 259 W. 27th St., N.Y.

For Sale, together or separately—Two 11 in. hydraulic Presses; Tubular Boiler, new, built by Fletcher & Harrison; Steam Engine, 25 h.p., built by Woodruff & Beach; three sets Hydraulic Pumps. Robert Dillon, 30 Burling Slip, New York.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water Street, New York.

Pat'd Graining Stencils—J. J. Callow, Clevel'd, O.

Lathe Dogs, Expanding Mandrels, Steel Clamps, &c., for Machinists. Manufactured by C. W. LeCount, So. Norwalk, Ct. Send for reduced Price List.

Dynamo-Electric Machines for electro-plating and other purposes. Send for illustrated circular. W. Hochhausen, 132 William St., New York.

"Abbe" Bolt Forging Machines and Palmer Power Hammers a specialty. Send for reduced price lists. S. C. Forsaith & Co., Manchester, N. H.

400 new & 2d hand Machines, at low prices, fully described in printed lists. Send stamp, stating just what you want. S.C. Forsaith & Co., Manchester, N. H.

Driving Belts made to order, to accomplish work required. Send full particulars for prices to C. W. Arny, 148 North Third St., Philadelphia, Pa.

Celebrated John Scott Scroll and Jig Saws made to order, of Jessup's superior cast steel, by I. Roberts, 108 Hester Street, New York. Send for circular.

Scientific American—The early Volumes for Sale—very cheap—either bound or in numbers. Address A. F. R., Box 773, New York City.

Hydrant Hose, Pipes, and Couplings. Send for prices to Bailey, Farrell & Co., Pittsburgh, Pa.

Machine-cut brass gear wheels, for models, &c. List free. D. Gilbert & Son, 212 Chester St., Phila., Pa.

"Dead Stroke" Power Hammers—recently greatly improved, increasing cost over 10 per cent. Prices reduced over 20 per cent. Hull & Belden Co., Danbury, Ct.

Power & Foot Presses & all Fruit-can Tools. Ferracute Wks., Bridgeton, N.J. & C. 27, Mchy. Hall, Cent'l.

Shingles and Heading Sawing Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Steel Castings, from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

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

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Temples and Oilcans. Draper, Hopedale, Mass.

Notes & Queries

J. R.'s observations on scarlet fever and diphtheria have been handed to a prominent physician for reply.—T. E. is informed that we do not know the article he mentions.—W. H. H. can protect his iron castings from rust by the means described on p. 169, vol. 33.—G. A. C. is informed that writing paper is glazed by rolling it under immense pressure.—J. R. will find recipes for bronzing iron on brass on p. 283, vol. 31.—J. C. G. can raise the pitch of his tuning fork by filing it shorter. It cannot be lowered without lengthening it.—W.H. H.'s idea as to burning steam is a chimera.—A. K. will find a good recipe for indelible ink on p. 129, vol. 28.—C. J. C. is informed that the oxyhydrogen light will probably suit his purpose.—E. W. M. should address the Signal Service Bureau, Washington, D. C.—M. D. K. will find a recipe for a fugitive ink on p. 267, vol. 34. Straw hats can be bleached by the process described on p. 11, vol. 32.—F. A. L. will find that chloride of calcium will absorb the moisture in his refrigerator.—C. K. W.'s idea that machinery runs better at night than in the daytime is perfectly absurd.—C. A. F. will find a recipe for fulminating powder for cartridges on p. 90, vol. 31.—B. F. K. will find a good recipe for ink on p. 250, vol. 34.—A. C. G. will find that the proportions of an induction coil are fully described on p. 344, vol. 33.

(1) M. E. B. says: Please give me a recipe for removing stains from marble table tops, supposed to be caused by lemon juice? A. If the stains mentioned are from lemon juice, they cannot be removed, as the organic acids they contain attack and disintegrate the marble. Try moistening the spots with benzole and covering with hot pipe clay. If this does not remove them, it will be necessary to resort to mechanical means.

(2) F. G. asks: By what rule do the "Farmer" and "Family" almanacs give the times of rising and setting of the sun? A specimen now before me gives, for example, on November 1, sunrise, 6h. 29m.; sunset, 4h. 59m. Now assuming the time for rising to be correct, that time, taken from 12 hours, would leave 5h. 31m. as the correct time of setting. Here is an error of 32 minutes. A. On November 1 the sun is south of the equator 14° 33', the length of the day 10 hours 30 minutes; one half of this, 5h. 15m. subtracted from 12, would make the sun rise at 6.45, but the sun is fast of true time 16 minutes on this day. This makes him rise at 6.29, and set 16 minutes earlier, 4.59, making the forenoon 32 minutes longer than the afternoon. There are only four days in the year in which the sun is on time, April 15, June 14, August 31, and December 24.

Does the attraction of magnetism vary as the square or cube of the distance? A. There are some cases in which it varies inversely as the cube, but the attraction of terrestrial magnetism varies inversely as the square, of the distance.

(3) C. M. asks: What is the number of threads per inch on the "society screw" of microscopical objectives? A. Fifty-five.

(4) D. H. asks: What color of paper is best to write upon, for a person having weak eyes? A. Green or blue, or an intermediate color, if there is light enough not to tax the eyes, as these colors reflect very little of the heat rays.

(5) E. O. K. asks. 1. Please give me a recipe for making a bright red mortar for pointing a foundation wall? A. Take Spanish brown, dry, and mix in with common lime mortar; color to suit. 2 Would red lead be affected by the lime? A. That you can try by experiment; a day or two would show.

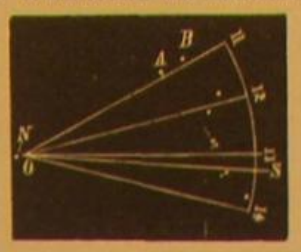
(6) S. P. M. says: What size of paddle wheels do we need on a steamer 45 feet long, and 10 feet wide at the bottom? She is built sharp at both ends, and draws, when loaded, from 14 to 18 inches of water. We have a 10 horse engine to run her, and plenty of power to spare. A. By using 10 feet wheels with your present engine, you might obtain a speed equal to 7 miles an hour, or you might get even better results by using feathering wheels of the same diameter as the present ones, 7½ feet.

(7) J. D. E, says: The flint glass of my telescope is very hazy, having a scum or smoky appearance on the outside, which will not wipe off. How can I remedy it? A. This trouble is quite common with heavy flint glass, and the only way to remove it is by polishing. When it is not very thick it can be removed by polishing with rouge on a piece of chamois leather. If this does not remove it, take a piece of yellow beeswax and make a polisher about one third the diameter of the lens. With this and a little rouge and water the lens may be cleaned. Care should be taken to go all over the glass evenly.

(8) E.G.F. asks: Can you tell how to remove a bad echo from a schoolroom, 26 x 29 feet, with 12½ feet pitch? The teacher's desk is at one end of the room, between two doors, on a slightly raised platform. The stove is a little in front of the platform. A recitation seat runs along the sides of the room, and between are low chairs and desks for nearly 100 scholars. There are three windows on each side, and two in the end opposite the doors. Teachers complain of sore throats and tired lungs after having charge of the room a short time, of a confusion of sounds when the scholars are only moderately restless, and of the great difficulty in rightly locating any noise. The room is so hard to teach in that a partition, an addition, or any reasonable remedy is to be tried if we can learn what will be best. A. It probably will be found that the difficulty in this case arises from the bad shape of the room, it being nearly square. It has been found that long and narrow rooms, with the speaker at one end, have been the best for the voice. The auditorium of the Academy of Music, which is the principal opera house of this city, is a good example of a room of this kind. If you should partition off a small room in the corner upon each side of the platform, you might help it: say 9 feet wide and 12 feet long, triangular, with the partition you insert curving outwardly towards the platform upon a radius of 13 feet.

(9) F. H. N. says: In the house I live in is a well, running down from the skylight, 8 feet x 3 feet in dimensions, for the purpose of conveying light and ventilating some rooms which have no opening on the street, and which, otherwise, would be dark and close. Now it is a great source of annoyance that all conversation on the fourth floor can be heard in the lower rooms, and *vice versa*. Can you tell me of any means or method that may be employed by which this may be obviated? Could it not be done by means of crossed wires, that is to say, wires crossing each other at angles of about 45°? A. We have no information that would warrant the success of such a plan. Can you not put in a horizontal sash, and procure means of ventilation in some other way?

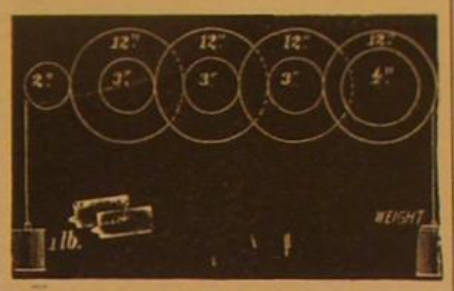
(10) C. H. asks: How may I find when the north star is on the meridian, by reference to the stars in the Dipper? A. The line, N S, represents the meridian, N the north star, O the north pole, and the lines O—11, o—12, etc., are 1 hour apart, and show sidereal time. A E are the Pointers. It will be seen that the north star and



the next to the last star in the handle of the Dipper are on opposite sides of the poles, so that when a plumb line will bisect both, they indicate the true meridian very nearly. They now pass the meridian between 5 and 6 o'clock.

(11) W. W. L. says: About four years ago, I made an upright refrigerator; but not liking the metallic taste which a metal lining gives to food, I left it unlined, but very foolishly varnished the wood inside, in consequence of which nearly every article of food placed in it tastes of the varnish. I have tried scraping and scrubbing the wood, but the smell and taste of varnish still remain. Will a coating of shellac remedy it? If not, what will? A. Coat the interior evenly with melted paraffin. It should be applied rapidly with a good brush and is perfectly tasteless and inodorous.

(12) W. C. A. says: The inclosed drawing will show you four 12 inch gear wheels working into 3 inch ones, the last one to the left being a 2 inch. The cord at the right runs off a drum 4 inches in diameter. What amount of weight will be required to lift the 1 lb. at the left, and what is the rule for calculating the power of gears



or the amount of weight required to move them? A. Disregarding friction, the power and weight are to each other in the inverse ratio of the distances passed over by each in the same time. 2. Is there any rule for calculating the power of coil springs? A. The power of a coiled spring is the product of the force with which it tends to unwind multiplied by the distance passed over by the point of application of the force in a given time.

(13) A. I. asks: Can you recommend with a certainty of success some inexpensive formula to preserve cider? Your recipe as follows: "To 1 barrel of new cider, add ½ part sugar and 2 handfuls of fish sounds to clarify. Let stand two weeks in cool place, then rack off into a well washed cask or barrel, and add from 1 to 2 dozen whites of eggs; let stand another two weeks, and then rack off into another barrel. Add finally 2 gallons of whisky, stirring well, then bottle. This cider will keep sweet through the summer." What do you mean by ½ part sugar? A. The recipe as given is a good one, with the exception that the proportion of sugar should have been stated more definitely as about 3½ lbs. to the barrel. If the liquid is bottled, the bottle containing it should first be placed with loosened stopper in a vessel of water, the temperature of which should then be gradually raised to about 180° Fah. and the bottle tightly stoppered and allowed to cool.

(14) F. B. L. asks: What can I put fruit up in so as to preserve it in its natural form and color? I want to carry the fruit round as samples. A. Try a weak solution of good carbolic acid in alcohol.

(15) J. H. G. asks: 1. How may I distinguish pure rubber? A. Pure rubber is of a dark, semi-transparent nature, quite elastic, but easily indented with the teeth; in hot water it swells up and becomes quite plastic. 2. How is rubber dissolved in a liquid, and how long does it take? A. When plastic it should be placed in the solvent; hot naphtha or benzole is preferred, the rubber having been previously cut into as small shreds as possible. In this condition it swells up very considerably and partially dissolves in a few hours. In order to obtain a rubber cement, the solution, together with the softened pasty mass, which should be well stirred and kneaded during the operation, may be evaporated down over a water bath, until of the proper consistence.

(16) Mrs. W. C. A. asks: 1. Is there any danger of incurring diseases from using water from a well which has not been used for about 1 year? A. If the water contains any notable quantity of organic matter, there is. 2. Is there any way to purify the water if it is not fit to use? A. One of the best remedies is to keep the water running for some time before attempting to use it. The addition to the water of a quantity of finely crushed, well burnt charcoal would also be advisable under the above circumstances.

(17) W. R. B. says: I have some vinegar which I cannot clarify. I have tried sand and charcoal in a barrel, but it does not clear it. Would you advise anything in preference to a charcoal filter? A. Try the following: Warm some finely crushed charcoal or bone black, throw this into the vinegar and stir occasionally for about 24 hours; then draw off the vinegar, mix with a quantity of common (clean) paper pulp, and filter through a bag of fine linen.

(18) A. B asks: Please give me a recipe for making a polish for wooden turned work, to be used on the work while in the lathe? A. Try a mixture of boiled oil and turpentine, well rubbed in with pieces of rag. 2. Is there any other method of bluing iron or steel than by heating it? A. Dissolve 4 ozs. hyposulphite of soda in 1½ pints of water, and then add a solution of 1 oz. acetate of lead in 1 oz. water. Place your articles in the solution, and heat to the boiling point. Your articles, if of iron or steel, will be blued.

(19) A. B. says: We have two engines, 7 inches bore and of 12 inches stroke, attached to one shaft. They have reversible link motion, and are each provided with the ordinary slide valve. They make 175 revolutions per minute with a pressure of steam of 85 lbs. to the square inch. One of the engines has too much lead when on either center. We have tried several plans to shorten the stroke of the valve, but without any success. Will you please give us some information? A. You must take the lead off your valve by setting the eccentric back

(20) W. B. asks: 1. Can charcoal be obtained in a liquid form for commercial purposes? A. There is no solvent for charcoal. 2. How can oils be filtered through charcoal, and the oil residuum remaining in the charcoal be extracted and saved? A. Digest the charcoal with the adhering oil in bisulphide of carbon. The oil may be recovered by distilling off the volatile bisulphide in a suitable retort, at a gentle temperature

(21) J. C. ask: I have an iron pipe conveying water from a cistern for culinary and other purposes. The water becomes so highly impregnated with iron as to render it quite unpalatable. A. Add a little clean lime water (experience will teach you the proper quantity) and filter through a sand and charcoal tub.

(22) J. S. F. asks: How is the lime water mentioned on p. 7, vol. 34, prepared? A. Digest a quantity of good quicklime in pure water for some hours, with occasional shaking; allow to settle and draw off the clear transparent liquid without disturbing the residue. It should be kept from contact with the air when not in use.

In steam or vapor baths, how is the steam handled so that the heat does not affect the person? A. The steam simply imparts its heat and a portion of its moisture to the air by actual contact.

1. The water here (among the San Fernando Mountains, Cal.) is of several kinds. Some springs contain small quantities of petroleum, others alkali, others sulphur, iron, and alkali. The ground over which the latter springs run, and boards with which the water comes in contact, become heavily coated with a bright yellow substance like rust; while on the surface of the surrounding soil, a thick white coat of alkali forms. Can anything be done to such water to make it fit to drink? A. We do not think it would be practicable under the circumstances. 2. One spring or well 8 or 10 feet deep, by the side of a now dry stream, has no bad taste, but the water makes the excrements almost black, and causes diarrhœa. What does the water contain, and what is the yellow substance mentioned? A. It is probably due to the large quantity of iron and sulphuretted hydrogen it contains. The deposit probably consists chiefly of the hydrated sesquioxide of iron

(23) A. H. says: In what should I boil cider so as to make a good article, free from foreign color or taste? Would an iron or copper kettle do? A. It would be better to use a tin vessel or one of cast iron, porcelain-lined. The vegetable acids corrode both iron and copper.

(24) F. D. H. asks: Are the connecting rods of the locomotive at the Centennial, built by apprentices, of the character shown in Fig. 1, p. 490, SCIENTIFIC AMERICAN SUPPLEMENT, that is, with simple eyes, without means provided for taking up the wear? A. No.

(25) C. W. S. asks: What will remove deeply set tea stains from an oak table? A. Try a little ether and alcohol.

(26) A. F. G. says: 1. I have 500 lbs. leaf tobacco, of such a bright color that cigars made with it find no acceptance. What ingredients should I use to make a compound with which to give the cigars a deeper color? A. We understand that in similar cases it is a practice of some manufacturers to make an extract of the stems and other waste of the leaf by boiling the same in water, and afterwards concentrating the solution by evaporation until a very strong liquid is obtained. To this is added the various essential oils, etc., the precise nature of which is strictly kept from the public as a "trade secret." The leaves to be colored are then dipped in the preparation and dried until of the required shade. 2 I have also some very good Pennsylvania tobacco to which I would like to give the aroma of Havana tobacco. How should I make a preparation of Havana tobacco that the Pennsylvania leaf can be darkened with, that would give the tobacco an Havana taste? A. Various means similar to that given above are constantly employed, with varying success to impart to baser leaves the peculiar flavor of Havana tobacco; but we are not prepared to give to the public the precise methods.

(27) N. says: I use a copying ink pencil (made of aniline, I suspect). Can you inform me of the quickest and easiest mode of copying letters written by this pencil without using a press? A. Try thin paper moistened with a little dilute gum water and alcohol.

(28) E. C. B. says: I frequently have to clean watches which have fallen into the sea, and the steel parts get rusty. I have tried putting them in soda water and then soaking in oil, but all to no use; for after 2 or 3 months the rust will reappear as bad as ever. Will you please tell me the best remedy? A. Try a little very dilute sulphuric acid. After removal from the acid, wash

quickly and cover with warm pipe clay for a time. The working parts should be polished perfectly before attempting to replace them in the watch.

(29) W. C. W. asks: What process or preparation will prevent strips of lead from blacking the hands? A. Coat them with a thin covering of varnish or melted paraffin.

(30) B. & B. say: We wish to build a large brick factory, 50 x 100 feet, four stories high, and wish the three upper stories to be damp or sweat proof. What is the best mode of building it? A. Build hollow walls laid up in a good cement mortar.

(31) J. McT. asks: 1. Will concrete do for a cellar wall and foundation for a frame building? A. Yes. 2. Will common lime do to mix it with, or will it require cement, or some of each? A. Pure cement is best.

COMMUNICATIONS RECEIVED.

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

On Newspaper Subscriptions. By J. H. P.

On Marine Propulsion. By R. F.

On a Discovery in an Ancient Temple. By J. E. W.

On a Body in a Hollow Sphere. By J. W.

On the Material Theory of Light. By G. L. B.

Also inquiries and answers from the following:

J. C. W.—J. G. A.—W. D.—U. R. D.—J. S.—W. M.—G. C.—C. S.—S. P. F. F.—C. Z.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes marbleized slate? Whose is the best steam-heating apparatus? Who sells the most accurate barometers? Why do not makers of agricultural implements advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

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

July 25, 1876,

AND EACH BEARING THAT DATE.

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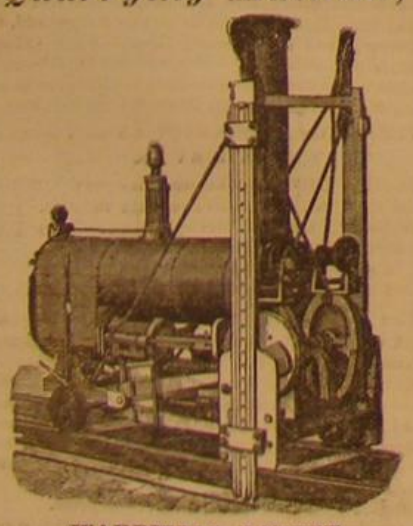
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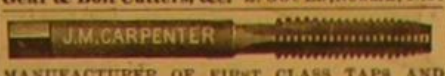
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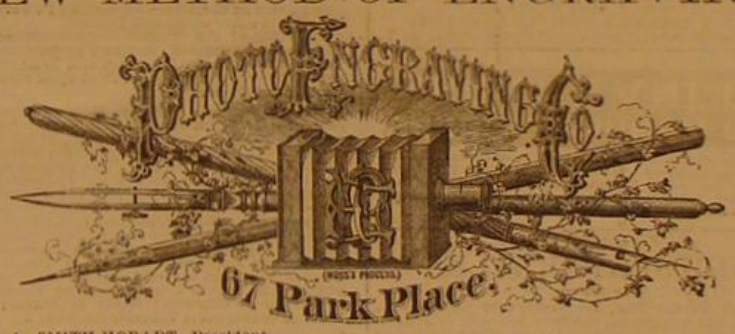
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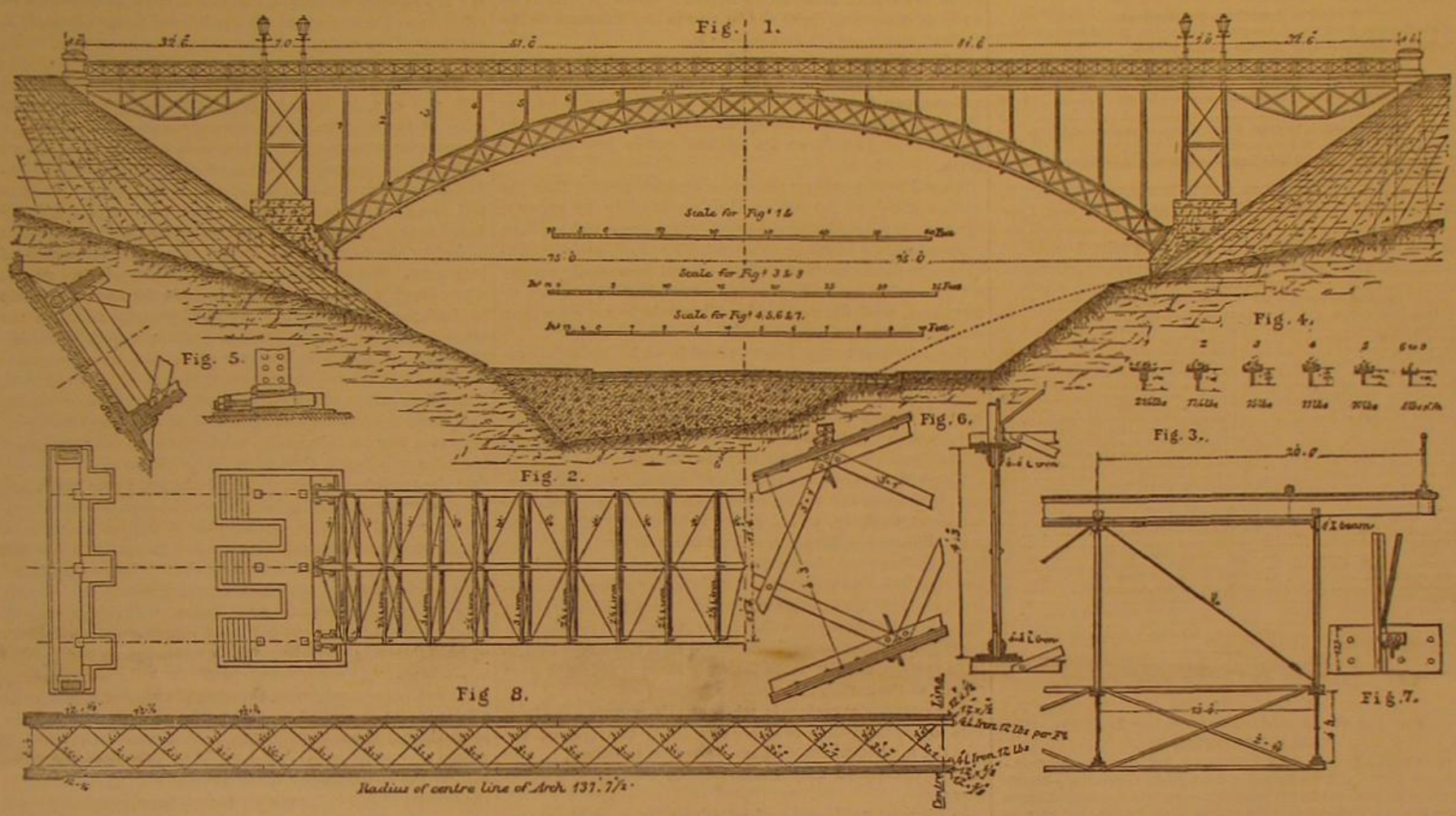
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NEW BRIDGE AT PITTSBURGH, PA.

The engraving published herewith represents a bridge erected two years ago at Pittsburgh. The length of the bridge is 250 feet, the clear span 150 feet, and there are side openings of 40 feet each, with roadways and sidewalks along the river's banks passing through them. It was decided by the commissioners who had charge of the work that the bridge should be calculated for a movable load of 100 lbs. per square foot, or 4,000 lbs., per lineal foot, with a factor of safety of 5. The bridge was designed by Mr. Pfeifer, and constructed by the Iron City Bridge Works, of Pittsburgh. The contract price was about $36,000, whereof $12,000 were for the excavation and stone work.

The main arches of the bridge were fitted together in the shop, but taken apart again and put together in place on scaffolding. The ravine crossed by the bridge is for the greater part of the year dry, and will in course of time be occupied by Boundary Avenue, a street of 80 feet in width, making with Forbes street, on the center line of the bridge, an angle of about 60°. In the elevation, Fig. 1, a section through this intended street is shown. The general construction of the bridge, says *Engineering*, to which we are indebted for the illustration, is so clearly shown by the views we give that no detailed description of it will be necessary. We may mention, however, that Fig. 8 is a diagram showing a development of half of one of the arched ribs, the rib being drawn straight instead of curved to its proper radius. The mode of adjusting the bearing of the ribs on the abutments is shown by Fig. 5. The other detail figures will explain themselves

Fig. 1.





WROUGHT IRON BRIDGE AT PITTSBURGH PA.

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THE MOON'S ATMOSPHERE.

The moon has no atmosphere, the text books tell us: or if any, it is comparable in density only to the best vacuum to be obtained in the receiver of an air pump. Bessel estimated the greatest surface density possible in a lunar atmosphere, consistent with lunar phenomena, to be the thousandth part of that of the earth's atmosphere; and most writers on astronomy have accepted his conclusion as final.

But it has been found that the calculations which led Bessel to this result were vitiated by serious errors and omissions. He failed in the first instance to take account of the difference in the force of gravity on the moon and on the earth. Allowance being made for that, it appears that the surface density of the moon's atmosphere may be three times what Bessel made it. He also overlooked the influence of temperature. Making the necessary correction for this element, his equation shows that, so far from being limited to a density a thousand times less than that of the earth's atmosphere, the moon's atmosphere may be five times as dense, or one two-hundredth that of our air. In view of the diminutive mass of the moon and the feeble action of gravity upon its surface, such an atmosphere would be relatively quite as important, quite as effective in its influence on the surface, as the earth's atmosphere is.

Taking the earth as unity, the diameter of the moon is less than two sevenths; its surface area, one thirteenth; its volume, one forty-ninth; its mass, a little more than one eightieth; its mean density about three fifths; and the the force of gravity on its surface rather less than one sixth.

Spread over a surface relatively so much greater than the earth's (as $\frac{1}{13}$ to $\frac{1}{81}$) and acted on so slightly by gravity, the moon's atmosphereic envelope—assuming it to have been proportionately as ample as the earth's at first, and the conditions to have remained similar—would necessarily occupy a very much greater comparative volume than the earth's atmosphere, while its surface density would be not more than one fiftieth part as great.

But this maximum density possible under Bessel's estimates must greatly exceed the density actually possible at the present time, since the absorption of the moon's atmosphere by the moon's surface must have gone on much more rapidly than the corresponding absorption by the earth, the surface exposed being relatively six times greater.

Think what enormous volumes of carbonic acid gas, oxygen, hydrogen, and so on, have been withdrawn from the earth's atmosphere, to enter into solid combination in the coals, limestones, granites, and minerals of every sort; and try to realize what the condition of atmosphere would have been had it been subjected to the absorbing action of a similar surface six times more extensive. Such, relatively, have been the conditions prevailing in the moon. If correspondingly reduced, its atmospheric envelope is not likely now to have surface density more than one three hundredth part of that of the earth's atmosphere.

The question therefore is whether astronomers have been able to detect positive evidence of a lunar atmosphere, not like the earth's, which we have no reason to expect, but of such a density as may reasonably be considered possible there.

In his recent able and authoritative treatise on the moon, Neison remarks that all astronomers who have devoted much time and attention to the detailed examination of the lunar surface have recognized more or less direct indications of a rare lunar atmosphere, besides the more indirect evidence afforded by the known conditions of the moon's surface and the phenomena presented by it. Again, with reference to Bessel's estimate of its density, he says: "But this opinion was coincided in by none of those astronomers to whom is due our knowledge of the condition of the moon, and they recognized that the lunar atmosphere seemed to possess a greater density than the theoretical considerations would appear to permit."

We have seen that those theoretical considerations rightly interpreted, are in accordance with the existence of a lunar atmosphere, very far from being insignificant; and it re- simply to examine the evidence borne by observable phenomena.

The only methods sufficiently delicate to detect unmistakably a lunar atmosphere, having a surface density less than one hundredth that of the earth's, are those based on the refraction of a ray of light traversing it; and of these the most trustworthy is that based on the observed times of lunar occultations, that is, the cutting off the light of a star by the moon coming between us and it. If the moon had no atmosphere, the disappearance of the star should coincide exactly with the calculated time. With an atmosphere of appreciable density, the disappearance of the star must be delayed by refraction. The difference between the observed and the calculated time of an occultation would, therefore, furnish a measure of the density of the lunar atmosphere, provided the calculated time were minutely exact.

Unfortunately this requires the moon's diameter to be exactly known, but that is still doubtful within very small limits, owing to the disturbing effect of irradiation. As the result of some hundreds of recent observations with powerful instruments, however, occultations appear to be retarded from five to ten seconds more than can be accounted for by the effects of irradiation. Consequently the existence of a lunar atmosphere sufficiently dense to produce the difference found is not only possible, but very probable, considering the consistent nature of the results obtained by observations and the apparent inadequacy of other causes to explain them. The maximum surface density of the moon's atmosphere, according to these conditions, is about one two-hundredth of that of the earth; but this result must be considered as merely probable, the exact density being unobtainable with the observations at present existing, owing, as already noticed, to the uncertainty as to the moon's exact diameter.

Among the appearances which are regarded by students of the moon's phenomena as proofs positive of a lunar atmosphere of considerable density, we may mention the twilight at the cusps of the moon, the dimness and obscurity observed at times in certain localities while surrounding objects stand out sharp and clear, the blue, transient fringe to crater walls at sunrise, the local and quickly disappearing gray border to the black shadow of some of the deep crater formations, the misty appearances within deep craters at sunrise, and the blotting-out of surface details by mists which vanish as the sun rises.

After reviewing at length the evidence of these and other lunar phenomena, Neison decides that the existence of an atmosphere to the moon must be regarded as certain; the only uncertainty that remains is with respect to its density, which he is persuaded must in all probability lie between three and four hundredths of that of the earth's atmosphere. It "is therefore capable of exerting almost as powerful an effect upon the surface as the earth's, and, proportionately to the mass of the moon, is not much inferior in amount."

THE RECENT WORKING MEN'S DEMONSTRATIONS.

In this city, in Philadelphia, in Newark, and in many other of the large populous centers, the abnormal spectacle is now being witnessed of working men banding together and marching in procession to demand of the authorities an opportunity to earn an honest living. It is impossible not to feel the greatest commiseration and concern for men reduced to this predicament, and it would be uncharitable not to find in the circumstance every condonation for errors of judgment. We are well aware that it is like offering stones, when bread is asked, to answer appeals for immediate help by indisputable maxims of political economy; but on the other hand, the working men have nothing to gain by closing their eyes to the truth, however distasteful or unfortunate the same may be, and there is something still to lose by their pursuing a course which can in no wise enure to their benefit

A moment's consideration must show to every intelligent workman that his is in reality neither an especially oppressed nor yet a privileged class of society. If he will remember that the terrible financial stress of the last three years has affected everyone, that great business houses, believed to be superior to all possible vicissitudes of fortune, have been utterly annihilated, great enterprises, apparently in the full tide of success, have been arrested, that we have experienced not a sudden panic, from which recovery was possible, but a slow yet inevitable shrinkage of value in all things, he will perceive that by no combination of circumstances could he and his fellow laborers be made an exception to the general misfortune. When employers barely have the means to keep their business in existence, and then are thankful that their affairs are no worse, when, as must be the case, every penny is considered more closely than dollars were before, when people cannot hire men to do work, simply because they have neither the money to pay for it nor any way of disposing of the results of labor, it certainly cannot be expected that work can go on. Nor is there any sudden and rapid method of forcing the same into existence.

There is no greater mistake than to suppose that government can do this. The governing power is not paternal here, as in France or Russia. No one would more quickly resent its interference with his private affairs than would the working citizen himself. The particular persons whom we call President, or Mayor, or Governor, or Aldermen, who manage, for brief periods, the mechanical proceeding incident to government, are but paid servants of the public, not rulers and for the working men or any other class of sovereign citizens to ask, of those whom they hire to do certain work, an exercise of power without the duties and powers which they themselves have strictly defined and limited by law is not sensible.

Again, it would not be just that one part of the population, because it earns a living by daily physical labor, should be provided for to the exclusion of every other class. The employer who may be laboring at his desk until his bodily powers threaten to succumb, in order to avert impending ruin, has an equal right to assistance. The butcher, the grocer, all the retail trades' people, who are dependent on the working man's custom for their living, would be equally justified in asking help because the working men now buy less of their commodities, It is clear that, if the State had power to make work, that work would have to be paid for by the people, through taxation; and when the working man came to spend his earnings, he would find that they would buy just so much less meat and coal in proportion as the dealers, through their increased taxation, have been compelled to raise the prices.

It seems to us that the only sensible course at hand is for the men to bear their misfortunes patiently, to be vigilant; and when any honest labor, no matter what, does appear, to take it and be content with any wages that will afford support. We say plainly that the present is no time for strikes such as the 'longshoremen and stone cutters have been making, no matter what the pretext, and that the period is still less propitious for enforcing dicta of trade societies or the unwritten laws of trade etiquette. We believe there is a deep-felt sympathy for the working men pervading the community, and that there is a growing tendency to afford employment whenever it can possibly be done. It remains for the men who join in processions and other demonstrations to see to it that no hasty or ill advised action, on their part, impairs this favourable public sentiment.

IS ANYBODY SANE?

That is to say: Is anybody so happily constituted that there is no corner of his mental organization in which he is prepared to admit, consciously or unconsciously, that somehow or somewhere the impossible may happen?

For our part we are inclined to think that perfect sanity, like perfect health, is a condition impossible in the present stage of human development. It is our misfortune as well as our advantage that we are heirs of all the ages. The past remains with us; so that every man carries more or less of the imperfection, the lower life, of all the long series of life forms, reaching back to the beginning.

Without going the length of the litanies and saying there is no health in us, we are nevertheless compelled by every day experience to admit that the best of men fall far short of that state of perfect healthfulness in mind and body which we can readily conceive to be possible, and to which the human race may sometime attain. The best of men inherit physical and mental weaknesses—more correctly, organic imperfections—from ancestors near and remote, which show themselves not only in the outer form but also in the inner constitution, in mental and moral traits as well as in bodily habits and diseases. In like manner man in the aggregate, that is, society, inherits creeds, customs, conditions, and surroundings, which tend powerfully to thwart the normal development of the individual.

For this reason, in the progress of nations, insanities in thought and action have not merely to be overthrown by what is right and true, but slowly outlived and eliminated from the constitution of the race by a long process of natural or artificial suppression. And often the foremost men of a nation have quite forgotten an outgrown error, a once prevalent vicious habit of thought or phase of epidemic insanity, long before it has entirely vanished—literally died out—among the masses. Not unfrequently, too, some seemingly trivial occurrence will start an astounding revival of the long quiescent evil, causing it to burst forth like a mental plague to ravage nations supposed to be beyond its contagion.

The recent wide-spread development of the delusions covered by the general term spiritualism is an instance in point. It is a revival of witchcraft and devilmongering, characterized by many of the obliquities and intellectual vagaries of rampant insanity. Men smitten with the disease cease to be amenable to reason in all matters connected with spiritualistic delusions. The most patent and ridiculous of frauds and follies, reputedly involving spirits and their mediums, are accepted by them with religious enthusiasm. They glory in their shame, proud to be fools in so sublime a cause. In all other fields of thought they may be shrewd, sensible, and logical to a degree; in this, the plainest demonstrations of the unreasonableness of their views, the most palpable proof of the dishonesty of their trusted "mediums," glance off from their minds like raindrops from a duck's back, making absolutely no impression.

The most amazing feature of the case, regarded otherwise than as a phase of insanity, is the prevalence of the delusion among the intelligent and well-to-do. No grade of society is exempt, though it runs more or less in streaks; and no amount of rebuff or exposure seems to lessen the victim's confidence in the absolute wisdom of his foolishness

The numerous and curiously varied clientage of Flint, the swindling tea kettle medium, affords abundant illustration. A clumsy and illiterate humbug pretends to answer, under spirit guidance, sealed letters (unaddressed, though directed within to the spirits of the dead), returning in each case the desired reply properly signed, with the letter of inquiry unopened, all for two dollars: and straightway men and women, of every rank in life, flood his office with banknotes and queries, in confident expectation that their departed friends and relatives will make them wise before their time.

From the newly appointed minister to England, who wants an improved family tree to give him something more than official rank at the Court of St. James, down to the gushing miss of doubtful virtue, who expects to be a medium and wants to know whether she will "wright impressnoley or makonakley," the whole lot of them seem to be on the same level of intellectual imbecility the moment they enter the spiritualistic sphere: a level so low that the medium's silly rant and senseless doggerel seem to each and all to be the natural talk of dead statesmen and dead fools alike.

No doubt some of them, now that their silliness has been been exposed by the medium's letter book, feel somewhat as the swindler did when he said to the reporter in jail: "I feel as if I should love to get out of here and fly!" Even the Honorable Mr. Pierrepont must feel a little like flying when he sees his correspondence with "My dear Lady Mary" in print, and has to face the chaffing he so richly deserves. But will his faith in spirit communications, or the faith of any of them, be shaken in the least? We very much doubt it. To sane people the conviction of ninety-nine people out of every hundred mediums as pitiful tricksters and knaves is presumptive evidence that the unexposed hundredth is no better, but not so with the faithful. With them it is not a matter of experience or judgment, but a pure delusion, which no dishonesty on the part of mediums can stagger. The venerable and credulous seeker for aristocratic connections did not slacken his pursuit in the least when the disgusted female Flint told him the secret of the tea kettle. What if the letters were opened and copied? What if the medium were a beggarly fraud? Could not the spirit of "My dear Lady Mary" make use of him all the same?

A few days ago a poor lunatic, in great agony of spirit, poured into our ear a pitiful tale of impossible ancestry: his great-grandmother was—say a kangaroo.

"But," we objected, "all this seems to hinge on the conjecture that your grandfather was a camel."

"To be sure!" he replied, with insane vehemence, "to be sure; but, you know, in my clairvoyant state conjecture *to me* has all the force of demonstration!"

That is precisely the mental condition of most spiritualists touching matters spiritualistic. Their conjectures about spirit life and spirit action have to them all the force of demonstration. In other fields of thought and action, they may be as sane as our unhappy friend was except where his paternity was involved; but in this field they are blindly irrational, incompetent alike of reasoning or of feeling the force of the reasoning of others

But—more's the pity!—spiritualists are not the only people who lead a double life, sane on one side, insane on the other, taking conjectures for what they are worth in most fields of thought, but exalting conjecture above all things else in some special field. The world is full of people who, with more or less enthusiasm, expect the impossible to happen somewhere. A fraudulent motor violates the plainest principles of science: therefore they believe in it. A dogma runs counter to all experience: therefore it must be divinely true. "I cannot comprehend: therefore I believe," is their ideal of spiritual exaltation; and too often they are ready to assign to a protracted and disagreeable future all such as cannot share their particular insanity.

The disease, more or less virulent, is indeed all but universal. When it involves matters of every-day real importance, we seclude the victims and subject them to medical treatment; when it deals wholly with the unreal, we—well, sometimes we call them philosophers and sometimes we canonize them; but it is the same disease, with varying intensity, throughout. The man who sees snakes in the air is sick; he who beholds angels is supremely blest!

Is there any cure? We are happy to believe there is: in time, and the slow development of the race toward perfect sanity. For untold millenniums the human race has been stumbling upward through intellectual infancy, acquiring much and forgetting much. By degrees men are learning to distinguish the real from the imaginary, to abide more and more by reason and sound experience, putting less and less faith in conjectures. Ultimately men may develope into a race purely rational, capable not only of habitually drawing right conclusions from correct premises, but of always refraining from positive judgment until the premises have been fully established and properly verified: a race constitutionally sane.

But progress in that direction cannot be very rapid until men have ceased, in each and every department of thought, to make a virtue of insanity: in other words, have ceased to set faith in the unverified and inconceivable above every other faculty, studiously training the young to be irrational. Not until the current methods in education are exchanged for more wholesome and rational methods, not until men have learnt at all times and in all connections to treat conjectures as conjectures—pleasant to think about sometimes, and sometimes very useful as aids and inspirations in the pursuit of knowledge and the development of character, but never to be mistaken for truth or rated as a superior kind of truth—then, and not till then, will the race cease to be liable at all times to outbreaks of epidemic insanity. Then, and not till then, will it be impossible for swindles of the Flint and Mummler and Katie King and Keely motor order to flourish outside of insane asylums.

HOW TALL ARE WE?

In discussing the results of the tables of measurement of drafted and enlisted men, prepared from the records of the Provost Marshal General's Bureau, made during the late war, Dr. Baxter remarks that probably no question of anthropology has been more debated and none left in a more unsatisfactory condition than that of the mean stature of the full grown man. The reason for this he finds principally in the confused manner in which measurements have been prepared for the purpose. "Hights of young and old, of men of widely differing nativities, of picked men, such as soldiers and militia, of men and women, of students under the age of full growth; of convicts, a class generally below the mean hight of their countrymen; of men measured in shoes and men measured without shoes, have been compared together in tables pretending to exhibit scientific conclusions!"

The half million sets of measurements, from which the conclusions to be summed up in this article were derived, are open to none of these objections. They were actual measurements, not guesses. They were measurements taken with a reasonable exercise of care by surgeons sworn to do their duty, furnished with needful aids and appliances, and without object or interest in evading or slighting their official instructions. And the records include the measurements of rejected as well as of accepted men, so that they fairly represent, not a picked portion of the men of the country, but the whole.

It is proper to observe here that the measurements made use of in this report were chiefly those of men examined towards the latter part of the war, after the finest fighting material of the country had been enlisted; consequently they under rather than overstate the average development of the American people. It was a time, too, when large bounties invited many of the better class of foreigners to enter our service: a partial explanation, perhaps, of the fact that in every instance the mean hight of our foreign-born soldiers was above that of the nation represented. Under such circumstances, it is gratifying to see that the first rank in stature is won by our native Americans, a somewhat discouraging circumstance to those who assert that our country and climate are destructive to the white race. Curiously, the list is headed by a small number of aboriginal Indians. Dr. Baxter is of opinion that this is not due to their being picked men, but to the fact that the Indians are really a tall race. In Mr. Gould's tables of statistics, gathered by the Sanitary Commission, 517 Indians show a mean hight considerably above that of the following table. If compared with the natives of the United States only, the Indians (enlisted Indians, that is) would rank as ninth in the list of States.

Here follows the table showing the superiority in stature of 501,068 men, of different nativities:

Order of Superiority.	Nativity.	Number of Men Examined.	Mean Hight in Inches.
1	United States, Indians,	121	67·934
2	United States, whites,	315,620	67·672
3	Norway	2,290	67·467
4	Scotland	3,476	67·066
5	British America	21,645	67·014
6	Sweden	1,190	66·896
7	Ireland	50,537	66·741
8	Denmark	383	66·648
9	Holland	989	66·637
10	Hungary	89	66·584
11	England	16,196	66·577
12	Germany	54,944	66·536
13	United States, colored,	25,828	66·531
14	Wales	1,104	66·418
15	Russia	122	66·393
16	Switzerland	1,802	66·381
17	West Indies	580	66·307
18	France	3,243	66·277
19	Poland	171	66·211
20	Mexico	91	66·110
21	Italy	339	66·000
22	South America	79	65·899
23	Spain	148	65·635
24	Portugal	81	65·432
	Total and mean of total	501,068	67·300

Two thirds of the native-born white Americans were fair-complexioned, but their mean stature was one tenth of an inch below the dark-complexioned. Among the natives of British America, England, Ireland, and Germany, the fair exceeded the dark in about the same proportion, while the dark show a slight superiority in stature, except in the case of Ireland, the light and dark complexioned natives of which had precisely the same hight.

Graded according to the mean stature of the inhabitants (American born whites), the different Northern States stand as follows:

Order of Superiority.	State.	Number of Men Examined.	Mean Hight in Inches.
1	Kentucky	4,252	68·677
2	Kansas	729	68·551
3	Minnesota	3,682	68·371
4	Missouri	6,031	68·337
5	California	1,308	68·306
6	Nevada	21	68·286
7	Indiana	38,354	68·080
8	West Virginia	5,187	68·005
9	Wisconsin	10,922	67·911
10	Maine	12,363	67·895
11	Iowa	7,823	67·895
12	Illinois	36,465	67·835
13	Michigan	12,583	67·826
14	Maryland	6,918	67·814
15	Ohio	39,311	67·782
16	Vermont	3,374	67·583
17	Delaware	1,215	67·490
18	Pennsylvania	47,124	67·470
19	District of Columbia	2,883	67·353
20	Rhode Island	3,013	67·290
21	New York	43,798	67·274
22	New Jersey	17,084	67·023
23	New Hampshire	2,801	66·929
24	Massachusetts	6,280	66·891
25	Connecticut	2,099	66·587
	Total and mean of total	315,620	67·672

According to Dr. Coolidge's examination of United States Army statistics, from 1839 to 1855, the mean stature of recruits from Georgia, Tennessee, North Carolina, South Carolina, Alabama, and Virginia ranged between 68·272 inches for the first and 67·488 for the last named. The average for the whole country, obtained from Dr. Coolidge's tables, was 67·357 inches, about one third of an inch below that derived from the records of the Provost Marshal General's Bureau (67·672 inches) for the Northern States; while that obtained by Mr. Gould, from the statistics of the United States Sanitary Commission—on the whole less accurately taken—was smaller yet, by about one hundredth of an inch. The close correspondence of the three sets of observations is an indication of the accuracy of the whole. Altogether they are the results of measurements of nearly a million and a half of American born white men, and the resulting mean stature of the whole is 67·646 inches. Even the lowest mean obtained would entitle the American people to the first rank among the nations in point of stature.

REMARKABLE ARTESIAN WELL.—At Prairie du Chien, Wis., an artesian well daily discharges 869,616 gallons of water. The well is only 960 feet deep, but has head enough to raise the water 900 feet above the ground.

SHOCKS of earthquake were felt, on July 5, at Corinth, Greece. The direction was east to west. On July 17 three violent shocks occurred in Vienna.

IMPROVED DREDGING MACHINERY.

The apparatus shown in our engraving is designed for cutting canals, deepening lakes, etc., and can be largely used in the work of reclaiming land. The barge, which carries the machinery, and the frame for carrying the mast or jib, are made of wood. A boiler, on deck or below, supplies steam to a small pair of engines on deck, which work two drums, two chains being necessary, which run over a double block or pulley, A. One chain, P, which may be a lighter one than the other, acts on the frame of the bucket, B B, and lowers it open. As soon as it is required to drag, the second or heavy chain, R, acts on the frames and side chains at D D, and causes the shaft, E, to unwind, which causes the bucket to close, as at C, and the sharp edges enter the ground. Though the edges jam, the chain goes on all the time, and the action becomes one of lifting, and the charge of earth or mud, often weighing two tuns, or measuring one cubic yard, is lifted through the water; and the man at the winch or or engine, knowing where he is going to dump it, puts in motion the wheels, H, acting on the chains, G, which guide the head of the crane, F, over the spot. As soon as the loaded bucket is over the barge, or the land where the charge is to be dropped, the man holds on to the first chain and lets the second chain slack, and the bucket opens, and so rapid is the motion that a single engine driver can excavate and dump four tuns per minute.

The barge is very often moored, says the *Engineer*, from which journal we select the engraving, by two poles or stilts at the sides, which are raised by a winch. This saves the time of pulling up an anchor, and keeps the barge steadier, and the advantage is that a mark can be tied on the chain; and whenever this comes to the same spot, the engine driver knows he is deep enough, and a level can be secured under water. When it is necessary to lift rock and stones, then the bucket is unhooked at O, and a pair of claws hooked on to the two chains, which claws act in a similar manner to the bucket. The tool is used for wrecking, and will work to the greatest nicety in a depth of water far below that at which any diver could descend. It has also the advantage that two men can work it with ease.

The Philadelphia Exhibition.

As time progresses, the Centennial Exhibition at Philadelphia arrives at a condition of more perfect completeness, and with the bright summer weather the surrounding grounds attain even more beauty than they possessed upon the opening day. The crowds, which are almost lost within the great enclosure, save at the special points of popular attraction, increase in number every week; and though probably some slight falling off in the attendance is to be expected in the burning months of July and August, there is little reason to doubt that this decrease will be far more than made up by the mass of visitors during September and October, always the two most crowded months at any exhibition.

The Exhibition is but, as it were, a handbook only to the great industrial developments of the United States, developments which to be believed must be seen, and which, when seen, fill one with astonishment that so much could have been effected in so short a time. The admirable address of the Hon. Abram S. Hewitt, President of the Institute of Mining Engineers, gives the reader some idea of the magnitude of two of the most important branches of industry in the United States—its mining and metallurgy—from the time when, in 1622, one hundred and fifty workmen were sent to the American colonies to erect ironworks, until to-day, when 2,108,000 tuns of iron represent the production of last year. Of every different mineral, indeed, except tin, the United States possesses practically, unbounded resources; of coal the quantity is equally unlimited; of petroleum she alone possesses, as far as is now known, those strange and extended subterranean stores, the discovery of which created, not many years ago, so wild an excitement, and by which the whole world is supplied from some 3,600 wells in the State of Pennsylvania, and which furnish an average of about 24,000 barrels of oil daily. The Centennial Exhibition contains specimens of nearly all these sources of national wealth; and though they do not of themselves afford much information to the visitor, all information respecting them may be obtained, and the centers of the various industries visited; for though distances are great, the facilities for overcoming them are great also, and the inconveniences of travel in the United States are reduced to a minimum.

But manufactures of all kinds may be studied fully within the limits of the Exhibition itself, and the position attained by the United States to-day, in the production of woolen, cotton, and silk goods, would astonish many European manufacturers who look to a freedom from transatlantic monopoly for all time, notwithstanding that to-day the export of cotton goods from New York to Liverpool is considerable, if not at present very lucrative.

We have already referred to the admirable arrangements made for the benefit of visitors who wish to go to different parts of the country and study different industries. There never was an exhibition held at which so many facilities were offered in every direction, so many kindnesses shown, so much trouble taken, and, let us add, so much that would be worth seeing and studying, if the distances were not so magnificent. But so many thousand miles have to be traversed, and time for most visitors in Philadelphia is limited, while their duties unfortunately are not, that only a very small proportion of what should be seen can be visited, despite the opportunities afforded, and the universal anxiety to aid the stranger in every possible way.—*Engineering*.

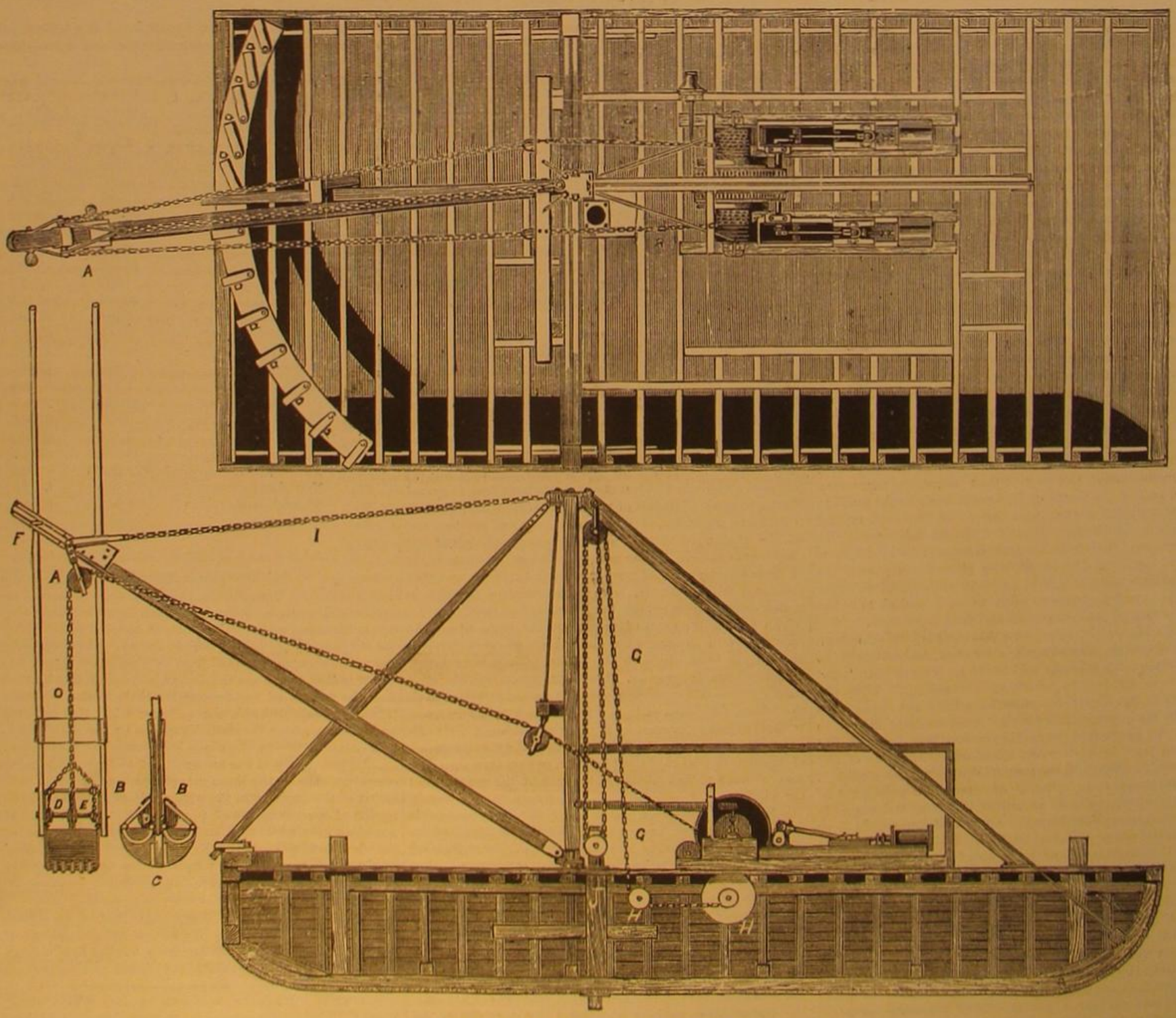
Wool Greasing.

A Mr. Lebrun mentions, in a German paper, that a considerable quantity of oil may be saved by the following process of oiling wool, besides insuring a more uniform and regular web, on account of the woolen fibers loosening and separating themselves more easily from each other. Moreover, this plan, it is said, is not open to the objectionable features of some processes, which sometimes cause the total disappearance of fine color dyes; and the cards wear longer and better, besides allowing the wool to be more easily and economically cleaned.

To obtain this preparative, pour into a wooden trough 20 parts oil, with 10 parts of liquid ammonia, adding 5 parts of water. Stir up this liquor with a wooden spoon, and, by inserting a steam pipe, allow the same to boil until the strong smell of ammonia has evaporated, after which the oiling or greasing may be proceeded with in the usual manner.

New Size for Cottons.

Haitra is procured from China and Japan, and may be used for thickening colors and sizing all tissues. For use it is washed in water and is then boiled with sixty times its weight of water, in a closed vessel, at 65° Fah. The paste thus obtained will keep, and adheres to the fiber so tenaciously that when once dry it cannot be removed with cold water.



NEW STEAM DREDGING MACHINE.

IMPROVED WOODWORKING MACHINERY.

A growing demand is noticed among manufacturers in wood for machines combining the functions of several different tools in one, thereby economizing space in the factory and capital in investment. These machines are, from the great range of work for which they are adapted, known as universal woodworkers.

In the manufacture of builders' material, sashes, doors, etc., as well as in the production of furniture, agricultural implements, railroad cars, patterns, etc., such machines are almost invaluable. Their true value, however, is based upon the ease with which they can be adjusted, and the facility with which the changes can be made for the different kinds of work.

The apparatus illustrated herewith combines all the features of the variety woodworkers and hand planers of the same manufacturers, with a complete molding and flooring machine. The essential features of the original Climer & Riley patent on woodworkers are all included, together with many novel and important improvements and labor-saving devices, originated by the makers.

The two sides of the machine are driven from one countershaft, which is so arranged as to convey the power to both sides simultaneously or separately, as the operator may desire. The double friction pulley on the countershaft is caused to come in contact with the driving pulleys for the utterheads by means of two levers, one for each operator, by which he sets in motion or stops his side of the machine as he may desire. This method of obtaining independence of the combination is new and effective, as two operators can perform their work, one on each side, without either interfering with the duties of the other.

Upon the molding side, the moldings can be worked to eight inches in width, also narrow surfacing and flooring to eight inches in width. This side is furnished with a pair of powerfully geared and heavily weighted feed rollers, the motion of which can be instantly started or stopped, or given a quick or slow motion, as may be required. The inside and outside cutterheads can be swung to an angle, and have a vertical adjustment with the table to which they are attached. The under cutterhead is adjustable for different thicknesses of cut, and can be used for forming moldings on the under side of the stuff. This molding side is provided with the same features and adjustments for making accurate moldings as the molding machines of the same manufacturers, and is convenient of adjustment and adapted for simple or complicated moldings up to eight inches wide.

The primary design of the woodworker side is for dressing out of wind, and for trying up and squaring lumber. By the addition of various heads and fixtures necessary to each operation, it is rendered capable of rabbeting, jointing, beveling, gaining, chamfering, plowing, making glue joints, beading, raising panels, ripping, cross-cutting, tenoning, making circular, waved, and serpentine molding, and a great variety of work, practically limited only by the ingenuity of the operator.

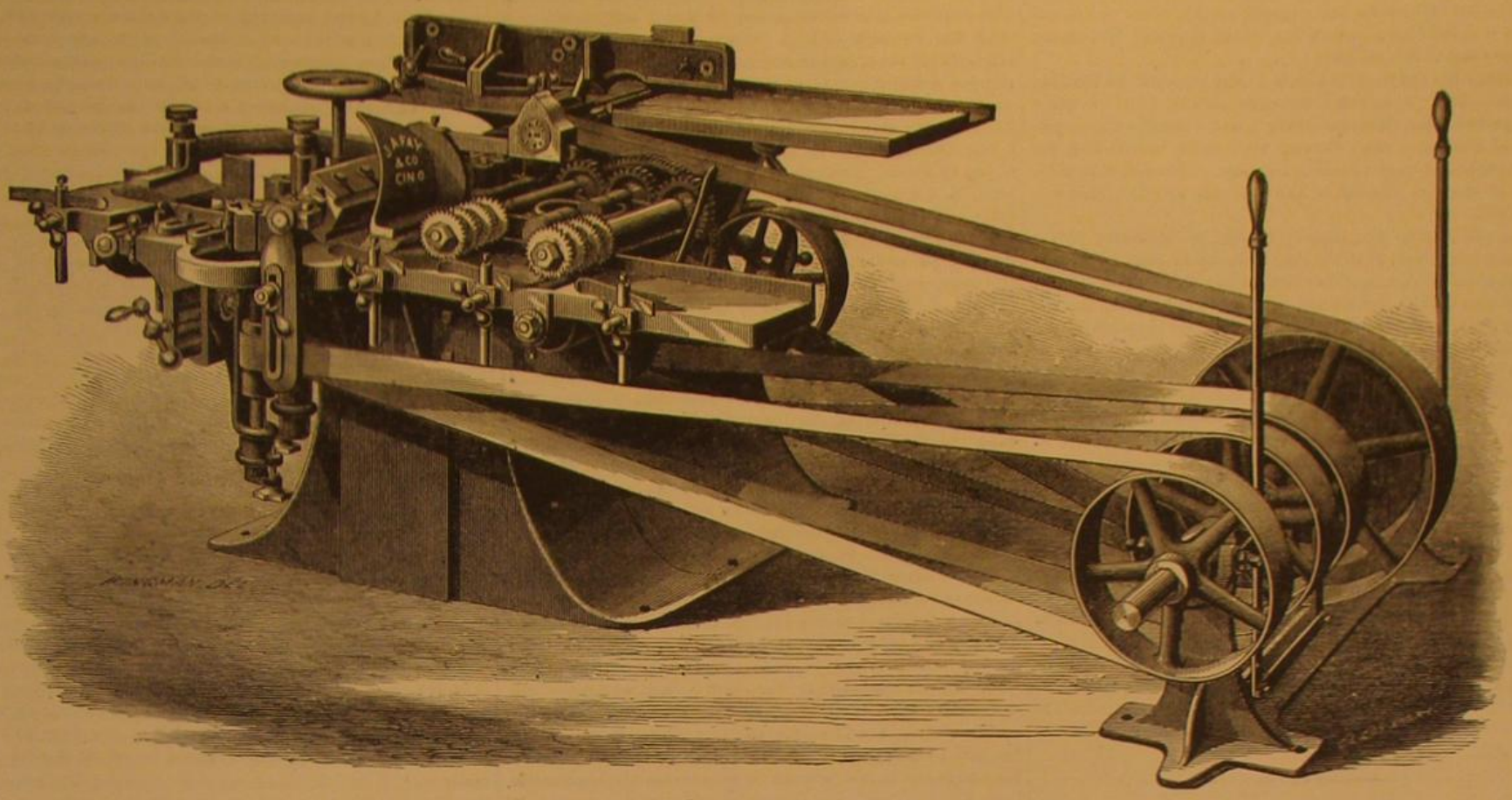
The whole machine has for its support a heavy iron column, upon which all the tables are planed and gibbed to move vertically, each having a separate adjustment. The woodworker tables have a horizontal adjustment for the accommodation of different sizes of heads and cutters, the vertical adjustment being used to graduate the depth of cut for grooving, gaining, panel raising, surfacing, etc.

One of the spindle bearings on the woodworker side is cast solidly to the column, the other being movable in a planed seat, and retained in its place by a screw. This outside bearing is readily removable to allow interchange of cutterheads on the spindle, and gives the spindle a steadiness not to be acquired where the head overhangs the framing of the machine.

The tables are furnished with grooves for receiving the gaining frame slide and other attachments, and for making a continuous table by fitting in slides of the proper form. The fence is attached to and moves with the forward table, can be adjusted to an angle of 45°, and is arranged to receive stud springs for holding down the lumber, and for bolting the panel-raising attachment.

The machine is very complete in all particulars, and the desirability of the combination can hardly be called in question. This machine can be seen in daily operation at the space of J. A. Fay & Co., Machinery Hall, Centennial Buildings, section B 8, columns 61, 62, 63. Any desired information will be furnished on application to the manufacturers, Cincinnati, Ohio.

[This description was published in our issue of August 19, the other engraving being, by an inadvertence, published therewith.—EDS.]



J. A. FAY & CO.'S UNIVERSAL WOOD WORKER.

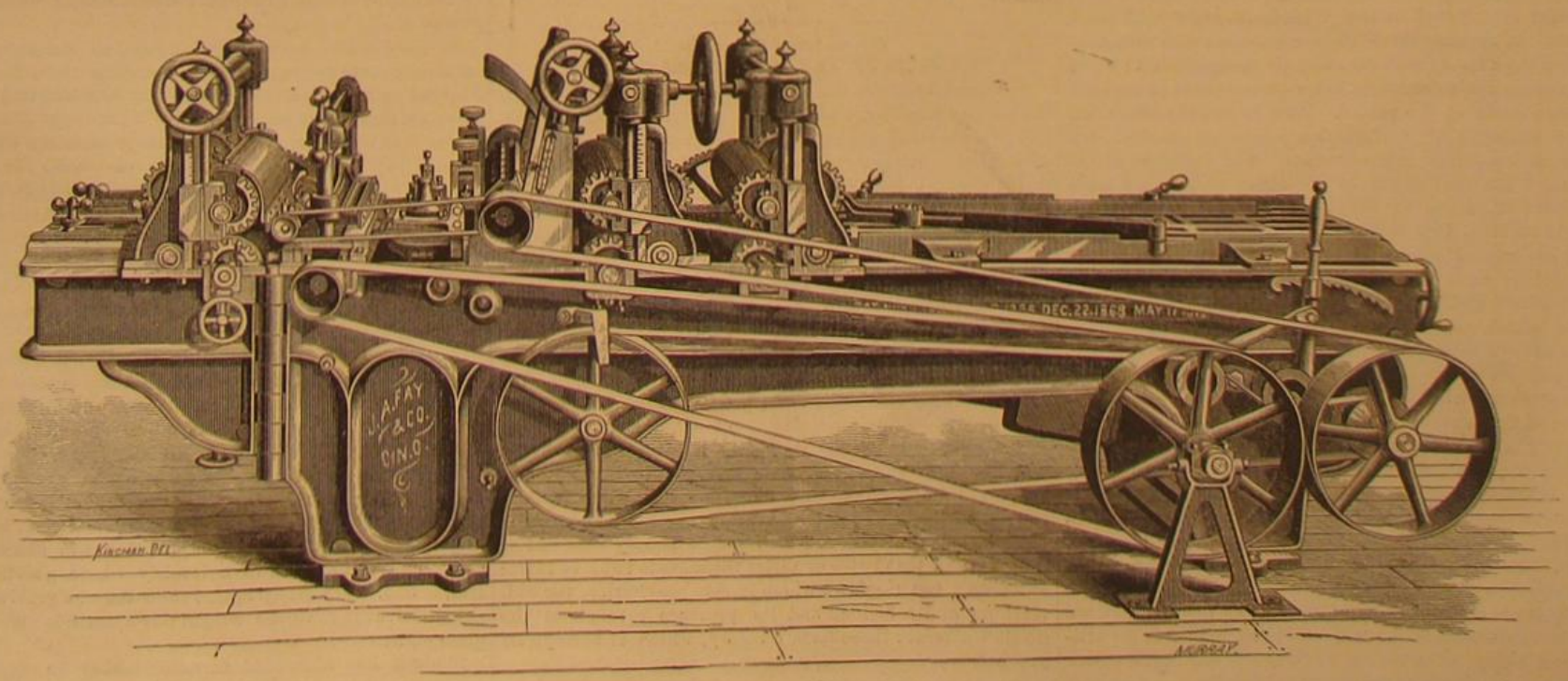
IMPROVED SIX-ROLL PLANER, MATCHER, AND BENDER.

Changes in machinery for working wood are so numerous and important in their effect on the trade that we feel justified in giving those who are interested in this class of tools the fullest opportunities of information in regard to any new machines of value which may be produced.

The machine herewith illustrated is manufactured by the well known wood tool builders, J. A. Fay & Co., of Cincinnati, Ohio. There are two cylinders, one for planing the upper surface of the board, and one for the under surface, each having two driving belts and three knives twenty-six inches in length, and being fitted with steel journals, and steel lips for chip breakers.

The two vertical sideheads are of gun metal, each having three cutters, and are adjustable for different widths of lumber to be jointed or tongued and grooved. They are also arranged to drop vertically below the bed to admit of surfacing the full width of the knives without removing the heads from their spindles.

The feeding mechanism consists of six rollers, six inches



J A. FAY & CO.'S SIX-ROLL PLANER, MATCHER, AND BENDER.

in diameter, in three pairs, connected by heavy expansion gearing at each end of the rolls. The rolls and upper cylinder can be elevated to take in lumber five inches in thickness. The upper rolls of the contiguous pairs are adjusted simultaneously by means of a hand wheel with geared connections.

The under cylinder is adjustable vertically for graduating the thickness of the cut, and is placed so that the discharging rollers carry the lumber from it. This is a novel and distinguishing feature of this planer, the rolls through which the lumber last passes being placed outside of the under cylinder and bending pressure bar, which is placed and adjusted over the under cylinder.

These rolls are usually placed in the machine so that the under cylinder does not commence cutting until the board has passed some distance through, and consequently a portion of the board must depend upon being driven over the under cylinder by the board following. This defect is obviated by the new position of the cylinder and the discharging rolls.

Accessibility to the under cylinder is facilitated by the method adopted of moving the discharging rolls by revolving the end of the machine supporting them upon a hinge in one side of the frame; and the pressure bar over the under cylinder, being revolved upon one of its supports, leaves the under cylinder entirely open for any purpose of adjustment the operator may desire. The side cutterheads, being adjacent to the under cylinder, can also be more readily adjusted by virtue of the position thus attained.

This arrangement is a very desirable one, and the end of the machine is claimed to lose none of its stability, as the supports are of the most permanent character, easy of access and attached or detached very quickly.

The lower roller on the movable end of the machine has a vertical movement to compensate for any changes in elevation of the under cylinder, and in order that a constant pressure may be retained upon the lumber by keeping the peripheries of the cylinder and roller in the same relative position.

One of the machines may be seen on exhibition in daily operation in Machinery Hall, section B 8, columns 61, 62, 63, Centennial Exhibition, Philadelphia, or further particulars can be obtained by addressing the manufacturers at Cincinnati, Ohio.

[For the Scientific American.]

THE EXHIBIT OF CORNELL UNIVERSITY AT THE CENTENNIAL.

In the account of technical schools recently published in the SCIENTIFIC AMERICAN, the exhibit of the mechanical engineering department of Cornell University was omitted, as the articles shown by this school are of such an interesting character as to warrant a separate description.

Cornell University, as most of your readers doubtless know, furnishes courses in almost every branch of learning; but the present notice must be confined to the practical part of the course in mechanical engineering. This course covers a period of 4 years, during which each student is required to work for 10 hours a week in the shop. Some of the results of this work are shown at the Centennial, and the visitor is not deterred from making a critical examination by notices that handling is forbidden, but, on the contrary, is invited to subject the articles to any test that he may desire. Some surface plates, placed upon a low table, are particularly inviting to the passing visitor, who can make one plate float upon the other, and, after working out the air between, can lift the pair by grasping the upper one. These surface plates are a regular article of manufacture at Cornell University, and are sold at such a reasonable price (10 cents a square inch) that it is a matter of surprise to find that they are not in great demand. The scholars also make steel triangles for the use of draftsmen, and these will be found very serviceable for nice work. Professor Sweet, who is in charge of the practical course at Cornell University, proposes to add, to the articles manufactured for sale, solid calipers, accurately ground to standard sizes, which will be as useful as the well known Whitworth gages, and much cheaper. A necessary machine in connection with this manufacture is an instrument for accurate measurement; and a measuring machine reaching to ten-thousandths of an inch has been made at the school. This is constructed on the general principle of Whitworth's measuring machine, but has some important improvements. The principle of the machine is the same as that of the sheet metal gage made by Brown & Sharp, in which the measuring points are brought together by a screw, and the fractions of the revolution are measured on a wheel attached to the screw. In the machine under consideration, the screw has a pitch of $\frac{1}{16}$ of an inch, and the wheel is divided into 625 equal parts, each of which measures a movement of $\frac{1}{10000}$ of an inch. In the use of a machine of this kind, it is found that, if several operators each measure the same article, adjusting the points by their judgment, their results will vary sensibly; and one of the improvements of the present machine consists in having the handle which moves the screw independent of it, being kept in contact by friction until the measuring point bears against the article to be measured, when it slips. Another important improvement over the Whitworth machine is the use of a short screw, and a nut of the same length. By this arrangement, the motion of the measuring point attached to the screw is only about an inch, but the other point is adjustable on a slide to any desired distance up to one foot, so that the range of the machine is for articles from $\frac{1}{10000}$ to 12 inches, varying by ten-thousandths. A steam engine, built by the students, from Professor Sweet's design, has several novel features The frame has three supports, the cylinder resting in a socket upon one, and being free to move under changes of temperature. The piston is made very long, and has a number of grooves, no packing being used. The piston rod passes through a grooved tube, without any packing, and the valve stem, also without packing, works through a plain brass tube of considerable length. The valve consists of two flat plates, accurately fitted to the valve seat and an upper plate, thus being perfectly balanced, and being made very thin, to obviate as far as possible the difficulties caused by unequal expansion. The governor is attached to the fly wheel, and is connected with the eccentric, which swings round a point near one edge, under the action of the governor. The effect of moving the eccentric is to change the amount and period of opening of port, while the lead remains practically constant. The eccentric acts on the valve stem through the medium of a bell crank lever, so as to equalize the cut-off at each end of the cylinder. The valve motion of this engine, it will be seen, is quite novel, and it may be illustrated and more fully explained on some future occasion. A model of the valve is shown, with a neat arrangement for tracing a diagram of its action. The crosshead of the engine is unusually long, and the connecting rod, instead of vibrating on the pin, is rigidly attached to it, and the pin moves in bearings on the crosshead. This arrangement greatly facilitates accurate adjustment. The crank pin works in cast iron boxes. The main bearings have considerable side play. It would be impossible, without illustration, to give a thorough explanation of the features which have been briefly enumerated. The design in building the engine was to give the students some idea of the requirements of a good engine. The result is a substantial machine, and one which will probably be serviceable as constructed at present, though it will be noticed that some of the details are experimental. It will be easy, however, to use packing, if it should be found necessary. The engine has a diameter of 6 inches and a stroke of 12, can be run at a speed of 300 revolutions a minute, and will be sold for $750.

If any of your readers is looking for a complete foot lathe he will do well to visit this exhibit. The amateur foot lathe made by the students, is the second that has been constructed at their shop, and seems to be as nearly perfect a machine of the kind as is usually met with. It has a 4 foot bed and 10 inch swing. There are three speed wheels for the driving belt, an internal back gear on the head stock, three friction feeds, and change wheels for cutting screws of 26 different pitches. The machine is adapted to all kinds of work that can be done on a lathe, straight and taper work, turning spheres, etc. The slide rest moves on one flat and one V way. There is an adjustment for a slight movement of the tool, such as may be required in screw cutting. One wrench fits all the nuts which must be loosened to make adjustments. Handles are fitted to all parts in which frequent changes are required. The rock shaft of the treadle motion works on knife edges, and requires no lubrication. On removing the foot from the treadle, it becomes detached from the pin of the connecting rod, and is caught and held up by a spring. There are drawers at the back of the machine for the extra wheels and tools. This machine is offered for sale at the very moderate price of $400. It is probable that it will be bought by some amateur who knows how to appreciate work of this kind.

The engine in this exhibit drives a Gramme machine, which has the power of a Grove battery of 100 cells. This machine was built by the students, from designs furnished by the Professor of Physics, and is, so far as the writer knows the only machine of the kind built in the United States. It furnishes power for several electric engines used by another exhibitor for driving a lathe, a sewing machine, and a mill, also for an electric light, and for burning wire. The machine has several ingenious adjustments or switches by which the direction and quality of the current can be changed, and it can also be used as an electric engine, driven by a battery.

Philadelphia, Pa. R. H. B.

[For the Scientific American.]

THE FACTS OF THE LAWS OF GRAVITATION.

The crucial test for the correctness of a scientific theory is the inquiry whether it will enable us to predict phenomena, and whether experiment or observation will verify every prediction. Recently a member of the French Academy stated that he had conceived a new theory of electricity, and was at once asked if it had enabled him to foresee phenomena, and if he had found practically the verification of his prediction. His answer was affirmative, but not as positively so as strict science requires, and his theory is therefore still an hypothesis.

Among all the scientific theories, there is none more firmly established than that which maintains the universality of gravitation, and establishes the laws governing it. We avoid speaking of a theory of gravitation, because we cannot help considering gravitation as a stubborn fact, and not as a mere speculation. That bodies fall to the ground, and after having falling exert an amount of pressure on their support in proportion to their mass, is a simple, universally recognized fact, without any theory about it; and this is what we call gravitation, which means simply that matter is heavy, and that twice or thrice the mass is twice or thrice as heavy. But the laws which govern gravitation, the universality of its action, and its presence throughout the whole Universe: these form a theory, which is susceptible to proof.

If ever any scientific theory was thoroughly tested, by predictions of phenomena expected under certain circumstances, it is this; and if ever any theory was fortified by the subsequent observation and verification of the predicted phenomena, it is this. It has been attacked in some quarters, even by persons of education, and doubts have been thrown upon its teachings. This was done by the great German poet and philosopher Goethe, among others; but he was simply ignorant of the facts. Every man judges about things according to the amount of information in his possession; and if Goethe had been informed of the manifold facts verifying this theory, he would surely never have attacked it. Unfortunately he did not know anything about mathematics, which is the science of the laws governing space and time, and therefore the *key to* all natural philosophy; neither had he ever received any training in practical observation and experiment, his large treatise on optics being a gigantic confession of ignorance of the subject, and also of his inability to draw correct conclusions from phenomena observed. He erred equally when treating of gravitation; he showed that he had not the least comprehension of the established theory, forgetting, as he did, that, in order to criticize anything thoroughly and successfully, we must first understand it well. Hence his strictures upon the Newtonian theory go for nothing, and have weight only among those who know as little about it as Goethe did; and their number is, unfortunately, not inconsiderable.

Newton tested his theory by the motion of the moon, and found that, if terrestrial gravitation (which is no theory, but a fact) extended to the moon, and diminished inversely as the square of the distance from the earth's center, it would, as the moon is at a mean distance of 60 terrestrial radii, be 60 x 60 or 3,600 times less in power on the moon. As a body on our earth falls nearly 16 feet in the first second, it would, at the distance of the moon, fall 3,600 times as slowly; and as an hour is 3,600 seconds, it would there fall in an hour no further than near the earth's surface in a second, so that the moon falls every hour 16 feet towards the earth. Comparing with this figure the tendency of the moon to move in a straight line, as is the natural property of all moving bodies, and the moon's consequent tendency to fly off in a straight tangent from its curved orbit, he found that, if terrestrial gravitation or attraction were withdrawn, she would in an hour be 16 feet further from the earth, this centrifugal force appearing exactly to counterbalance the terrestrial attraction at that distance, and proving that it really was 16 feet for the first hour: verifying thus the law that the attraction is inversely proportional to the square of the distance.

That this terrestrial attraction or gravitation was partially counteracted, even on the earth's surface, by the earth's rotation around its axis was proved by the fact that this attraction was stronger near the poles, where the circle of rotation is smaller and the velocity less, and weaker under the equator, where the circle is larger and the velocity greater; while in the latter case the centrifugal tendency is in a direction exactly opposite to that of gravitation, so that bodies weigh more at the poles than near the equator.

That the terrestrial attraction is not a property of the earth, but is diffused throughout all matter, so that all bodies attract all other bodies, was proved by the torsion balance of Coulomb, by which he proved that a heavy mass, suddenly brought before a small ball delicately suspended in a glass case, will attract the latter from its position; he even measured the amount of this attraction for masses of a given weight, and in this way came, by comparison, to the knowledge of the mass of our whole earth.

That the terrestrial gravitation is not concentrated in the earth's center, but a resultant of the sum total of all the individual attractions of every particle contained in it, is proved by the diminished gravitation when descending in a mine. If indeed the attraction solely resided in the center, it should increase when going down; but being a result of the attraction of the whole mass, the central attraction is counteracted by the attraction of all masses above the observer; and hence gravitation decreases with the depth, and if it were possible to reach the earth's center it would be found there to be zero, the attraction being balanced all round.

In Herschel's "Astronomy," published many years ago, an arrangement is suggested for observing the difference in gravitation on the earth's surface, by counteracting it by a force not dependent on gravitation, namely, a spiral steel spring. It is evident that, if we wish to ascertain whether a mass of say 1 lb. in weight, weighs less under the equator than near the poles, we must not use a 1 lb. weight as counterpoise, as this would be equally affected by the terrestrial attraction; but if we use a spring to suspend it from, we shall observe less tension in the spring on which the mass of 1 lb. is suspended when brought to a locality where the gravitation is less, as is the case under the equator, than it is at the poles.

The apparatus suggested by Herschel is but a rough contrivance, and only fit to show that there is a difference, and it is not adapted to measure the amount of this difference. It consists of a stand from which a spiral spring is suspended, to the lower end of which a weight is attached. The weight and spring are so arranged that, when the whole machine is placed perpendicularly, the weight will just touch a piece of glass plate, inserted in the base under it. If now this apparatus is carefully packed up so as not to disturb anything, and transported to a locality where gravitation is less, it will, when set up again, show that the gravitation is not sufficient to draw the weight down until it touches the glass plate.

Siemens has succeeded in constructing an apparatus, founded on this principle, so perfect that he can measure the diminished gravitation with sufficient accuracy to calcu-

late the distance from the earth when in a balloon; and not only this, but, as water is of less density than the earth, he can also calculate from its indications the depth of the ocean. Evidently the gravitation at the ocean's surface must decrease in proportion as the depth increases; because, when there is more water under the ship's bottom (water having less weight than earth) its attraction will be, proportionally to its mass, less. This instrument, which has been described in the SCIENTIFIC AMERICAN SUPPLEMENT (page 368, volume I), is thus constructed in entire accordance with the theory of the law of gravitation; and having been fully verified by experiment, it is an additional confirmation of this theory, of which the ultimate triumph is as complete as that of any theory in the whole field of Science.

New York city. P. H. VANDER WEYDE

[For the Scientific American.]

NICKEL AND ITS PREPARATION.

Nickel is not an abundant metal; and although it occurs in a dozen different ores, the number of localities where it it is found in paying quantities is very few. It is never found in a metallic state, except in meteorites. In ores, it is generally associated with iron and cobalt, both of which it resembles. The principal source of nickel is the native arsenide, a copper-colored mineral, called by the Germans *kupfer-nickel*, or false copper, because it contains no copper. This ore contains from 33 to 55 per cent of arsenic, 33 to 45 per cent of nickel, and small quantities of sulphur, iron, and other substances. Another compound of nickel and arsenic has received the name of cloanthite or white nickel. Annabergite, or nickel bloom, is a compound of arsenic acid with oxide of nickel, quite soft and of an apple green color. The most beautiful nickel mineral is the sulphide, or millerite. It has a brass yellow color and metallic luster, and usually occurs in capillary crystals, in the cavities and among the crystals of other minerals, hence called capillary pyrites In this country it is found chiefly in Lancaster county, Pa. The other nickel minerals are breithauptite, nickel glance, ullmanite, emerald nickel, pyromelin, grunanite, pimelite, garnierite, and noumeite. Speiss is a deposit formed in the pots in which roasted arsenide of cobalt, mixed with copper nickel, is fused with carbonate of potassium and quartz, for the preparation of smalt, in the blue color works; it collects below the blue glass, in the form of a metallic alloy, the nickel not oxidizing so easily in roasting as the cobalt. It is an important source of nickel

Of the metallurgy of nickel little is known outside of the works, which are carefully guarded, although it is difficult to see of what use a knowledge of a process could be to those who have no source of material at hand, or why those who have a monopoly of the ore need fear competition. Professor C. Küntzel has, however, published some interesting facts in regard to the method used in the metallurgy of nickel, from which we glean the following:

The preparation of metallic nickel and cobalt is sometimes conducted in the dry way, by collecting and concentrating the nickel, cobalt, and copper, in an arsenical or sulphur compound (*speise* or stone), while, at the same time, the iron in the ores is removed by scorification; the cobalt is afterwards fluxed with pure quartz sand, and the protoxide of cobalt precipitated, from the silicate of cobalt thus formed, by fusion with excess of carbonate of soda; the sulphur or arsenic is expelled from the *speise*, which has had the cobalt removed by roasting and heating with soda and saltpeter, and finally reduced with carbon. It is more frequently obtained in the wet way, by dissolving the nickel and cobalt ores in acids and separating the dissolved metals; but the greater part of the iron should first be removed and the nickel and cobalt concentrated before dissolving. In the dry method the first step is also to get rid of the iron in the ore or *speise*. The complete separation of iron from arsenical compounds of nickel and cobalt is not very difficult, for iron has much less affinity for arsenic than cobalt or nickel; but to separate it from the sulphides was, until recently, very difficult, if not impossible. The reason of this is that nickel and cobalt have nearly the same affinity for sulphur that iron has. This operation is now accomplished by smelting the rawferruginous ore in a reverberatory furnace, with a mixture of two parts of fine barytes and one part quartz sand; for 1 per cent of iron, 18 to 19 per cent of this flux is required. A fusible ferro-silicate of barium is formed and sulphurous acid driven out. In 1870, Dr. R. Wagner proposed to make use of the oxidizing action of Chili saltpeter for removing the iron, sulphur, and arsenic. For arsenical products, this method is inferior to the one generally employed, namely, roasting the metallic arsenides after the iron has been removed, then heating with saltpeter and soda. Wagner's method may be employed with advantage when it is desired to smelt a nickel ore, which has been freed from iron, with a metal free from sulphur, provided it contains enough copper to prevent the resulting metal from being too infusible.

The manufacture of nickel in the wet way varies with the material or source. The principal steps are the following: 1. Dissolving the roasted products in hydrochloric or sulphuric acids. 2. Precipitation of the iron by means of lime or carbonate of lime, or soda, after oxidizing, if necessary, with chlorine or chloride of lime. 3. Precipitation of the copper with sulphuretted hydrogen, or alkaline sulphides. 4. Precipitation of the cobalt as sesquioxide by means of chloride of lime. 5. Precipitation of the nickel as hydrated oxide or carbonate with milk of lime or carbonate of soda. 6. Igniting this precipitate so as to obtain anhydrous oxide of nickel, insoluble in dilute acids. 7. Leaching out the excess of lime and gypsum from the ignited oxide of nickel. 8. Reduction of the pure oxide of nickel by ignition with charcoal.

In dissolving nickel ore, care should be taken to prevent silica going into the nickel solution, for, on neutralizing the previously acid solution, all the silica is precipitated in the form of silicate of nickel. Sometimes in analyses a small quantity of silicic acid runs through all the operations, and there is no simpler method of removing it entirely at the start than by adding to the neutral solution some neutral nickel salt.

For precipitating the copper with sulphuretted hydrogen, Gerstenhoefer's precipitating tower, which was first employed at Freiburg to precipitate arsenic from sulphuric acid, may be employed. Such an apparatus avoids any escape of the gas, and precipitates the metals in the shortest possible time. The solution enters automatically at the top of the tower, which has an hydraulic seal. It falls, drop by drop, down into an atmosphere of sulphuretted hydrogen, passing from one platform to another: and if it does not contain too much copper, it passes out at the bottom free from copper. The gas, which is absorbed by the nickel solution, is expelled by heating it with steam. If a soda ash works is near, the waste sulphide of calcium may be employed with profit for precipitating the copper. Injury to the workmen from inhaling sulphuretted hydrogen can be prevented by the use of wine or spirits; sulphuretted hydrogen retards the circulation of the blood, which is neutralized by the property that alcohol has of accelerating the circulation.

Nitrite of potash cannot be employed to separate nickel and cobalt when there is lime in the solution. In this case it cannot even be used as a test; for in the presence of lime or other alkaline earth, a yellow precipitate is formed, similar to the nitrite of cobalt and potash, and said to have the composition $K_2 Ca Ni (NO_2)_6$. If there is enough lime present, all the nickel is thrown down as a double nitrite.

Cobalt and nickel may be separated by means of sulphate of ammonia and sulphuric acid, if the quantity of cobalt is not too small relatively. The separation is quite exact if the solution is sufficiently concentrated. The nickel separates as a difficultly soluble double sulphate of nickel and ammonia, while the double salt of cobalt remains in solution. From the former the sulphate of ammonia is expelled by heating in clay pipes. The sulphate of nickel is almost entirely converted into oxide by roasting with charcoal; the last trace of sulphur is removed by igniting with soda and saltpeter.

The best method of removing the sulphate of lime is to extract the excess of lime added with hydrochloric acid water, then to boil the oxide with steam, and add slowly such a quantity of carbonate of soda that, after boiling a quarter of an hour, there is still an excess of the carbonate in the solution. Sulphate of soda and carbonate of lime are formed; the first is washed out with water, and the latter with water acidified with hydrochloric acid.

Oxide of nickel can be reduced at a bright red heat by simple contact with coarse broken charcoal. The reduction extends inwardly from the surface of the cubes. If left in contact with the carbon after it is entirely reduced, it absorbs more and more carbon. The reduction usually takes place on the clay crucibles on the hearth of a flame furnace. At Val Benoit, near Lüttich, a continuously working furnace is used, the reduction being accomplished in upright tubes.

E. J. H.

[For the Scientific American.]

SCIENTIFIC APPARATUS.

At the loan exhibition of scientific apparatus, now open at the South Kensington Museum, London, free evening lectures are delivered on scientific subjects. The collection includes apparatus of the most primitive and ancient forms, with specimens of the successive improvements down to the present time. Many of these articles have a great personal interest, as associated with the names, labors, and discoveries of eminent scientific men, mechanicians, discoverers, and inventors. On a recent occasion, the lecturer, Mr. Chandler Roberts, F.R.S., chemist of the mint, took for his theme: "The Apparatus Employed in the Researches of the late Master of the Mint, Mr. Graham." The name of Thomas Graham is well known as the author of "Elements of Chemistry" His scientific papers, published in the transaction of societies, range in date from 1834 down to 1869, the year of his death

The lecturer, with specimens of apparatus before him, both that of Mr. Graham and of others, gave a very interesting discourse. In its scientific aspects, and in its comparison of the processes followed, the reasoning employed, and the results obtained, the lecture was very interesting. But there is another respect in which the lecture has a general interest, as demonstrating that the essential apparatus for scientific researches is found in the mind, the memory, the power of analysis and comparison, in the ingenious adaptation of means and implements. in a word, in the genius of the discoverer.

Mr. Roberts concluded his lecture by saying that, although for delicate researches or measurements complicated instruments are necessary, still the most ordinary appliances, in the hands of a man of genius, are capable of yielding very important results. With a glass tube and a plug of plaster of Paris, Mr. Graham discovered and verified the law of the diffusion of gases. With a tobacco pipe, he gave additional evidence that atmospheric air is a mechanical mixture of its constituent gases. By the aid of a tambourine and a basin of water, he divided bodies into crystalloids and colloids, and obtained silicic acid, and oxide of iron soluble in water. With a toy balloon of india rubber, filled with carbonic acid gas, he separated oxygen from atmospheric air, and developed points, the importance of which it is impossible to overrate from a physiological point of view. By the expansion of a wire which attended its absorption of a gas, he did much to prove that hydrogen is the gas of a white metal.

Such facts as these are of great interest to mechanics and operative chemists, whose daily occupation is the proof of mechanical and scientific discoveries, the application of laws and facts already discovered. Their daily employment is suggestive; and if they have active minds and patient habits of observation, there are frequent chances for testing the value of their thoughts and the possibilities of improvements in machinery and processes. "If" they had only such and such tools, or apparatus! The "if" must be met as Thomas Graham met it.

Liquid Indicator.

Dr. Siemens has designed an instrument by which a stream of alcohol and water mixed in any proportion is measured in such a manner that one train of counter wheels records the volume of the mixed liquor, while a second counter gives a true record of the amount of alcohol contained in it. The principle on which this measuring apparatus acts may be shortly described thus: The volume of liquid is passed through a revolving drum, divided into three compartments by radial divisions, and not dissimilar in appearance to an ordinary wet gas meter; the revolutions of this drum produce a record of the total volume of passing liquid. The liquid, on its way to the measuring drum, passes through a receiver containing a float of thin metal filled with proof spirit, which float is partially supported by means of a carefully adjusted spring, and its position determines that of a lever, the angular position of which causes the alcohol counter to rotate more or less for every revolution of the measuring drum. Thus, if water only passes through the apparatus, the lever in question stands at its lowest position, when the rotation motion of the drum will not be communicated to the alcohol counter; but in proportion as the lever ascends, a greater proportion of the motion of the drum will be communicated to the alcohol counter, and this motion is rendered strictly proportionate to the alcohol contained in the liquid, allowance being made in the instrument for the change of volume due to chemical affinity between the two liquids. Several thousand instruments of this description are employed by the Russian government in controlling the production of spirits in that empire, whereby a large staff of officials is saved, and a perfectly just and technically unobjectionable method is established for levying the excise dues.—*Nature.*

Naval Items.

REDUCTION OF PAY AND MEN.

"Abstract of general order No. 216, dated August 12, 1876: The estimates made for pay of the navy for the current year were $7,600,000. Congress, however, determined that by a very rigid enforcement of a somewhat disused power on the part of the secretary of the navy to furlough officers, instead of having them under the heads of "other duty" or "waiting orders," a very considerable reduction could be made; and appropriated for the current year, for the pay of the navy to be administered upon this plan, and also reduced by cutting off 1,000 from its former complement of 8,500 men, the sum of $5,750,000, or nearly $2,000,000 less than the amount of the estimates. Under these circumstances, the department, although entertaining different views, feels bound to make, in good faith, the effort to bring the actual expenses of this branch of the service as near as possible to the amount appropriated by Congress. This can only be done by reducing the number of officers employed, to those absolutely needed to meet the daily pressing requirements of the service, and by putting those unemployed upon the lowest pay recognized by the provisions of existing laws.

"It is therefore ordered that: Until further orders, all officers not on duty on September 1 next, and all on leave, will, at the expiration of leave or waiting orders, be regarded as on furlough, and will be so paid.

"The foregoing applies only to the active list of the navy, the pay of retired officers being fixed by special provision of law."

NAVAL ENGINEER CORPS GAZETTE.

Chief Engineer James B. Kimball, detached from the U. S. steamer Hartford, and as Fleet Engineer of the North Atlantic Station, and placed on waiting orders.

Chief Engineer A. J. Kiersted, detached from the U. S. steamer Vandalia, and ordered to the Hartford, and also to discharge the duties of Fleet Engineer of the North Atlantic Station.

Chief Engineer Joseph Trilley to the Vandalia.

Cadet Engineer George S. Willits, detached from the Vandalia and placed on waiting orders.

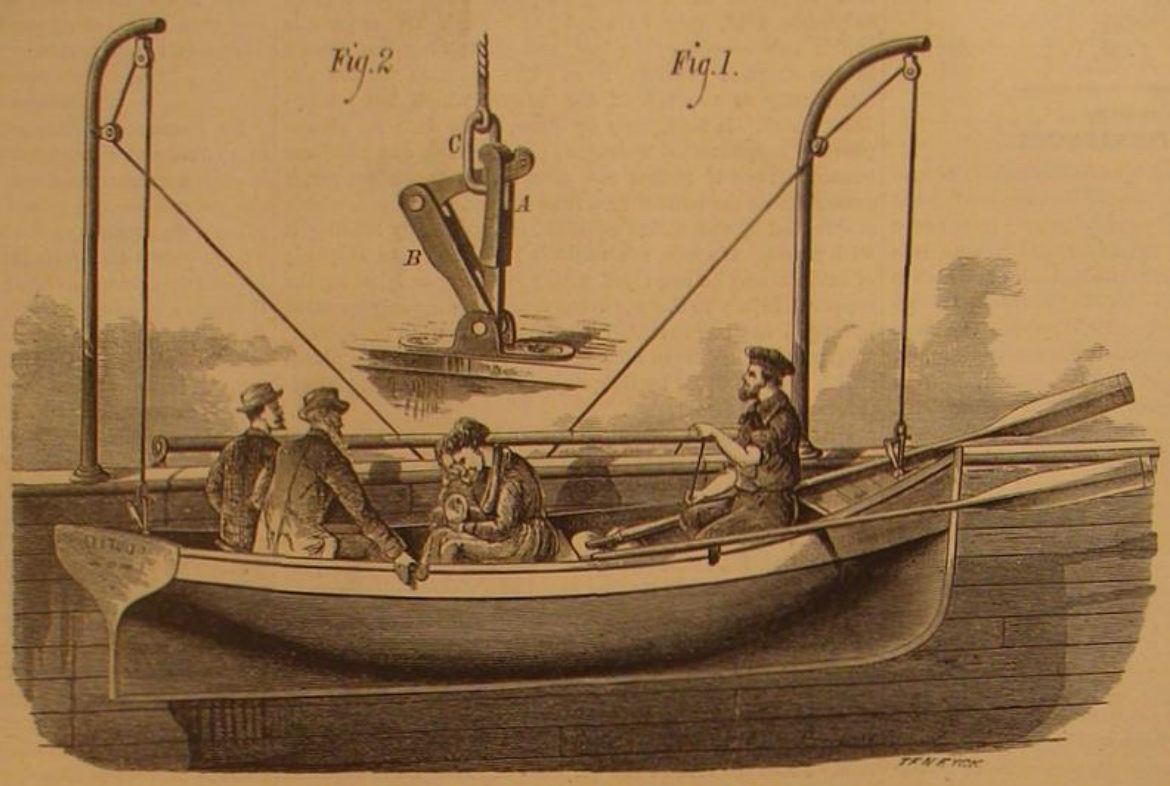
A Panic among Sponge Divers.

Mr. Vice-Consul Jago, writing from Beyrout, says that the last crop of Turkey sponge was very deficient, and prices of ordinary and common sponges have greatly risen in consequence. The deficiency is attributed to a panic among the divers, caused by the appearance in the neighborhood of Batroun, Mount Lebanon, the chief sponge fishing locality, of a sea monster, alleged to have been equal in size to a small boat. Its actual depredations among the divers appear at the present time to have been limited to one man, whom he is said to have swallowed whole.

A SQUARE of 208·72 feet each way covers one acre, so also does a circle 235·5 feet in diameter.

IMPROVED BOAT-LOWERING APPARATUS.

We illustrate herewith a new boat-lowering apparatus, in which the inventor seeks to use the buoyancy of the boat as a means of detaching it from the falls. He has contrived the hooks, whereby the latter is fastened, so that they will open when the weight of the boat is taken by the water. The release is thus automatically effected. In order to secure the even lowering of the boat, the inboard ends of the falls are wound about a drum bolted alongside the bulwarks, and the rotation of the drum is governed by a pawl and ratchet or other simple mechanism. The hook which forms the essential feature of the invention is illustrated in Fig. 2. It consists of three parts two of which, A and B, are pivoted in lugs attached to the boat, and a third, C, is pivoted to one of the aforesaid parts, and enters a slot in the other. Over the part, C, the ring at the end of the fall passes; and so long as there is any weight suspended by the hook, its parts will maintain their relative position as shown in Fig. 2. When, however, the stress of the weight is removed, the part, C, falls from the upper portion of the slot where it engages by the shoulder formed upon it, and is drawn out by the part, B, which falls flat, the part, A, doing likewise. The falls are thus instantly released, leaving the boat free. To hook the boat on for hoisting, it is simply necessary to insert the part, C, through the ring, and catch it in the slot. The parts are then held together until the weight of the boat rests on the hook, when no further attention is required. The inventor provides a safety cord, which, as the boat descends, comes out of the hole at the end of the small hook. This is intended to prevent all danger of the boat being lifted accidentally, and so released before the proper time. Fig. 1 shows the invention complete, as attached to a boat.



BRICE'S BOAT LOWERING APPARATUS.

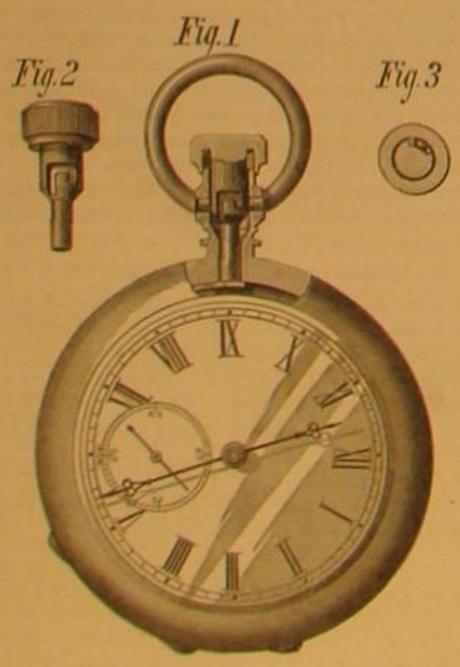
Patents pending through the Scientific American Patent Agency in this country, Great Britain, and France.

Mr. W. C. Brice has also invented an actinometer, or photographic testing plate, to be applied to a camera, for the purpose of determining the quality of the chemicals employed, and for discovering where the trouble lies in foggy and undefined pictures. It consists of a frame with a sliding glass, to which are applied fixed pieces of transparent material, superposed in layers in regular succession, to produce a graduated obstacle to the passage of light. Patents have been applied for on this improvement in the United States and several countries of Europe.

For further particulars address the inventor, W. Alexander Brice, care R. C. Poulter, 4a Middle Temple Lane, London, England.

DUEBER'S IMPROVED WATCH CASE.

The obvious advantage of the stem-winder watch is that, as its winding apparatus is contained in the case, there is



no necessity for carrying a separate key. But many consider that the annoyance of lost or mislaid keys is of less importance than the liability of stem winders to get out of repair and their higher first cost, so that probably the majority of people prefer the older-fashioned system.

In the invention herewith illustrated, the object sought has been to combine a key with the case, making it form a part thereof in the place where the stem-winding apparatus is usually located. The key, however, is detachable, and is used to wind the watch in the ordinary way.

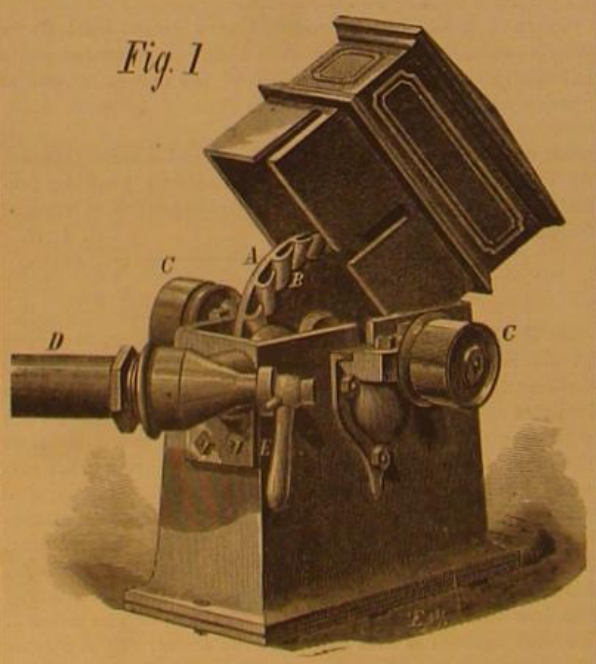
In the engraving the key, Fig. 2, is shown inserted in Fig. 1. A small projection inside the pendant enters slots cut in the side of the key, as represented in Fig. 3, and hold it in place. It suffices, in order to remove the key, to push it in and turn to the left; the reverse operation re-fastens it in place.

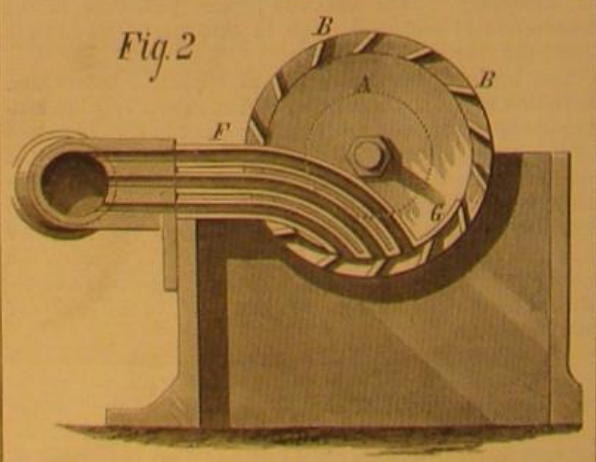
It is claimed that this arrangement involves but very little extra cost, and that the key cannot get lost misplaced, or filled with dirt.

For further information address the Dueber Watch Case Manufacturing Company, 175 West Fourth street, Cincinnati, Ohio.

IMPROVED WATER MOTOR.

The invention herewith illustrated applies water to a wheel of a novel construction, whereby the whole centrifugal force of a jet of water is concentrated on the center of the buckets From these it is immediately discharged, thus avoiding any friction or dead lift, and imparting to the wheel not





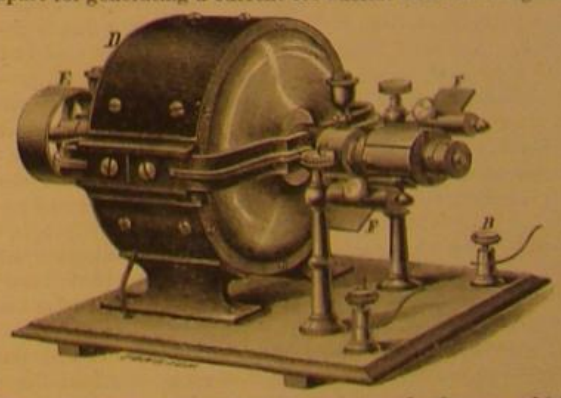
only a greater impetus but, it is claimed, a very high degree of power, considering the pressure and the size of the stream used. Although adapted to all purposes where water is used as a motive power, this invention is more particularly designed for use where the supply of water is limited or variable; and this is believed to be a desideratum, as streams of water are liable to much fluctuation at different seasons of the year. More especially is it designed for use in propelling light machinery, such as printing presses, sewing machines, lathes, etc., wherever water can be taken from a hydrant. It is also claimed to be well adapted for heavy work.

The disk of the wheel, A, Fig. 1, is made of brass of various sizes, and, together with the buckets, B B, is of a peculiar construction and of a capacity to correspond with the size of the stream and the power required. C C are the belt pulleys; D the supply pipe; E a self-packing faucet or stop-cock, which is the subject of another patent obtained by the same inventor. This faucet is capable of supplying one, two, three, or more streams of water of different dimensions through the pipes, F, which are firmly held in position at the point of delivery of the water on the buckets by a shoe, G. The pipes are provided with bushings at their extremity, which can be removed at pleasure, and others of a different capacity inserted. The waste pipe, of course, can be arranged as required, either from the sides or bottom of the casing. The communication between supply pipe and buckets is shown in section in Fig. 2. Patented June 13, 1876. For further particulars address the Little Giant Water Motor and Self-Packing Faucet Company, Glen's Falls, Warren county, N. Y., Frederick J. P Chitty, manager.

THE WESTON DYNAMO-ELECTRIC MACHINE.

Our engraving represents a new electric machine, adapted more especially for electro-plating. It is of simple construction and, we are informed, requires very little power. The illustration gives an exterior view; the mechanism is as follows: From the interior of an iron ring or cylinder, a number of radial magnets point to a common center. These, as well as the ring, are wound with wire. In the central space is a shaft which carries a series of armatures, the outwardly projecting ends of which are so arranged as, when reversed, to approximate closely to the extremities of the magnets. When the armatures are thus rapidly carried past the magnets, currents of electricity are induced in the wires surrounding said armatures. Instead of making the commutators with as many springs or brushes as there are insulated strips to connect their currents—a cause of loss and of frequent readjustment—a device is provided in which all the strips which convey currents of like kinds are united in the commutator itself, and it is only necessary to use the springs or brushes to collect the currents from all the armatures, no matter how many magnets or armatures may be employed. Only two springs or brushes are used, one being always in connection with one of the projecting pieces of one half the commutator, while the other is always in connection with the other half. Hence one transmits the positive and the other the negative currents.

When the machine is set in motion, a current is produced which flows through the halves of the commutator, then passes through wires to the coils which surround the magnets, and through the coils surrounding the iron ring. This circuit, small at first, rapidly excites the magnets, producing the maximum effect. The current is then led through any desired circuit and is returned to the machine through a spring into one half of the commutator, then into the other, completing the circuit from the coils surrounding the armatures, and then back to said cores. The entire current generated in or by all the armature coils is passed through the magnet and ring coils, and none of the armatures are set apart for generating a current for excitation of the magnets.



There is, besides, a new and ingenious pole charger which prevents the currents being changed during periods of rest, so that no preliminary examination of the currents is necesary before at once setting the apparatus in operation.

Four sizes of the machine are made, and one of medium dimensions is capable of running 200 gallons of nickel solution. The apparatus will be found at the Centennial, at west end of Corliss engine avenue, B 78. Patented by Edward Weston, July 18, 1876. For further particulars address Condit, Hanson, & Van Winkle, 236 Market street, Newark, N. J.

OCEANIC BIRDS.

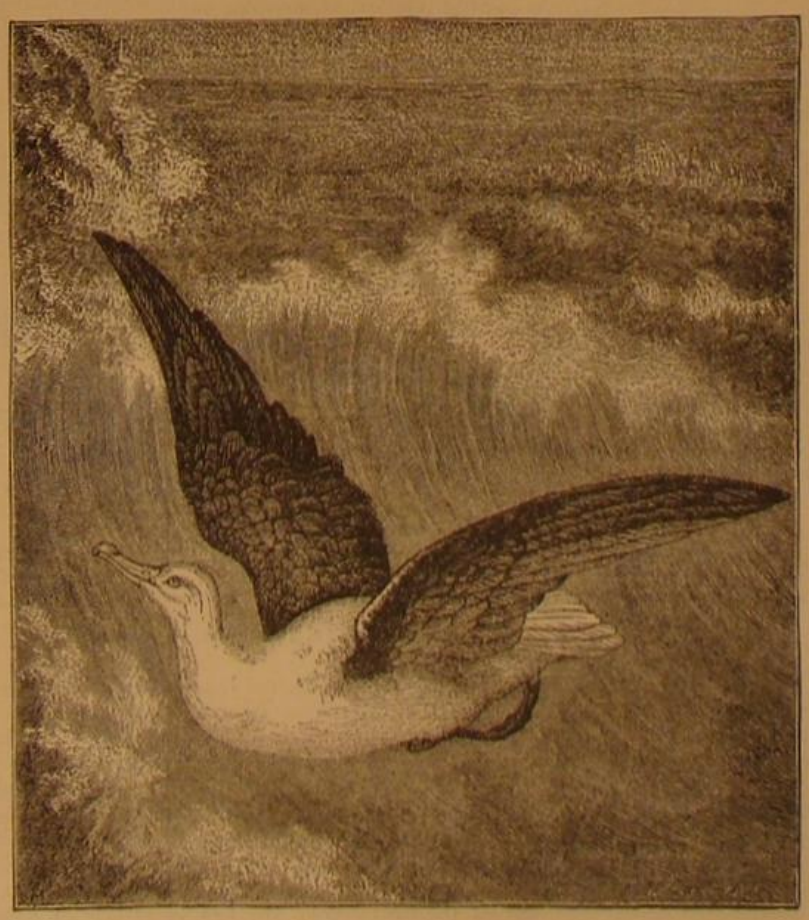
The sub-family of web-footed oceanic birds known to zoölogists as the *procellarinæ* contains several *genera*, the best known of which are *procellaria* or petrel proper, and *thalassidroma* or stormy petrel. The name petrel is derived from Peter, in remembrance of the apostle's walking on the water, a characteristic of the bird excellently shown in the first of our two engravings. The birds here shown, commonly called by sailors Mother Carey's chickens, are readily distinguished from the common petrel by the shorter and slenderer bill. The species are about twelve in number, and inhabit the oceans of both hemispheres, skimming lightly over the waves or running along their tops; they are dark in color, but more or less marked with white. The Mother Carey's chicken (*thalassidroma pelagica*) is about six inches long in the body, with wings opening to a width of over thirteen inches; the bill and feet are black; the body is grayish, black above, tinged with brown. The presence of these birds is supposed by mariners to forebode stormy weather, and they are never molested by sailors, as their warnings are usually accepted in perfect faith; they are found all across the Atlantic, especially in the temperate zone, and are common on the banks of Newfoundland. They breed on rocky shores and islands, in the North Atlantic.

On the Shetland Isles, Scotland, they begin to lay toward the end of June, depositing a single egg in a nest made of plants and earth, which they carefully conceal, sometimes placing it three or four feet under a heap of stones. The naturalist Brünnich states that these birds become so fat that the inhabitants of the Faroe islands attach wicks to them and burn them as lamps.



THE STORMY PETREL.

Our second engraving represents another of the tireless wanderers of the deep, the albatross, also of a web-footed genus. Three species are known —the common albatross (*diomeda exulans*), the albatross of China (*diomeda fuliginosa*), and the yellow and black beaked albatross (*diomeda chlororynchos*). The first is the species chosen by the artist for representation; it is also called the man of war bird. The genus is distinguished principally by a very strong, hard, straight beak, which suddenly curves downwards, with a sharp hook at the point. The feet are short, the three toes long and completely webbed, the wings long and narrow. The common albatross is the largest sea bird known, weighing from twelve to twenty-eight lbs. Its wings measure, when extended, about eleven feet across; but a specimen, measuring seventeen and a half feet was shot off the Cape of Good Hope. The top of its head is of a ruddy gray, all the rest of its plumage, with the exception of some black bands on its back and a few wing feathers, being white. It is abundant from the Southern Ocean to as far north as Kamschatka, but scarcely ever visits our coasts. Its voracity is extreme, its ordinary food being fish and fish spawn; it can readily be caught, however, with a strong line and a hook baited with a piece of fat pork. Its powers of flight are very remarkable; and its voice is harsh and disagreeable, resembling the braying of an ass. The albatross is regarded with superstitious awe by sailors; and the killing of one is believed to bring down disasters on the ship.



THE ALBATROSS.

Suggestions about Breeding Cattle, etc.

1. A perfect development and sound vigorous health, constitutionally, especially in the generative organs, are conditions of fertility.

2. In the maintenance and improvement of a breed, the truth that "like produces like," that the reproductive germ will stamp upon the animal developed from it the characters of the parent organisms, is the backbone of success.

3. We can, in a great degree, at will, produce variations and improvements in breeds, as by abundant feeding, a mild and salubrious climate, a rich and healthy soil, moderate use, education, stimulation, or selection of desirable qualities; by disease or rejection of undesirable characters and properties; by soliciting the weight of imagination in our favor; by allowing the breeding animals to mix only with those of the stamp desired; by crossing less improved breeds systematically with mates of a better race, and by crossing animals faulty or deficient in some particular point with others, in which this point is developed in excess.

4. The herding of pregnant high-class animals with low-bred ones, and the resulting attachment between the two races, are to be especially avoided, as occasionally affecting the progeny injuriously; strong impressions from a new or unusual condition of surrounding objects are to be equally guarded against.

5 If a valuable female is allowed to breed to an inferior male, she cannot be relied upon to produce pure-bred animals for several succeeding pregnancies. Through a strong and retained impression, through the absorption into the system of living particles (germinal matter) from the fœtus, or through some influence, during pregnancy, on the ova, then being most actively developed, the good or bad features of the first sire are perpetuated in the progeny of succeeding ones.

6. All breeds show a tendency to breed back, or to produce offspring bearing the marks of their less improved and comparatively valueless ancestors; hence, individuals of this kind must be rejected from the best breeds if we would maintain their excellence.

7. Certain races and individuals have their characters more fixed, and will transmit and perpetuate them in greater proportion than others with which they may be crossed. If their qualities are desirable, they prove highly valuable in raising other stock of greater excellence. If undesirable, they will depreciate the value of any stock crossed for many generations. That fixity of type, however, is, above all, a characteristic of those which have been carefully selected and bred up to a certain standard for many generations, so that, in our best, longest established, and most esteemed breeds, we have a most valuable legacy left us by the successful breeders of the past, with which we may mold our inferior races almost at will.

8. While breeding continuously from the nearest relations tends to a weakened constitution, and the aggravation of any taint in the blood to sterility, these may be avoided by infusing at intervals fresh blood of the same family which has been bred apart from the branch of it for several generations. Moreover, the highest excellence is sometimes attained only by breeding very close for a time.

9. Diseased or mutilated animals are generally to be discarded from breeding. Mutilations resulting from disease during pregnancy, and disease with a constitutional morbid taint are, above all, to be dreaded as transmissible.—*Professor James Law.*

Laying the First Cables of the East River.

New York and Brooklyn are at last joined together. The bond is a frail one at present, being only two ¾-inch wire ropes stretched from tower to tower of the future East River bridge, but it is the beginning of the great superstructure, marking the first step in the second portion of the enterprise, and the substantial completion of the vast stone monuments which form the foundation for the whole. The two cables, each 3,600 feet long, were made fast near the Brooklyn anchorage, drawn up over the top of the pier, and then lowered to a scow, which carried the ends over to the New York side, the slack being paid into the river. A hemp rope, leading from a drum on a small engine, and previously brought over the New York tower, was made fast to the end of one cable, which was thus hauled over the pier until said end could be attached to a larger engine. The latter then hauled the cable taut and to an altitude of 180 feet above the river. The second cable was then raised in similar manner.

The work occupied five hours, and was witnessed by a large number of people. The cables will next be stretched from the towers to the respective anchorages, and all will then be joined together to form an endless chain, by means of which the material used in the construction of both the temporary and the permanent bridges will be transported across the river.

Facts and Simple Formulæ for Mechanics, Farmers, and Engineers.

The following are fair approximate rules for the power required to drive cotton machinery: Cotton openers, 1 horse power per 1,000 lbs. of cotton delivered; cotton pickers, 3 horse power per 1,000 lbs. of cotton delivered; cotton cards, $\frac{1}{50}$ horse power per lb. of cotton delivered per day, and, at 125 revolutions per minute, 0·125 horse power; railway heads, breakers, 1 horse power per each 10 yards per minute; railway heads, finishers, 0·001 horse power per revolution per minute; drawing frames, 0·002 horse power per revolution per minute; spindles, 0·005 horse power per spindle per 1,000 revolutions.

To find the safe pressure a cylindrical boiler will bear in lbs. per square inch: Divide the thickness of the plate in inches by the diameter of the boiler in inches, and multiply the quotient by 5,000 for a copper boiler with single riveted shell; by 6,400 for a copper boiler with double riveted shell; by 7,600 for a wrought iron boiler with single riveted shell; by 9,000 for a wrought iron boiler double riveted; by 10,000 for a steel boiler single riveted; by 12,000 for a steel boiler double riveted.

To determine the amount of coal in lbs. which will be burned per square foot per hour with chimneys of good proportions, Professor Thurston's rule is to subtract 1 from twice the square root of the hight of the chimney. To determine the hight of chimney required to give a certain rate of combustion, add 1 to the weight to be burned per square foot per hour; divide by 2 and square the quotient.

Pulleys covered with leather, iron pulleys polished, and mahogany pulleys polished, rank for working value as 36, 24, and 25, respectively, wood and iron uncovered being almost identical.

Iron castings shrink $\frac{1}{10}$ inch to the foot in cooling in the mold.

To find the weight of pipe per lineal foot in lbs., subtract the square of the inside diameter in inches from the square of the outside diameter in inches, and multiply for cast iron by 2·45, for wrought iron by 2·64, brass by 2·82, copper by 3·03, lead by 3·86.

The natural slopes of earths, with horizontal line, are as follows: Gravel (average) 46°, dry sand 38°, sand 22°, vegetable earth 28°, compact earth 50°, shingle 39°, rubble 45°, clay well drained 45°, clay wet 16°.

Sand weighs about 30 cwt. per cubic yard, gravel the same; mud 25 cwt., marl 26 cwt., clay 31 cwt., sandstone 39 cwt., shale 40 cwt., quartz 41 cwt., granite 43 cwt., trap the same, slate 43 cwt.

To true a carpenter's grindstone, use a ¾-inch bar of iron or a gas pipe, for a turning tool, holding it below the center of the stone.

Chipping hammers should weigh about 1¼ lbs. and have handles 15 inches long.

A 6 inch emery wheel should make about 2,400 revolutions per minute, an 8 inch 1,800, a 12 inch 1,200.

The pressure in lbs. per square foot of water acting against a plane surface at right angles to the direction of movement is 0·976 times the square of the velocity in feet per second

BREECH-LOADING FIREARMS.

We herewith publish the second of a series of three classes of breech-loaders, the illustrations of which are selected from Mr. E. H. Knight's "American Mechanical Dictionary." The arms shown were recommended by the U. S. army commission in 1873.

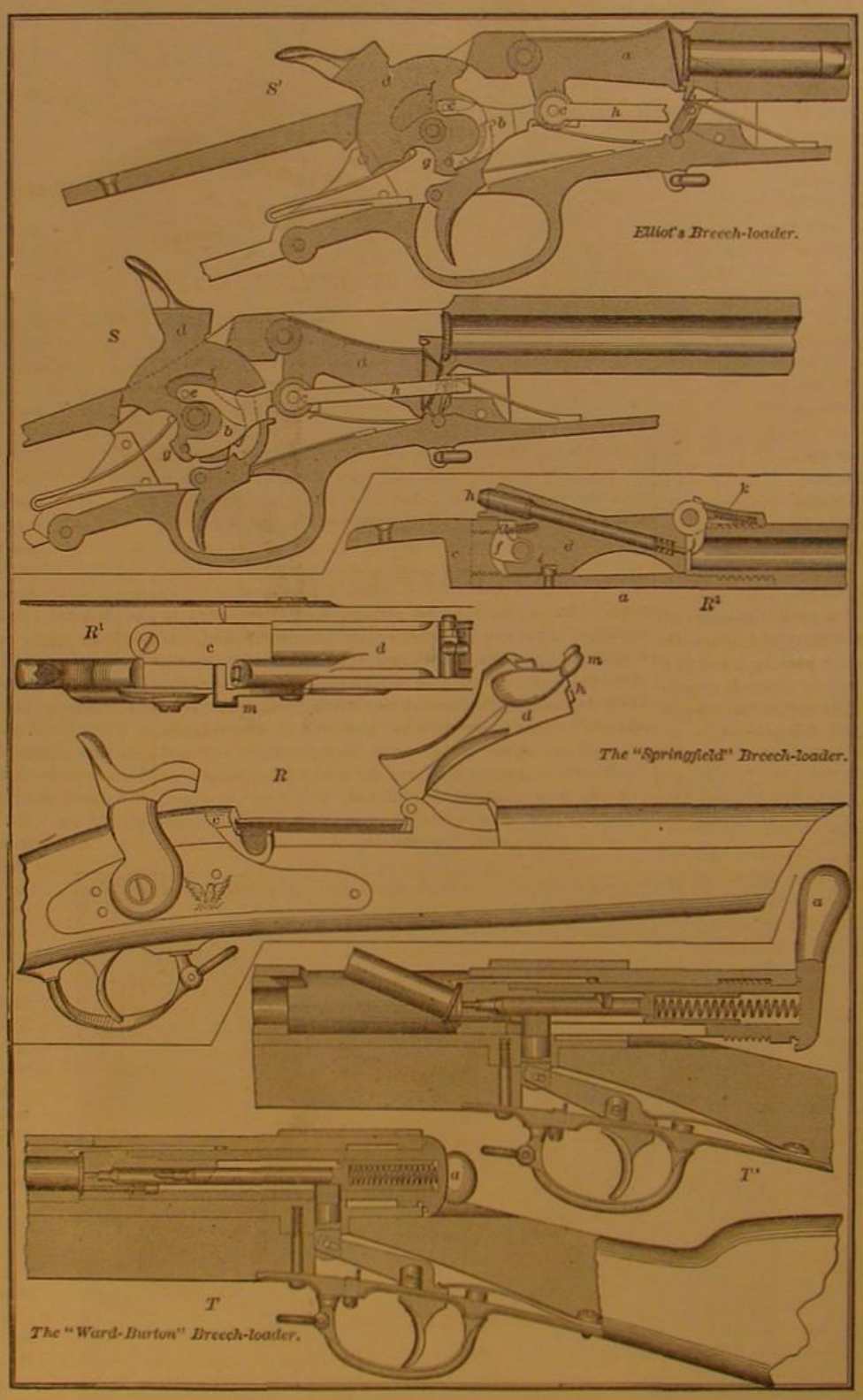
In the engravings, R, is the Springfield arm, having a breech block hinged to the upper edge of the barrel and swinging upward and forward. The indorsement of the board as the best, all things considered, entitles it to an honorable place in the series of examples. R is a side view of the gun, with the breech block, *d*, thrown up; *a* is the bottom of the receiver, *c* the breech pin, with its circular recess to receive the cam latch *f*, which locks the breech block in place; *g* is the cam latch spring, *h* is the firing pin, which transmits the blow of the hammer to the priming of the cartridge, and is pressed back by a spiral spring after the delivery of the blow; *j* is the cartridge shell ejector, *k* its spring; *l* an incline which tips up the ejected shell so as to throw it out of the receiver. R^1 is a top view of the gun with block closed. R^2 is a section with the breech block closed. The dotted lines show the block raised.

The breech block is raised upward and forward in the act of opening by a thumb piece, *m*, which releases it by turning up the cam latch out of its recess in the breech pin. When fully open, it discloses the chamber, or rear end of the barrel, ready for the insertion of the charge contained in a copper cartridge case, holding seventy grains of musket powder, and firing a bullet $\frac{45}{100}$ of an inch in diameter and weighing about 400 grains. When the breech block is closed, it is held down and braced against the effort of the heaviest charges by the cam latch, which flies into place in closing. The piece is fired by the ordinary side lock taken from the old muzzle-loaders. In opening the piece after firing, the breech block strikes the lump on top of the extractor, and revolves it so as to carry the now empty cartridge shell to the rear. After passing a certain point, the spiral spring in front of the extractor is released, and accelerates its motion, so that the cartridge is thrown sharply against the beveled surface of the ejector stud, by which it is deflected upward and expelled from the gun.

S S′ are two views of the Elliot carbine recommended by the same board for trial in the field, as exhibiting "remarkable facility of manipulation in requiring but one hand to work it." This arm has a breech block hinged to the breech pin and operated by the hammer. Fig. S shows the gun in loading position and S′ in the position "ready to fire." After firing, the hammer, *d*, is pulled back to the position shown in S, and in so doing draws by the yoke, *b*, upon the breech block, *a*, to which it is pivoted at *c*. This pulls down the front end of the breech block, exposing the rear of the barrel for the insertion of the cartridge. Having done this work, the pin, *e*, of the yoke slips out of the socket, *f*, into the lower portion of the groove, while the lower branch of the yoke engages over the pin, *g*, so that, when the hammer is again pulled back, the breech block is pushed up again into the position shown at S′, where the hammer is on full cock and the arm ready to fire; *h* is a strap which works the retractor, so that the shell is ejected as the breech block is pulled down. S shows the cartridge ejector pulled out; S″ shows it in its bed. One pull on the hammer depresses the breech block and ejects the empty shell; another pull closes the breech block and puts the hammer in position for firing; a pull on the trigger fires the arm.

T T′ are two positions of the Ward-Burton gun, which is on the bolt principle, like the Prussian needle gun and the French Chassepot. This gun, in its magazine form, was also recommended "for farther trial in the field." This gun, having been fired, is opened by raising the handle, *a*, of the bolt and withdrawing it directly rearward; the position is shown in Fig. T′ in the engraving. As the cartridge shell is pulled out by the spring hook on the upper edge of its flanged rim, the pin which rests against its lower portion comes in contact with the front end of the trigger pin, which tips it up and throws it out of the receiver. Another cartridge is then introduced by hand or by automatic devices from the magazine, and pushed into the bore of the gun by the longitudinal forward motion of the bolt. Near the head of the bolt is seen a part of the sectional screw which engages with a corresponding section within the gun when the piece is closed, and the handle turned down into place, so as to support the bolt against the force of the discharge.

The firing pin is an axial spring pin released from the bolt by a downward pull by means of the trigger and lever. Fig. T is the position "ready to fire," the driving spring being condensed and ready to act. Fig. T′ shows the bolt withdrawn and the cartridge tumbling out. When the bolt is withdrawn, the sleeve of the firing pin is so far retracted that a shoulder catches behind the trigger. When the bolt is pushed home, driving the cartridge into the barrel, it leaves the shoulder of the firing pin resting against the trigger, as shown in Fig T



BREECH-LOADING FIREARMS.

*Published in numbers by Messrs. Hurd & Houghton, New York city.

Astronomical Photography.

The facility and precision with which photography represents luminous phenomena in their minute details renders this application of optics more and more important in the sciences of observation, and especially astronomy. But photography could not take a regular place in observatories unless the photographic apparatus had the same simplicity and theoretical perfection as the instruments used for current observations. M. Cornu states, in a note to the Paris Academy, that, having had occasion to study this problem in connection with the transit observations, and later at the request of the Council of the Paris Observatory, he has found a solution of it as complete as possible. The negatives he had to lay before the Academy would, he trusted, justify this opinion.

It is the peculiarity of this method that it does not require any special instrument, any telescope, and may at once be adopted for photographical observations by means of a purely mechanical arrangement, which does not at all affect the optical qualities of the instrument; the two lenses which compose the objective have merely to be separated to an extent depending on the nature of the glasses, but rarely exceeding 1½ per cent of the focal distance. This operation shortens this distance about 6 to 8 per cent. Theory and experience prove that the original achromatism of the visible rays is transformed into achromatism of the chemical rays, which is necessary to the perfection of photographic images. Direct and precise measurement has shown that this slight separation of the glasses does not cause any aberration in the images.

This method has succeeded perfectly at the Paris Observatory with the large equatorial of the eastern tower, the objective of which is 14·934 inches in aperture, and 29·13 feet in focal distance. By a very simple arrangement the glasses can be separated, and the instrument may be employed for optical as well as for photographic observations. The photographic adjustment does not present any inconvenience in observation of faint stars. M. Cornu states that he easily observed Uranus, and at least one of his satellites, without finding it necessary to re-establish optical achromatism.

At the principal focus of this instrument are obtained direct photographic images of the sun and of the moon, measuring nearly 3·42 inches in diameter: images which might be easily magnified by means of the eyepiece so as to give negatives of more than 39 inches in diameter. The images thus enlarged gain, perhaps, in artistic effect, but they lose in distinctness.

Alcoholic Solution of Shellac.

The production of a clear alcoholic solution of shellac has been the subject of numerous experiments, but hitherto none has turned out satisfactory except slow filtration. As is known, by digestion of one part of shellac with six or seven parts of 70 per cent alcohol, a solution is obtained which, when warm, is almost clear, but upon cooling becomes turbid, and is only partially clear after standing a week. The plan of pouring sufficient alcohol over coarsely powdered shellac to form a thin paste, yields, upon the addition of more alcohol after the lapse of eight or ten hours, a liquor that does not deposit any more, but which is not clear. Another method suggested, of boiling the alcoholic shellac solution with animal charcoal, gives a clearer liquid, but there is always loss through absorption by the animal charcoal.

The object sought by the author was to obtain a clear alcoholic solution in a short time without much loss. Previous communications upon the substance occurring in shellac to the extent of five per cent, which renders its alcoholic solutions turbid, and is described by some authors as wax, and by others as a fat acid, suggested an attempt to effect its removal before dissolving the shellac. The shellac, therefore, was boiled with water, from one to five per cent of soda or ammonia being added, but without satisfactory result; a somewhat larger addition of the alkali caused the solution of the shellac. The author next prepared a solution with one part of shellac and six parts of 90 per cent alcohol at the ordinary temperature, which was effected with frequent shaking in ten or twelve hours. To this he added carbonate of magnesia to about half the weight of the shellac used, and heated the mixture to 140° Fah. The solution so obtained cleared more rapidly than a solution to which magnesia had not been added, and filtered in less time; but it did not supply what was sought. When powdered chalk was substituted for magnesia, the solution, after standing some hours, became three fourths clear, while the lower turbid portion could be rapidly filtered. It only required a little alcohol to wash the filter, and a clear alcoholic solution of shellac was obtained. Further experiments, for instance with sulphate of baryta, did not give a better result. When such a solution is made on a large scale it would be best filtered through felt.

Notwithstanding that the object of the author had thus been attained, one or two other experiments were tried. To three parts of the above mentioned shellac solution one part of petroleum ether was added, and the mixture was vigorously shaken. After standing a few moments the liquid separated in two layers; the upper light colored layer was the petroleum ether with the wax dissolved in it, the lower yellow brown layer was a clear solution of shellac with only a little petroleum ether adhering. Upon allowing the petroleum ether to evaporate spontaneously, the wax that had been dissolved out of the shellac was obtained as a white residuum. By using alcohol at 95 per cent to dissolve the shellac, and then adding petroleum ether, a perfectly clear solution was obtained that only separated into two layers after water was added. Consequently an alcohol weaker than 90 per cent should be used.

The shellac solution obtained by means of petroleum ether, however, has the advantage that the shellac is left, after evaporation, in a coarser form, and easily separates; this may be obviated by adding one to three per cent of Venice turpentine.—*A. Peltz, in Pharmaceutische Zeitschrift für Russland.*

THE TAPAYAXIN.

Mr. F. W. Fanning, of Corsicana, Texas, has forwarded us a specimen of the crowned tapayaxin or horned lizard (*phrynosoma cornutum*). This curious reptile is not uncommon in the South and in California, and is stated to be very lively when at liberty, pursuing its prey with much eagerness. In confinement, however, it becomes almost torpid, remaining for some hours in the same attitude. In spite of its formidable looks, it is perfectly harmless, and can be taught to eat flies from its owner's hand. Red ants are its favorite food; but it will eat insects of all kinds. Its general color is gray, one variety (*phrynosoma Blainvilii*) being variegated with irregular bands of brown. This animal is sometimes erroneously called the horned frog and horned toad.

Mr. Frank Buckland describes a specimen in his collection as follows: "My new friend is about the size of a common sized toad, and at a distance off looks very like one. He is covered all over with spines, some of which are larger and stronger than others; he has two fixed spines, one over each eye, and three fixed spines on each side of his face. At the top of his head are situated the two biggest spines, each about half an inch long, giving him a most diabolical appearance All the spines are fixed firmly into his head. As will be seen by the picture, his body is covered with spines of different sizes, and set into his skin very thickly. The consistence of the spines reminds me much of the spines of the blackthorn. The color of the animal is gray, varied with brown and ochrey yellow; in fact it is very like the color of the bark of an old tree."



THE TAPAYAXIN OR HORNED LIZARD.

The tapayaxin sent us by Mr. Fanning has remained very quiescent since his arrival, hardly deigning to notice the flies placed in his box for his sustenance. He is apparently in good health, and his reticence of speech may be attributed to his philosophical temperament, and perhaps to some provincial bashfulness, natural to a new comer to the metropolis.

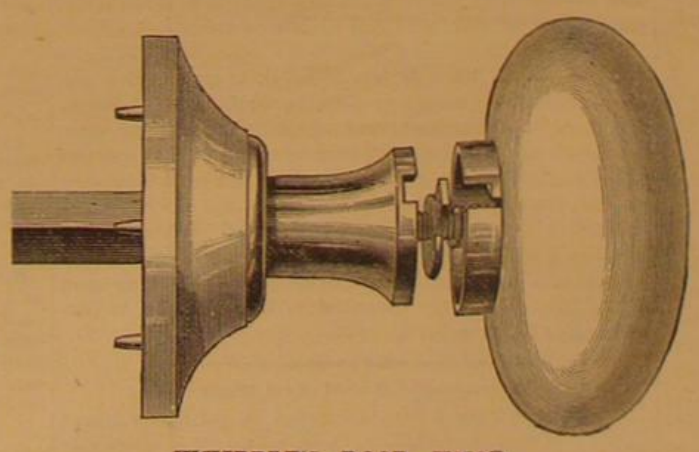
Lightning Conductors.

Dr. Mann lately showed, at the Science Conference at South Kensington, how unimportant is the form of lightning conductors, whether rods, ropes, or pipes; and that the real desideratum was that they should be of sufficient size to afford an unobstructed path for the passage of the electric fluid. He insisted on the necessity of a goodly number of points, and above all upon the indispensability of large earth contact, saying that a lightning discharge passing through a large rod with an ample earth contact is only a gentle stream of low tension; but that, if the size of the rod or the area of its contact with the earth is diminished, the tension is increased, and the fluid has a dangerous tendency to discharge itself laterally by chance outlets.

IMPROVED DOOR KNOB.

The chief failing of the ordinary door knob is that it works loose. Sometimes this occurs from the wood of the door not being properly seasoned, and hence shrinking, and frequently from the device itself not being secured to the woodwork as tightly as it should be. The above difficulty is claimed to be completely remedied in the improved knob illustrated in our engraving. The roses are secured to the door by little points on the underside. There is but one screw, which is attached to one of the knobs, and passes through the square rod. This is regulated, as shown, by a small catch pushed by a spring into a notch. As this notch represents an adjustment of but the one hundredth part of an inch, it is easy to see how well the knob can be made to fit. In mineral and porcelain knobs, the necks are secured by spurs going down in grooves and turning under the material of the knob.

The device is strong, easily adjusted, applied, or removed, simple and suitable for all kinds of knobs or latches. Further information may be obtained by addressing the Parker & Whipple Company, West Meriden, Conn., or 97 Chambers street, New York.



WHIPPLE'S DOOR KNOB.

Mechanical Photo-Printing.

The following practical directions for mechanical photo-printing are from the text of Herr Husnik:

Use for the supports some plates of glass one quarter of an inch or less in thickness, roughened on one side by means of very fine emery and water, and applied by friction from another and smaller piece of glass to which a handle is attached. Do not allow the emery to become dry, or it will produce deep scratches. A circular motion should be adopted, using considerable pressure, and in about twelve minutes a very fine grain will be obtained. If plates be employed that have been previously used, remove the gelatin by immersing in a vessel containing a solution of soda. This wash keeps more than two months, and it is always possible to strengthen it by the addition of lime. The gelatin, in the case of a plate that has been previously used, will detail itself in about twelve hours. Rinse the surface and rub with emery to remove the gelatin that may have lodged in the pores; but this time one application of the emery will suffice. The glasses thus prepared are washed in several changes of water and wiped dry with clean cloths.

First: Preparation of the plates.—Take fresh albumen 25 parts, distilled water 45 parts, silicate of soda 8 parts. Mix well together, beat to a froth, and allow to stand for several hours; then decant the clear part and filter it two or three times so as to ensure its being free from impurities.

In preparing the plates, place them, ground side uppermost, on a large slab of glass carefully leveled; and having brushed them over with a soft brush to remove all dust, pour a little of the preceding liquid near one edge, and cause it to flow over the surface by slightly inclining the large slab. If the liquid do not flow over the glass easily, it can be helped on by using a small slip of paper, taking care that it does not run too fast. Now raise one of the corners so as to allow the superfluous liquid to flow off the plates into a receptacle placed beneath; and if there be any air bubbles on the glass, pour some of the solution over it again while the glass is in an inclined position, leaving it thus to dry. The superfluous liquid can be filtered and used again. A great number of plates may be prepared in this way and kept for about six months; but it is better not to use them on the day on which they are prepared, as they improve by keeping.

In order to coat the plates with gelatin, they ought first to be carefully washed with cold water, taking care not to injure the prepared side. Let them stand upright until dry, after which they are ready to receive the gelatin, which is done in the following manner: Provide a case with a bottom of sheet iron and a curtain for the top; and in the interior, about two and three quarter inches from the bottom, place a frame, upon which stretch calico or filtering paper, so as to diffuse and equalize the heat, which is obtained from a spirit lamp. About two and three quarter inches or so from the top, bars of iron with leveling screws are placed horizontally. A thermometer, with the bulb inside and tube and scale outside, fastened at the side, indicates the temperature of the interior. Place two, three, or more of the plates on the leveling screws, laying them in a horizontal position; shut the case and heat to 110° Fah.

During this time put 15 parts of the finest French gelatin in 300 parts of distilled water, and leave it to soak for about an hour, after which dissolve in the water bath. Next, heat to a high temperature, and add 1 part of bichromate of ammonia and 1 part chloride of calcium; when these are all dissolved, add 60 parts of ordinary alcohol, after which filter. This solution is poured upon the heated plates, and must be spread by means of a small slip of paper. Experience regulates the proper quantity to be applied, and a considerable degree of dexterity will be required; but this is easily attained. Care must be taken to prevent the layer from being either too thick or too thin. The plates thus coated are placed in the case to dry at the temperature of 110° Fah., and after being well dried, they will keep in summer for about eight days, and in winter about four weeks, in a dark place; they improve by keeping.

Exposure.—With a good negative in the shade an exposure of from fifteen to forty-five minutes will be required, according to the intensity of the light—diffused light giving the best half tints. After exposing, the bichromate not acted upon by the light is removed by being washed with water, and the plate is then well drained and dried. In about three hours it is ready to be printed from.

Printing.—The plate is attached, by means of plaster of Paris, to a lithographic stone, and submitted to the action of a lithographic press. Damp the plate and ink it with two kinds of ink, one stronger than the other. After obtaining a print the plate is moistened, wiped with a cloth, and inked. If the details in the shadows be not properly brought out, put extra pressure on that part. One plate will furnish a considerable number of proofs, provided the instructions be carefully carried out and the gelatin be of good quality.

Final observation.—This method, according to Herr Hisnik's experience, is the best in use, and it gives certain results. Some photographers substitute isinglass for a portion of the gelatin, but this substance can rarely be obtained of good quality.

The choice of the inks is very important. Munich varnish ought not to be used for black, as it attacks the gelatin and the plate loses its vigor. Good black printing ink answers better when mixed with red oxide of iron, and a little César varnish imparts a good brown tint.

Utilization of Waste.

Cotton waste is a singular example of the successful application of scientific utilization. It is the collected sweepings of the card room, and formerly had no value. Large heaps were suffered to accumulate until it fermented, and was then spread over the land. After that, cartridge paper makers bought it at $10 to $20 per tun; then it rose in price, and means were found to bleach and tear it up, in order that it might be respun and woven, and now there is a trade of 14,000,000 cwts., giving employment to 500 dealers. The various uses are all exhibited, and the refuse is then sold for engine cleaning, and finally to the paper maker; jute is next. An immense trade has been created. It is a product of Bengal, and formerly was used only for gunny bags, to pack rags or merchandise in, but now it yields to processes which fit it for weaving with silk or cotton, or in the making of thread, ropes, sail cloth, and with wool in flannels and carpets, and with cocoa nut fiber for matting, etc. During 25 years the consumption has risen from 391,000 cwts. to 1,250,000 cwts., and the value from $450,000 to $5,000,000, and the refuse now equals the original import of the raw material.

Failures---What they Teach.

The numerous failures and suspensions which have made the commercial world, since the panic of 1873, one of constant upheaval and change, should be utilized, by those fortunate ones who have thus far escaped disaster and by those who are entering, for the first time, the field of business life for the lessons that may be drawn from them. Failures, like every species of mishap, only follow from a sufficient cause; and usually it is one that could have easily been counteracted or avoided if the fact of its existence had not been unknown. And it is just here that we find so many of our business men weak. In their acquaintance with their own business, they lack that complete command, of the calling they have professedly made themselves master of, which alone enables one to understand and avoid its dangerous points.

The man who makes a study of or who devotes time to an accurate and scientific education in the business he has chosen, as a means for the accumulation of wealth, is now rarely found; and it seems to us that a large number of the failures of the last three years might justly be attributed to this cause. The idea seems to prevail that a business transacted on one's own account is a kind of perpetual motion, that, once started, will not only keep itself in operation, but may be drawn upon to an almost unlimited extent for the means to sustain other enterprises. The inventor who spends years in attempting to realize his impossible machine is not more certain of failure than he who starts in business with such expectation. The time when money could be made by ignoramuses, and when wealth could be had almost for the taking, has faded far away into the dim past; and an era of strife and struggle has dawned, in which only those who have most carefully prepared themselves for the warfare can hope to succeed.

It is not luck that makes one man fail and his neighbor succeed; it is not fickle fortune that brings clouds of difficulties upon one while another has apparently plain sailing; it is something far more certain in its operations than either of these. It is skill and a perfect command of his resources that enables one man to advance where another can make no progress; and these two qualities are possessed only by those who have made their business the one thing they must become perfectly familiar with.

The world is not yet so crowded that any need go to the wall to support the rest; there is room for all, and an abundance to spare. The great want is for more men who are well qualified for work, and who will put their shoulders to the wheel and push. Any person who is determined to win, and who unites with his perseverance sense enough to know that success comes only to those who deserve it, by the patience and skill with which they toil, has before him an inviting field for labor, and may enter it with the assurance that, if his efforts are rightly directed, they will meet with a sure reward.—*Northwestern Lumberman.*

FILTERS for waterworks may be calculated for as follows: 1 square yard of filter for each 700 gallons in 24 hours, formed of 2 feet 6 inches fine sand, then 6 inches common sand, 6 inches shells, and lastly 2 feet 6 inches of gravel. Perforated pipes should be laid in the lowest stratum, to carry off the supply of filtered water

Illumination of Lighthouses.

M. E. Allard, engineer-in-chief of the Administration of Lighthouses, has lately brought before the Paris Academy of Sciences some papers on the illuminating power of the flames employed for illumination, their transparency, and the translucency of the atmosphere. The first paper treated on the transparency of flames. The burners used in lighthouses have diameters of from 1 to 5 inches, and carry from 1 to 6 concentric wicks. In measuring the luminous intensity of the flames which they produce, it is found that these intensities increase a little less rapidly than the consumption of oil, and also that the intensity for each $\frac{1}{4}$ of a square inch of apparent surface increases, while, on the contrary, the intensity for each $\frac{1}{16}$ of a cubic inch of volume diminishes in direct proportion to the diameter. These results can only be explained by admitting that the transparency of the flame is not absolute.

This is the object of the first investigation made by M. Allard; he has determined the co-efficient of this transparency by three series of experiments: by measuring the intensity of different flames with a flat wick looked at sidewise or edgewise; by means of a curved mirror, which reflects towards the focus the rays which it receives, and thus causes them to pass through the flame; and by measuring the intensity of an electric light across a flame of large diameter. These investigations have led to the adoption of the number 0·8, as a mean value of this co-efficient reduced to a thickness of 0·39 inch in the flame passed through. One important conclusion is arrived at, namely, that the total quantity of light produced, or the absolute intensity, increases much more rapidly than the weight of oil consumed; but as the quantity of light absorbed, by the passage of the rays across the flame itself, increases in a still greater proportion, the difference between these two quantities, or the effective intensity, follows a law of augmentation a little less rapid than the consumption of oil.

M. Allard was next engaged on the translucency of the atmosphere. The observations made by lighthouse keepers on the visibility of neighboring lights consisted in noticing, three times each night, whether each of the lights could or could not be perceived, so that it might be ascertained, at the end of a certain number of years, how many times out of a hundred each of these lights was visible. A diagram showed, for each of the lights noticed, what is the limit of translucency in which it ceases to be perceived from the place of observation.

In another paper M. Allard has studied the impressions produced on the organ of sight by flashing lights. It appears that, by causing a series of flashes to be succeeded by equal intervals of darkness, each flash at moderate speed produces the same effects as if in an isolated state; in proportion as the speed increases, the impression on the retina is prolonged, and after a certain speed the effect is that of a constant light

Volatilized Gold.

General Howston lately donated to the Microscopal Society of San Francisco a slide mounted with volatilized gold, which, under a $\frac{2}{3}$ objective, opaque, was not only a beautiful but instructive object. The microscopic globules were perfect in shape, and were obtained at some distance from the melting pot, from which they had been thrown off by the draft and heat in a volatile form, so to speak, and condensed in the air in the form of minute shot, forming a veritable shower of golden rain. With all the care and appliances for the prevention of wastage in smelting or refining gold, a portion is lost in this way; and no doubt the roofs of the houses adjacent to mints and refineries would yield enough of the precious metal to show the color, at least, under the microscope.

Hiring Horses.

It has been decided, says the *Turf, Field, and Farm*, that when a horse or carriage is let out for hire, for the purpose of performing a particular journey, the party letting warrants the horse and carriage fit and competent for such journey. If the hirer treats the horse or carriage as any prudent man would do, he is not answerable for any damage either may receive. But he must use the horse for the purpose for which he hired him. For instance, a horse hired for saddle must not be used in harness. If the hirer violates this express condition of the contract, he is liable for any damage that may occur. If the horse is stolen through the hirer's negligence, such as leaving the stable door open all night, he must answer for it. But if he is robbed of it by highwaymen, when traveling the usual road at usual hours, he cannot be held for damages. As these questions are frequently in dispute, it is not out of place to shed a little light upon them.

Comparative Photographs of Blood.

The *American Naturalist* states that Dr. J. G. Richardson, for the sake of illustrating in criminal cases the distinguishable appearances of different kinds of blood, has flowed drops of blood from different animals so nearly in contact on the glass slide that portions of the two drops appear in the same field, and can be photographed together. Dr. C. Leo Mees has modified this method, and obtained exquisite results in specimens presented to the microscopical section of the Tyndall Association. He spreads the blood by Dr. Christopher Johnston's method, which is to touch a drop of blood to the accurately ground edge of a slide, and then draw it gently across the face of another slide, leaving a beautifully spread film. In this way one kind of blood is spread upon the slide and another on the cover. When dry, one half of each is carefully scraped off with a smoothly sharpened knife, and the cover inverted upon the slide in such position as to bring the remaining portions of the film into apposition. Under the microscope and in the photograph the two kinds of blood appear in remarkably fine contrast, even those bloods that are too nearly alike for safe discrimination in criminal cases being easily distinguished when thus prepared from fresh material.

Musical Sand.

Mr. Frink states in the "Proceedings of the California Academy of Sciences," that, in order to ascertain, if possible, "the cause of the sound that is produced by the sand from Kauai, presented to the Academy at a former meeting, I investigated its structure under the microscope, and I think the facts I have ascertained fully explain the manner in which the sound is produced. As the grains of sand, although small, are quite opaque, it was necessary to prepare them so that they should be sufficiently transparent to render their structure visible. This was effected by fastening them to a glass slide and grinding them down until one flat surface was obtained. This surface was then attached to another slide; and the original slide being removed, the sand was again ground down until sufficiently transparent. The grains were found to be chiefly composed of small portions of coral and apparently calcareous sponges, and presented under the microscope a most interesting object. They were all more or less perforated with small holes, in some instances forming tubes, but mostly terminating in blind cavities, which were frequently enlarged in the interior of the grains, communicating with the surface by a small opening.

A few *foraminiferæ* were also met with, and two or three specimens of what appeared to be a minute bivalve shell. Besides these elements, evidently derived from living beings, the sand contained small black particles, which the microscope showed to be formed principally of crystals of augite, nepheline, and magnetic oxide of iron, imbedded in a glassy matrix. These were undoubtedly volcanic sands. The structure of these grains, I think, explains the reason why sound is emitted when they are set in motion. The friction against each other causes vibrations in their substance, and consequently in the sides of the cavities they contain; and these vibrations being communicated to the air in the cavities, under the most favorable conditions for producing sound, the result is the loud noise which is caused when any large mass of sand is set in motion. We have, in fact, millions upon millions of resonant cavities, each giving out sound which may well swell up to resemble a peal of thunder, with which it has been compared; and the comparison—I know from others who have heard it—is not exaggerated. The effect of rain in preventing the sound is owing to the cavities in the sand becoming filled with water, and thus rendered incapable of originating vibrations."

Another Opportunity for Inventors.

An interesting competition is about to be opened by the German society *Verein von Gas and Wasser Fachmännern Deutschlands*, which offers a prize of $400 to the author of the process for the economical purification, from carbonic acid, of illuminating gas obtained from coal. The systems now commonly employed involve either hydrate of lime, certain salts, muriate of manganese for example, and iron oxides. Whether these methods leave more or less to be desired according to the nature of the coal distilled, or whether the forms of purifiers are imperfect, it is nevertheless certain that carbonic acid still remains present in illuminating gas, and its presence is decidedly unhealthy. Either a new system for its complete removal, or an effective improvement on the older processes, is required. The invention must be economical, easy of manipulation, and must not lower the illuminating power of the gas. The memoir describing it must be complete, and explain both the theory and the practice. Manuscripts must be signed with some distinctive device, which is to correspond with a similar mark on a sealed packet in which is written the name and address of the author. Communications are to be addressed to the president of the commission, Dr. Schilling, at Munich, prior to December 31, 1876.

Microscopic Ruled Test Plates.

"The finest lines I have succeeded in ruling are about $\frac{1}{180000}$ of an inch in width. These values are substantially the same as those given by Dr. Royston-Pigott, as representing the ultimate limit of visibility under the microscope. The smallest angle at which an object can be distinctly seen is stated by him to be 6", while other writers place it as high as 60", or even 120". Even the smallest value named is much too large. I will at any time undertake to rule a a single line, $\frac{1}{30000}$ of an inch in breadth, which can be seen at the distance of seven inches from the eye. This corresponds to an angle of about 1'. In this case the line is filled with plumbago; but if reflected from a silvered surface, it can be easily seen at the distance of eleven inches from the eye. Comparing minute particles of matter which can be seen under a Tolles' $\frac{1}{8}$ objective with those which can be measured, in the way indicated above, there is every reason to suppose that the limit of visibility falls beyond $\frac{1}{400000}$ of an inch. It is quite possible that the conclusion reached by Sorby, that the microscope has already reached the limit of its power in separating lines whose distance apart is equal to one half of a wave length, may be found to be justified by future observations. It is certain that no lines beyond Nobert's 19th band have ever been resolved. The great difficulty in distinguishing true from spurious lines has caused more than one skillful microscopist to doubt whether the resolution has been certainly carried as far as that point. But that light is 'of too coarse a nature' to enable us to see particles of matter, as small as $\frac{1}{200000}$ of an inch, is a conclusion which can be refuted without the slightest difficulty."—*William A. Rogers.*

VENTILATION OF RAILWAY TUNNELS.—Mr. G. J. Morison says that, when tunnels without shafts are to be ventilated, fans should be employed to keep up an artificial ventilation; that for a given amount of traffic the power required to ventilate long tunnels varies as the fourth power of the length; that when a long tunnel is to be ventilated it is more advantageous to have a double line tunnel with trains in each direction than two single line tunnels with trains in one direction only: that for every tunnel there is a limit to the amount of traffic, where locomotives are used, beyond which ventilation becomes impossible: this limit cannot be very definitely fixed, but for a tunnel of twenty-two miles it does not exceed a total of twenty trains a day.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From July 4 to July 28, 1876, inclusive.

ACOUSTIC TELEGRAPH.—T. A. Edison, Menlo Park, N. J.
AXLE BOX AND OILER.—J. N. Smith, Jersey City, N. J.
BATTERY.—J. Byrne, Brooklyn, N. Y.
BOILER.—V. D. Anderson, Washington, D. C.
BOTTLE STOPPER, ETC.—S. S. Newton, Binghamton, N. Y.
CARTRIDGE PRIMER, ETC.—E. Remington & Sons, Ilion, N. Y.
CLEANING BOLT CLOTHS.—L. V. Rathbun, East Pembroke, N. Y.
CLEANING COTTON, ETC.—R. Kitson, Lowell, Mass.
COPYING PRESS.—W. B. Sargent, New York city, *et al.*
DRIVING CHAIN.—W. D. Ewart, Chicago, Ill.
ENVELOPE MACHINE.—M. S. Chapman, Hartford, Conn.
FLUID METER.—W. Smith, San Francisco, Cal.
FOLDING PAPER.—S. D. Tucker, New York city.
LANTERN, ETC.—J. E. Folk, Brooklyn, N. Y.
LUBRICATOR.—T. F. Stevenson, New York city.
OIL STOVE.—E. B. Cox, New York city.
OIL STOVE.—O. Edwards, Northampton, Mass.
PAPER-CUTTING MACHINE.—E. Schlenker, Buffalo, N. Y.
PAPER MATERIAL.—W. F. Nast (of New York city), London, England.
PENCIL SHARPENER.—J. Herts, New York city.
PIN PACKAGES, ETC.—G. C. Hoadley, New Haven, Conn.
PREPARING CHINA GRASS, ETC.—J. B. Vogel *et al.*, New York city.
PROJECTILE.—B. B. Hotchkiss, Paris, France.
SCOURING LEATHER, ETC.—F. A. Lockwood, Fall River, Mass.
SHARPENING SAWS.—W. L. Covel, Providence, R. I.
SPINNING MACHINERY.—T. Mayor, Providence, R. I.
STEAM GENERATOR.—D. Renshaw, Cohasset, Mass.
TRANSMITTING POWER.—J. Good, Brooklyn, N. Y.
WASHING BARRELS, ETC.—G. Schock, New York city.
WATCH ESCAPEMENT.—F. H. Voigt, Buffalo, N. Y.
WATCH KEY.—J. S. Birch, New York city.
WRINGER ROLLER.—G. P. Clark, Windsor Locks, Conn.

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED RELEASING DEVICE FOR STABLES.

Arthur Chapman, Doylestown, Pa.—This invention consists of a longitudinal rod that extends along the manger of the stalls, and is hinged thereto, having slightly curved fingers or hooks, that retain rings, to which the cattle are fastened. A crank attached to the rod at the outside of the building operates the rod, and releases all the rings when turning the same.

IMPROVED SNAP HOOK.

Newton E. Cissna, Sioux Falls, Dakota Ter.—This is an improved snap hook for connecting the various straps, rings, and other parts of a harness, by which the straps may be readily taken out and inserted, and securely and reliably retained therein. When the tongue is swung in outward direction to be at right angles with the hook, the strap, ring, or other article is introduced, and by carrying the tongue back on the hook, firmly retained therein. The draft on the tongue causes the closing of the same, and secures the locking of the snap hook.

IMPROVED STREET LAMP.

John S. Woods, Brookline, Mass.—This consists of a duplex reflecting lamp, in which an oil holder is located between two burners, both of which are supplied from it, and it serves for the support of reflectors for the burners, to throw the light in opposite directions along a street.

IMPROVED GALVANIZING MACHINE.

George R. Acheson, Philadelphia, Pa.—This invention consists of a machine with rollers for tightening the wire cloth while passing through the galvanizing or painting liquid. Suitable skimmers and beaters are arranged in connection with the cloth at both sides of the same, to secure the regular tinning or painting. A sectional and diagonally jointed winding-up roller serves for being readily taken out of the cloth.

IMPROVED PHOTOGRAPHIC PICTURE CASE.

Thomas F. Adams, New York city.—This is a case with hinged door, to which the frame-carrying board is hinged, to be opened and closed with the door, and locked into open position by suitable spring bolts. The supporting board carries a number of photograph frames, so hinged to intermediate pieces that any one may be readily swung to either side for the inspection of the photographs.

IMPROVED LIME KILN.

Daniel G. Farrell and Andrew T. Lien, Mason City, Iowa, assignors to Farrell, White, & Lien, same place.—The object here is to afford a better application of the fire to the limestone than in kilns constructed in the usual way; to make the kiln airtight, even should it crack; to avoid the use of heavy timber and rods for tying the kiln; to cause the lime to drop evenly to the center of the draw; to avoid the necessity of drawing the lime while at a white or red heat, and to enable the lime to be dropped readily and surely. The invention consists in providing the kiln with a case and filling the space between them with clay, to render the kiln airtight, even in case it should crack in consequence of the effect of excessive heat. The invention further relates to a device for dislodging the lime and causing it to drop into the hopper.

IMPROVED LATTICE PIERS FOR TIMBER TRUSS BRIDGES.

Lewis Scott, Brighton, Mich.—In this invention two sets of posts are so arranged in a truss bridge that they will incline in opposite directions, and be located on opposite sides of the girts. They are all sustained upon a common base, that is thus connected with a superposed beam, so as to form a re-inforcement brace or support to each other. This has the effect of dividing and evenly distributing the weight or strain along the whole length of the foundation or base.

IMPROVED BRIDLE BIT ATTACHMENT.

Thomas M. Allen, Augusta, Ky.—This is an improved attachment bridle bit for driving hard-mouthed horses with great facility; and it consists of the driving lines being passed through a small pulley at the end of the bridle bit, and back through a loop in the saddle, and then downward to the shaft.

IMPROVED COMBINED PUTTY KNIFE AND SCREW DRIVER.

Charles Collins Bartlett, Medford, Mass.—This consists in combining a putty knife and screw driver in one implement, securing the sliding and spring-acted screw driver to the handle when not in use.

IMPROVED DENTAL FLASK.

William E. Buckman, Easton, Pa.—This is an improved dental flask, which shall be so constructed that it may be readily emptied of the plaster without danger of breaking the teeth. By suitable construction, after the molding or hardening of the celluloid or other material has been completed, the few taps required to separate the parts of the flask crack the plaster in such a way that it falls away from the teeth without danger of breaking them, so that the plaster and teeth are readily removed from the flask and separated from each other.

IMPROVED THIMBLE.

Gilbert H. Finger, New York city.—This invention consists in a thimble made with a concave top, and with concave surfaces, one or more, upon its sides. The tops are made thicker than the sides. The object is to prevent the eye of the needle, while being used, from slipping from the thimble and injuring the fingers of the operator.

IMPROVED SOAP RE-MELTER.

Daniel Whitaker, Boston, Mass.—The object of this invention is to provide a vessel for re-melting the scraps or fillings of soap produced by the cutting up of the soap into bars while in the soap frames, whereby the said scraps are utilized by being re-embodied into a solid homogeneous mass, without burning or decomposing. It consists mainly in constructing a pot or cauldron with an open bottom adapted to be closed by a door or cut-off, and providing the interior with steam coils and a diaphragm of woven wire. The said vessels are heated by steam admitted through the steam coils, and also by a steam jacket; and as the scraps of soap are thrown into the vessel, their lodgment upon the coils and the woven wire diaphragm maintains them in suspension in a uniform steam heat until they are melted; and as soon as melted, they drop through the coils and woven wire out through the open bottom before the soap has time to decompose.

IMPROVED FEATHER RENOVATOR.

William M. Shelton, Williamsburgh, Mo.—This invention is an improvement upon the feather renovator constituting the subject of letters patent No. 108,161, and relates chiefly to a roll mounted upon a hollow perforated shaft, which is open at one end to adapt it to receive a perforated tube. Steam is admitted to the renovating chamber through the shaft and tube; but when the latter is adjusted in a certain position, the steam is prevented passing into said chamber and caused to pass into the hollow casing of the same, for heating it and thus drying the feathers.

APPARATUS FOR THE MANUFACTURE OF SULPHUROUS ACID.

William Maynard, New York city.—This invention relates to certain improvements in apparatus for hydrating gases, and it consists in the particular construction and arrangement of the condenser or chamber in which is effected the absorption of the gas by the water; the said chamber being provided with an inlet for the water above and an inlet for the gas below, and fitted interiorly with alternating inclined imperforate shelves, which are provided with ledges or cleats at their lower ends that dam up the water upon the shelves for the absorption of the gas, which water gradually weeps or trickles over the edge of the cleats from one to the other of the shelves. These ledges or cleats are also notched and sawn down to form slits or scores, which permit the draining of the shelves when the apparatus is not in operation.

NEW HOUSEHOLD INVENTIONS.

IMPROVED WASHING MACHINE.

James J. Daly, Bloomington, Ill.—This invention consists in placing in a wash box, between two inclined parallel arms, two wash boards with their ridged surfaces facing each other. The projecting ends of the arms are provided with slots in which projections on the upper wash board travel, thus giving the latter a reciprocating motion. The lower wash board is pivoted between short arms, which themselves pivot at their lower end in the inclined parallel arms, their upper arms being connected by a transverse rail. Immediately below the wash boards is a grooved roller, which has its bearings in the two inclined arms, and is provided with ratcheted ends, which are moved by pawls pivoted to the upper wash board. Motion is imparted to the machine by a crank handle or otherwise.

IMPROVED DRY YEAST COMPOUND.

Charles W. Gschwind, Egg Harbor City, N. J.—This consists of boiled hops, scalded wheat flour, malt, sugar, ginger, rice flour, and middlings. It is well adapted for bread making.

IMPROVED STOVE COVERING.

Andrew J. Vandeventer, Martinsburg, Mo., assignor to himself and Archibald M. Vandeventer, same place.—The object of this invention is to improve the construction of the cook room refrigerator for which letters patent were granted to P. D. Vandeventer, November 8, 1870, to enable the cooking to be done with less fuel and with a more uniform heat. It consists in doors made in two parts, and with their adjacent edges overlapping each other, and at such a distance apart as to leave spaces between them for the entrance of cold air.

IMPROVED CLOTHES DRYER.

David J. Clark, East Elma, N. Y.—This consists of a series of horizontal bars, which are connected at their ends by cords, and provided with wires, for the suspension of the clothes beneath the bars. The latter are capable of being folded together or extended, and may be supported upon frames resting on the ground.

IMPROVED STOVE.

Charles R. Sipes, Arkansas City, Kan.—This relates to improvements on a class of stoves known as the "Tod" stove, by which the objectionable escape of the smoke in the same, when the doors are opened, may be avoided. There is an additional flue and damper at the highest part to prevent the escape of smoke on opening the door, and a swinging foot rail hinged to the lower part of the stove.

NEW AGRICULTURAL INVENTIONS.

IMPROVED WHEEL CULTIVATOR.

William N. Riddle, Caddo Grove, Texas.—This improved wheel cultivator is so constructed that it may be readily adjusted for use in marking the ground, covering the seed, and cultivating the plants. It is simple in construction and reliable in operation in either capacity.

IMPROVED COTTON CHOPPER.

Theodore C. Burnham, Burnet, Tex.—The essential feature of this improved cotton chopper is a contrivance of choppers on vertical rock shafts, with a cam wheel attached to one of the truck wheels, for closing them, and a spring for opening them, upon the row of plants, for chopping them out.

IMPROVED CHURN.

Sylvanus B. Robison, Allenville, Mo.—This churn may be readily put into place and detached, and the gear wheels may be readily adjusted to take up the wear.

IMPROVED BUTTER TUB.

James E. Higgins, Holland City, Mich.—This is a device for fastening covers to pails, and other similar packages, by means of a jointed hasp attached to the cover, which shuts over a staple in the pail, and a wedge placed between the hasp and cover.

COTTON FEEDER AND CLEANER FOR COTTON GINS.

George F. Colquitt, Bremond, Tex.—This invention has reference to devices for feeding seed cotton to cotton gins, and also for cleaning the same preparatory to ginning; it consists of a hopper having wires extending from side to side over a revolving toothed cylinder and a concave thrasher. It is made to reciprocate on a track by pinions on the ends of the thrasher cylinder, working in double rack bars, one in each side of the hopper, so contrived that the pinions run them over one way and under the other, making a simple and cheap mode of obtaining the motion.

IMPROVED GRAIN SEPARATOR.

William Holladay, Blairstown, Iowa.—This invention consists of contrivances for separating the light coarse matters, and also the dust, before the grain goes on to the sieves, and conducting them away in a tube out of the room containing the mill. By separating the straw, etc., before coming to the sieves, the capacity of the mill is greatly increased, in consequence of the sieves not being choked by such matters. The blast can be wholly turned on either device, or partly on both; there is a contrivance whereby a blast may be applied, by suction, to the grain as it passes off from the screen for separating light grain and like matters, not separated by the mill proper.

IMPROVED GRAIN ELEVATOR FOR HARVESTERS.

Ebenezer McFadden, Sparta, Ill.—This is a contrivance of the teeth, the apron, and the rollers which work the apron, for allowing the teeth to swing back automatically to pass the trough into which the grain falls, and in like manner take the required position for taking up the grain.

IMPROVED SULKY PLOW.

John W. Grimes, Appleton City, Mo.—This invention is an improvement in the class of sulky plows in which the plow proper is suspended from the wheeled frame in such a manner as adapts it to be raised and lowered at will, for the purpose of changing the depth of furrow, or for holding the plow entirely off the ground while being transported from one place to another. The improvement relates particularly to the construction and arrangement of parts, whereby the plow beam is held steadily while in use, adapted to be raised and lowered bodily, by means of a single lever, while in operation, and without changing the horizontal position or angle of the plow beam, and whereby the draft is applied in a direct line with the plow beam, whatever be its adjustment.

IMPROVED REAPER.

Solomon Rawson, Scott Thacher, and Isaac Rawson, Hornellsville, N. Y.—This invention relates to certain improvements in reapers for harvesting grain, and it consists mainly in making the platform and sickle-driving mechanism together, adjustable on the main frame, in raising and lowering the sickle, by pivoting the tongue to the main frame, just below the bearing or the main drive wheel, whereby the sickle and its driving mechanism are geared directly together without the intervention of a joint, and whereby also the draft is more in a line with the sickle. It also consists in the construction and arrangement of the devices for connecting and disengaging the sickle from its driving mechanism, and in the means employed for regulating the motion of the rake arms.

FERTILIZER DISTRIBUTER ATTACHMENT TO SEED DRILLS.

Lyman W. Shepard, Arcola, Va.—The invention relates to an improvement in the class of fertilizer distributers in which the material is fed through openings in the bottom of the hopper, by means of auger-shaped or spiral twist shafts. The improvement consists in the application of radial or curved arms to the feed shafts for the purpose of stirring or agitating the fertilizer and drawing it toward the feeders.

IMPROVED HORSE HAY RAKE.

Amos W. Coats, Alliance, Ohio.—This invention relates to certain improvements in horse hay rakes, and it consists in a cheap, simple, practical, and durable means of attaching a clearer for cleaning the rake teeth when elevated, the said clearer being held rigidly in an elevated position above the rake teeth upon supporting bars, projecting rearwardly from the driver's seat, and forming a part of the support for the same.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED GLOVE TREE.

John B. Stevens, Littleton, N. H., assignor to Nelson Parker, of same place.—This invention is a glove tree, made double or in duplicate, the wrist portions of the two different sized parts being joined together, so that the fingers project in opposite directions. The tree is made in sections, and a spring is placed between them to make the tree expansible and compressible. The invention also includes a sliding clamp for holding gloves while being drawn on the tree. For holding the glove on the table on bench, for inserting the tree, a vertically sliding hook plate is hooked into the mouth of the glove to clamp it on the bench, together with a foot treadle for pressing it down, and a spring for raising it.

IMPROVED MOTIVE POWER.

Adam Graner, New Orleans, La.—This invention consists in combining a drive shaft, counter shaft, and saw shaft, the latter provided with a roll arranged thereunder. The crank for turning the driving shaft, by hand, has a handle to which is attached a connecting rod, which, at the lower end, connects with a foot treadle, so that the operator may work with both. It is also proposed to apply these drivers to both ends of the driving shaft in practice.

IMPROVED WATER CUT-OFF.

Charles O. Wilson, Cincinnati, O.—This consists of a cap in combination with a crank, so applied to the cut-off pipe as to bring the mouth of the pipe squarely over the outlet, and make the communication and non-communication with the outlet perfect.

IMPROVED BARBED FENCE WIRE.

George W. Allen, Creston, Ill.—This is an improved barb for wire fences, so constructed and applied to the fence wire that it will keep its place firmly and securely, and will not slip or turn. It consists in a fence barb formed of two short pieces of wire placed parallel with each other upon the opposite sides of, and at right angles with, the fence wire, and having their end parts twisted together, leaving their points projecting.

IMPROVED RAILROAD TRACK LIFTING MACHINE.

Robert Aldred, Glencoe, Ontario, Canada.—This machine consists of a truck adapted to run on the rails, and having clamping jaws or hooks, with which the rails may be seized and raised by levers suitably arranged for the purpose. The entire apparatus is simple, and apparently effective for the purpose.

IMPROVED DISCHARGING CAR.

James W. McDonald, Campbellton, New Brunswick.—This invention relates to a novel construction of cars, designed for distributing gravel and broken stone upon railroads for the purpose of ballasting the same while under process of construction. It consists in a car provided with a supplemental frame, carrying polygonal rollers at the ends, around which passes a continuous, endless belt of sheet or plate iron, which forms the upper surface of the car. This belt is provided with a detachable connection with the running gear of the car, by means of which it is set in motion at the proper time, and the supported load is evenly distributed at the end, a second endless belt being arranged at the end transversely to the car, and inclined to the earth so as to receive the gravel and stone and carry it from its own gravity to one side of the track whenever it is desired to fill in the road bed upon the side.

IMPROVED APPARATUS FOR CONDENSING STEAM.

William Walker, Manchester, England.—This invention is embodied in a cylinder or vessel having a valve for regulating the admission of water, a flexible (rubber) button, or diaphragm, a water supply pipe at the top, a stationary perforated spray plate, a water eduction orifice near the bottom, and a steam induction orifice directly beneath the spray plate. The amount of water admitted to condense the steam, by spraying through the perforated plate, is controlled by the valve whose rod is attached to the flexible diaphragm, and hence rises or falls as the latter is caused to bulge in or out. The object of the latter is to prevent the vessel being completely filled with water when the pump is running at either high or low speed, as the case may be, so as to ensure a vacuum in the vessel, which may be supplied by the exhaust steam.

IMPROVED MACHINE FOR TWISTING HAY FOR FUEL.

James S. Foster, Yankton, Dakota Ter.—This invention is an improvement upon that for which letters patent, No. 180,218, have been granted. It relates chiefly to the combination of a rotating hook, a sliding extensible frame, carrying the fixed or non-rotating head, and devices for locking said extensible frame and the rotating head when required in the operation of the machine. The machine forms a double twist of the hay or straw, which is compact and hard, so that it constitutes a good article of fuel, and is particularly serviceable as such in districts where wood and coal are scarce and dear.

RAISING AND LOWERING PROPELLERS.

Benjamin Mitchell, Hancock, Md.—This invention relates to means for raising and lowering the propellers of canal boats, so as to cause them to work equally well whether the boat is loaded or not. The invention consists in a propeller shaft supported in side plates and raised by adjustable hangers; in an auxiliary plate at the outer bearing, that moves with the bearing plate so as always to cover the slot in the latter and prevent the ingress of water. It also consists in a plate that simultaneously slides and revolves to close the slot in the fixed plate, in which the inner bearing moves, the pinion being adapted to be operated by the same drive wheel, in whatever position it may be placed.

IMPROVED MACHINE FOR BOTTLING AERATED WATERS.

George Wenker, St. Joseph, Mo.—This is an improved machine or pump for manufacture of soda and mineral waters, by which the exact quantity of sirup to be used in bottling may be measured for each bottle. It consists of a barrel with adjustable piston and valve, in connection, with a three-way cock for the sirup and aerated water pipes, and a swinging handle lever that opens and shuts the bottle.

MACHINE FOR TWISTING HAY AND STRAW FOR FUEL.

James S. Foster, Yankton, Dakota Ter.—In using the machine, a handful of hay or straw is placed in a box and its ends are secured to the heads by clamps. The crank is then turned; and as the hay and straw is twisted, its contraction draws one head and frame inward. The movable half of the box is folded over upon the stationary half, doubling the twisted hay, which is afterward allowed to twist itself into a wisp.

IMPROVED ELEVATOR.

Thomas K. Austin, New York city.—This consists in the arrangement of elevators working on guides in wells or shafts, provided at the front and rear of the building. The said elevators are connected above and below by ropes or chains, in such a manner that they may counterbalance each other, and are each provided with gearing, which can be operated by one or more persons on the elevator, to raise or lower it, as may be desired.

IMPROVED GATE LATCH.

Cirby J. Wallis, Troy Station, Tenn.—The latch has a curved rear arm, which is extended to a suitable length beyond the pivot to give the required weight for producing automatic locking. When the latch is applied to doors that are to be opened from both sides, knobs are arranged in connection with a lever that serves to raise the latch by turning either knob.

IMPROVED WEIGHING SCALE.

Hosea Willard, Vergennes, Vt.—The object of this invention is to contrive a lever and beam scale in a simple way that will allow of being suspended for use, and at the same time will be efficient in operation. The weight hook pivot is connected adjustably to the beam lever, and provided with a shifting screw to set the scale for net or gross weight. And there are other ingenious devices well suited to the ends in view.

MACHINE FOR SHAPING GRAIN CRADLE FINGERS.

Andrew Denney, Beverly, O.—This consists of a disk having a groove in the face, corresponding in form to one half the cross section of the finger, with a number of radial notches, in each of which is a cutter having a notch of corresponding form. The cutters are bolted to lugs of the disk projecting from its sides. The disk is made to revolve against the blank, which is first dressed on one side and then on the other.

IMPROVED TIME LOCK.

John B. Overmyer and James A. Huston, New Lexington, O.—This consists of a time piece having a screw connected with one of the posts of the time mechanism, to be turned thereby. On the screw is a nut, which is made to operate the releaser, which lifts the stop from behind the bolt of the lock, the screw being geared to the time piece by friction devices, and having a thumb disk to facilitate the setting of the nut. A graduated scale is arranged in connection with the nut, by which to set it to release the bolt in any predetermined length of time.

IMPROVED CAR COUPLING.

Hiram Pitcher, Fond du Lac, Wis.—This consists of a double coupling hook, that is hinged to the drawbar and united at the front part, to lock over the side extensions of the drawbar to be coupled. The double hooks are raised or lowered by rods extending to the top or side of the car.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Pat. Att'ys & Experts wanted everywhere, to Coll't Millions. Good pay. Add. Am. Pat. Coll'n Co., Phila., Pa.

Agricultural Implements and Industrial Machinery for Export and Domestic Use. R. H. Allen & Co., N. Y.

John McDonald (formerly of Kingston, Jamaica) will please address Geo. B. Lundy, Balmoral, Ontario, Ca.

A Responsible Patent Right Manager Wanted—Carriages and R. R. Cars can be run without oiling. Address or call on Geo. Beck, Charlotte, Monroe, Co., N. Y.

Adjustable Screw Wrenches (Monkey Wrenches), equal to the best in strength and utility. Mailed, post paid, viz.: 6 in., 60c.; 8 in., 75c.; 10 in., 90c.; 12 in., $1; 15 in., $1.50. E. H. Bawley, New Haven, Conn.

Pattern Makers can get Metallic Pattern Letters, to letter patterns, of H. W. Knight, Seneca Falls, N. Y.

Wanted, to take charge of Shop, a good Machinist who can invest $2,000 in the business. Address, with reference, N. Upham, Agent, Athol, Mass.

Models for Inventors. H. B. Morris, Ithaca, N. Y.

Wanted to Buy Patents of Saleable Articles in Iron or Brass. Address, with particulars, "Star," 245 North 8th St., Philadelphia, Pa.

Jethro Wood.—If any of our readers can send or refer us to any publication containing a portrait of Jethro Wood, the plow inventor, we should be obliged. Munn & Co.

For the cheapest and best Small Portable Engine manufactured, address Peter Walrath, Chittenango, N. Y.

Amateur Scroll Saws, the best.—Address, with stamp, Trump Bro's, Wilmington, Del.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Ramsey & Co., Seneca Falls, N. Y., U. S. A.

Drops for Sale—Very Cheap—One each 250 & 400 lb. Peck Drops—perfect order, with lifters, &c., suitable for sheet metal stamping. Hull & Belden Co., Danbury, Ct.

Linen Hose, Rubber lined and unlined, for factories or fire engines, at lowest rates. Greene, Tweed & Co., 18 Park Place, New York.

Baxter's Adjustable Wrench for first class Mechanics, 62 cents each. Sent by mail on receipt of price. Greene, Tweed & Co., 18 Park Place, New York.

See Boult's Paneling, Moulding, and Dovetailing Machine at Centennial, B. 8-55. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

M. Shaw, Manufacturer of Insulated Wire for galvanic and telegraph purposes, &c., 259 W. 27th St., N. Y.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water Street, New York.

Pat'd Graining Stencils—J. J. Callow, Clevel'd, O.

Lathe Dogs, Expanding Mandrels, Steel Clamps, &c., for Machinists. Manufactured by C. W. LeCount, So. Norwalk, Ct. Send for reduced Price List.

Dynamo-Electric Machines for electro-plating and other purposes. Send for illustrated circular. W. Hochhausen, 132 William St., New York.

"Abbe" Bolt Forging Machines and Palmer Power Hammers a specialty. Send for reduced price lists. S. C. Forsaith & Co., Manchester, N. H.

400 new & 2d hand Machines, at low prices, fully described in printed lists. Send stamp, stating just what you want. S. C. Forsaith & Co., Manchester, N. H.

Driving Belts made to order, to accomplish work required. Send full particulars for prices to C. W. Arny, 148 North Third St., Philadelphia, Pa.

Scientific American—The early Volumes for Sale—very cheap—either bound or in numbers. Address A. F. R., Box 773, New York City.

Hydrant Hose, Pipes, and Couplings. Send for prices to Bailey, Farrell & Co., Pittsburgh, Pa.

Machine-cut brass gear wheels, for models, &c. List free. D. Gilbert & Son, 712 Chester St., Phila., Pa.

"Dead Stroke" Power Hammers—recently greatly improved, increasing cost over 10 per cent. Prices reduced over 20 per cent. Hull & Belden Co., Danbury, Ct.

Power & Foot Presses & all Fruit-can Tools. Ferracute Wks., Bridgeton, N. J. & C. 27, Mchy. Hall, Cent'l.

Shingles and Heading Sawing Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Steel Castings, from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

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

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon, 470 Grand Street, New York.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Temples and Oilcans. Draper, Hopedale, Mass.

Notes & Queries

W. C. W. will find directions for purifying his cistern water on p. 395, vol. 32.—R. C. C. will find a description of an incubator on p. 273, vol. 33.—E. F. Y. can waterproof his boots by following the directions on p. 154, vol. 26. Wire will do as well or better than string for the two cent telegraph.—G. P. A. will find a recipe for a durable paint for iron on p. 319, vol. 31.—W. R. H. is informed that a steam derrick is commonly used for raising a sunken ship.—A. P. M. can clean light leather shoes by the process described on p. 68, vol. 34.—W. C. M., J. C. L., J. H. D., E. L., R. R., J. H. P. & Co., S. & E., and many others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) F. McA. says: 1. I have produced colors from a certain bug, and I have also procured a color from the gum of the fir tree. How can I tell whether they are dyes or not? A. Treat them with the various solvents, such as water, alcohol, acid liquids, alkaline solutions, etc., until you discover the proper solvent. Then experiment with the solution obtained on woolen and other goods with the various mordants. 2. How can I separate nitric acid from a mixture without altering the nature of the mixture? A. You fail to state with what the acid is associated. It is necessary to know this in order to answer your question.

(2) J. W. and others.—We do not think that feathers are generally injured by steam heating. We believe this method is considered one of the best ways of purifying feathers.

(3) A. S. asks: 1. Is a person liable to get the hydrophobia from having been bitten by a dog entirely free from it? A. No. 2. How soon does it make its appearance? A. Sometimes years elapse, but it is oftener developed in a few days or weeks. 3. What are its first symptoms? A. It is characterized, as its name implies, by a singular loathing for water, also by violent spasms of pain in the spinal column and brain.

(4) J. W. W. says: A friend contends that whisky, brandy, etc., increase in strength after they are three years old. I contend that they continue to decrease as long as there is any spirit remaining. Which is correct? A. As far as we have observed, the liquors, if kept in barrels, decrease constantly in the percentage of alcohol by evaporation and otherwise.

(5) J. E. F. asks: What can I mix with cotton seed oil, as a substitute for boiled oil in paints, and to make it act as a dryer? A. Litharge.

(6) A subscriber asks: Is it possible for an iceboat sailing in any direction to sail faster than the wind? A. Yes. On smooth ice, sailing at the proper angle, ice boats often move much faster than the wind. The wedge principle is involved. For example: a wedge two inches square at the head, six inches long, sloped on one side to point. If such a wedge be introduced between two sufficiently strong bodies, one of which is fixed, the other movable against the sloping side of the wedge: if sufficient force is applied to the movable body, it will expel the wedge, which latter must move six inches, during the same time that the impelling body moves two inches. The ice boat sail is the wedge, ice the fixed body, wind the force acting against the sloping side of the wedge.

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

J. M. N.—It is clay containing a large percentage of carbonate of lime.—E. W.—It is an trilobite, found in the older fossiliferous rocks. It was long supposed to be an insect fossil, but it was at length ascertained that it corresponded most nearly to the living genera of crustaceans, the [illegible] men appears to be brown coal.—H. & J.—The specimen of clay is of unusual purity, and gives a very clear porcelain.—G. H. S.—Nos. 1 and 3 are magnetic oxide of iron (lodestone). No. 2 is spiegeleisen, a carburet of iron with manganese.—R. C. J.—Your sample appears to be a scrap of spiegeleisen—a carburet of iron.—F. T. M.—The water contains a considerable quantity of carbonate of iron in solution, which, on exposure to air, is precipitated by the escape of the carbonic acid with which the water is charged. The sediment consists of hydrated sesquioxide and carbonate of iron, together with some carbonate of lime. The water will be improved by the addition of a little lime water—not too much.—R. Y. G.—It is an impure clay containing iron. It might be employed for the purpose you mention. There is an alloy commonly known by the name you mention.—We have received a slate pencil box, not labeled, containing a number of pieces of granite, gneiss rock, and hornblende.

J. A. P. asks: In making fruit butter, etc., I am anxious to know if the dried fruit is wholly used, or is there a mixture of both dried and fresh? Is it ground, or reduced by boiling, etc.?—A. R. asks: Can any one inform me of the process of making lager beer?—P. McS. O'F. asks: What purpose does the two-fold division of the back and belly of a violin serve? Is the belly carved or scooped out to the proper shape, or is the material steamed and then compressed to the required shape?—J. N. J. asks: How much does a wagon axle need to be set under, and why should not the under side be straight or level as it lays in the box? Does the concavity of the wheel make any difference as to the setting of the axle? Is not a straight wheel better and stronger than one that is concave?

COMMUNICATIONS RECEIVED.

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

On the Moon's Longitude. By J. H.
On Working Men's Education. By A. S.
On Weight on and in the Earth. By H. A. H.

Also inquiries and answers from the following:

G. F.—L. H.—H. T.—F. T. H.—E. C. W.—W. C.—C. C.—C. F. S.—J. E. K.—F. E. H.—M. D. H.—G. T. W.—J. F. C. G.—V. T. B.—G. W. P.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells friction match making machinery? Whose is the best railway ticket printing machine? Why do not makers of telegraph batteries advertise in the SCIENTIFIC AMERICAN? Who sells the best carriage varnish?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

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

August 1, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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

Air brake relief valve, C. Chadwick 180,469
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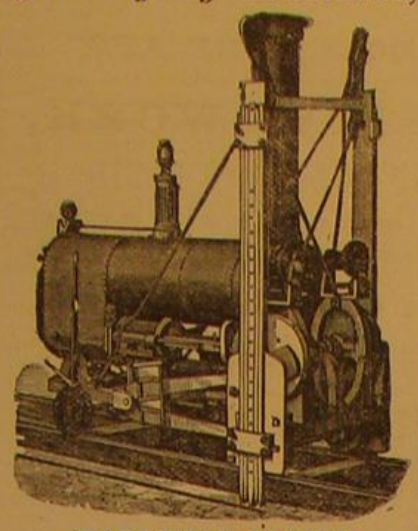
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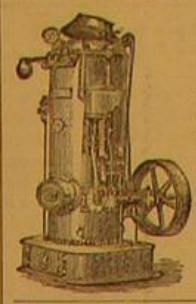


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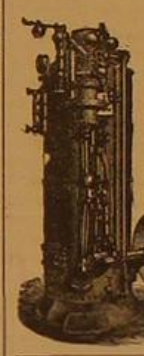
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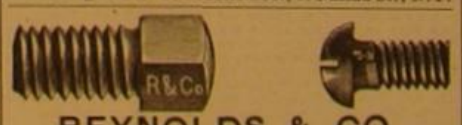
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THE VALIDITY OF PATENTS.

The inexperienced purchaser of a patent does not generally appreciate the importance of having its claims examined, and their validity and scope defined by some person experienced in such matters, before parting with his money. It is not unusual for the assignee, just as he is commencing the manufacture of articles under his recently purchased patent, to find that it is an infringement upon some previously issued patent, and that he has not only made a worthless investment, but that he is likely to get mulcted in damages if he proceeds with his manufacture. Cases are continually coming to our knowledge wherein parties have made purchases in good faith, and paid considerable sums of money on the assurances of the patentee and a mere glance at the patent, presuming that all that the drawing of the invention showed was protected by the claims, when, in fact, the point covered was almost infinitesimal. Another manner in which purchasers are sometimes deceived is that the claims, although broad enough and worded properly to cover the invention, contain a single element protected by some prior patent, which covers the very part in the new machine which is necessary to insure its efficiency. The Howe sewing machine patent illustrates this. It protected but little that any of the manufacturers cared to use, except the one small part essential to all sewing machines; and all manufacturers had to pay Howe a royalty, and he derived from that apparently trivial item an immense income.

We therefore recommend any person who is about to purchase a patent, or about to commence the manufacture of any article under a license, to have the patent carefully examined by a competent party, and to have a research made in the Patent Office to see what the condition of the art was when the patent was issued. He should also see that the claims are so worded as to cover all the inventor was entitled to when his patent was issued; and it is still more essential that he be informed whether it is an infringement, as above suggested, or not. Parties desiring to have such searches made can have them done through the Scientific American Patent Agency, by giving the date of the patent and stating the nature of the information desired. For further information, address MUNN & CO.,
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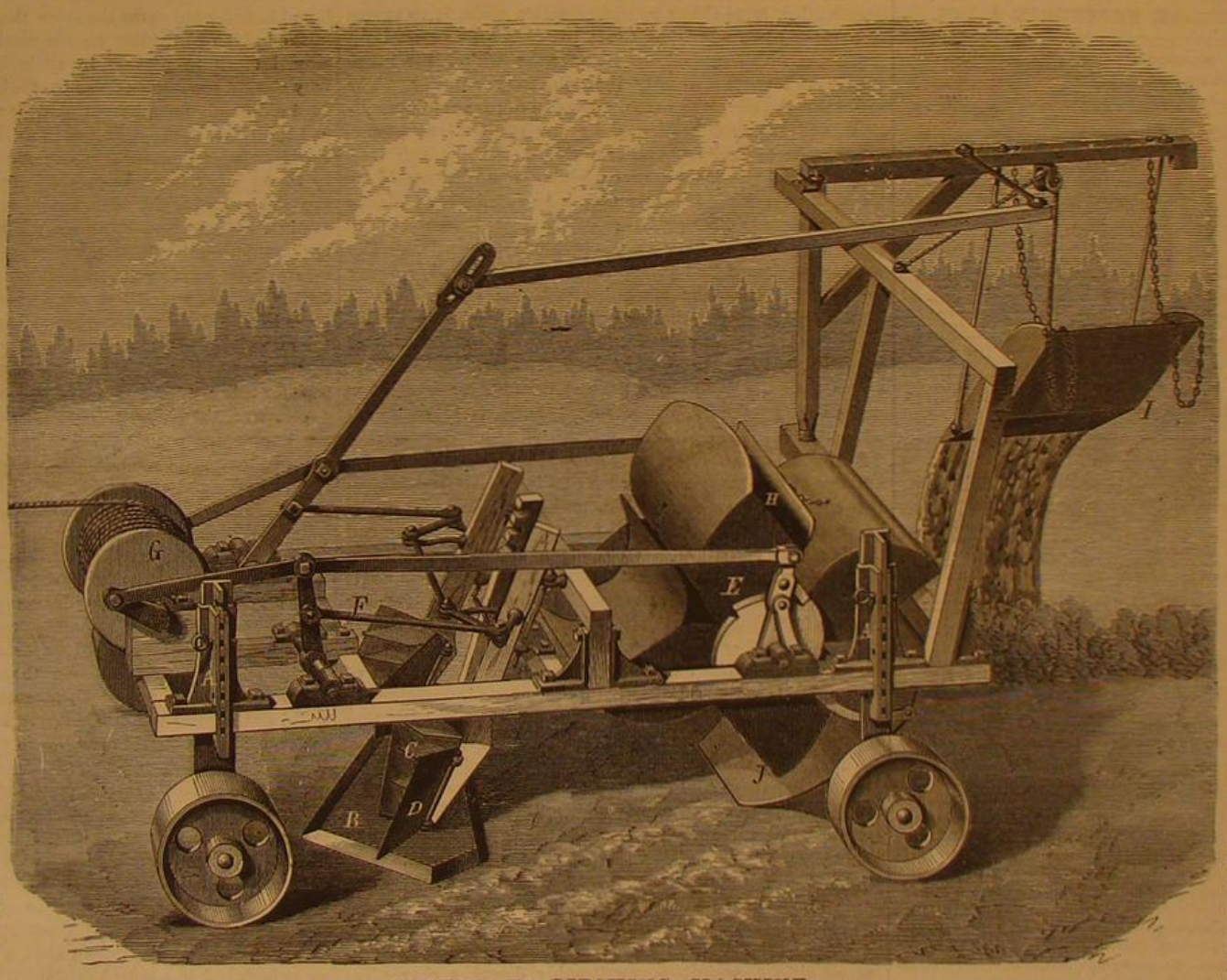
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IMPROVED DITCHING MACHINE.

The improved apparatus illustrated in the annexed engraving can be constructed of any size, and hence may be used for ditching, dredging, or for railroad embankment making and leveling. It can be operated either by animal or by steam power, and is so designed as to perform the triple motion of a ditching hand. The earth is cut down and loosened by the cutters and scrapers, then taken up by the buckets, and is received therefrom by the vibrating pan.

The frame of the machine is supported on wheels, which are pivoted to lower ends of rack bars, A, which slide in guides and are secured by pins passing through their notches, so that the apparatus can be readily lowered as the depth of the ditch increases. The slice of soil to be raised is separated by the plow, B, the standard of which is notched or perforated, and works in guides, so that it may be secured to adjust the plow to work deeper or shallower in the ground. In order to loosen the soil above the plow, colters, C, are provided, attached to an oscillating block, the latter also having hinged to it scrapers, D, which are curved forward and backward, so as to scrape off the soil from the forward end and sides of the ditch and throw it back so that it will be taken up by the buckets of the ditching wheel, E. The scrapers are supported to their work by a spring attached to the oscillating block. Said block is moved by the joint levers, F, which by suitable cranks communicate with the drum, G, which is turned by a rope unwound from it by the team pulley in the direction in which the machine moves. It will also be observed that, by a simple assemblage of jointed levers and pawls, the bucket wheel, E, is rotated so as to scoop up the earth and (by the tilting spoon, H, which is in each bucket) to deliver it to the pan, I. Said pan causes the spoons to be thrown out by being swung in so as to arrest the edge of each successive spoon in passing. The spoon in turn throws its load into the pan, which, by a series of levers, also connecting with the drum, moves out and back during two movements of the bucket wheel, so that a bucket is presented to the pan each time it moves back.



GONELLAZ'S DITCHING MACHINE

At J is a shovel, which is so arranged as to be drawn forward at each movement of the ditching wheel to scrape up any soil that may be dropped or missed by the buckets. As the earth accumulates on the shovel, the bucket wheel, in its revolution, scrapes it off. The machine is ingeniously constructed, and embodies many useful devices. It was patented through the Scientific American Patent Agency, April 4, 1876. For further information, address the inventor, Mr. Hyacinth Gonellaz, Vermilionville, Lafayette Parish, La.

Zinc as an Anti-Incrustant.

We have already noted numerous reported cases wherein pieces of zinc, inserted in steam boilers, seem to have prevented incrustation or scale. Some further and more extended investigations into the subject have recently been carried on by Messrs. Bruckmann & Son, manufacturers at Heilbronn, Germany, and the results given point strongly to the efficacy of the metal introduced.

In the first experiment, 66 lbs. of zinc, in the shape of shavings and small fragments, were inserted in a boiler of 307 square feet of heating surface, having, besides, two new superheaters. At the end of six weeks there was formed in the boiler a muddy, white-gray mass, easily withdrawn by a sheet iron shovel; and water forced in by a hand pump sufficed to render the interior of boiler and heaters completely clean. The iron of the latter retained its black color, and in the boiler not a trace of former incrustations was visible. The zinc had entirely disappeared, with the exception of a little *débris* in a state of disaggregation, and this remained in the locality where the mass had previously been deposited.

A second experiment was then made on a larger boiler, with but 37 lbs. of zinc, and at the end of four weeks the deposit was easily washed out. The third experiment was made on the boiler first mentioned, using well water, which was very hard and rich in calcareous matter; 57 lbs. of zinc were used. Formerly this water produced the hardest kind of scale, which almost defied hammer and chisel. After four weeks' running the boiler was opened and merely a few easily detachable bits of lime were found. A part of the zinc was still in its normal state, and seemed fully capable of protecting the boiler for from two to four weeks longer. An average of several experiments shows that about 2·2 lbs. of zinc scrap per month and per horse power is the proper proportion. This, however, must be increased or diminished with reference to the known composition of the feed water.

Wages in England.

Complaints regarding the inflated state of wages in England are becoming both bitter and frequent. At a recent meeting of the Manchester, Sheffield, and Lincolnshire Railway Company, the chairman said that at the present day the cost of mining coal in Great Britain is 15 per cent higher, as a matter of wages, than it was eight or nine years ago. He pointed out that the English iron trade is seriously affected, and that it is now impossible for it to compete in American or other markets of the world. He further stated, however, that the diminution of wages paid in England was already nearly $10,000,000 weekly, and expressed the hope that, after another year of such discipline in the way of financial stress, England, by reducing the inflation of wages and doing more work, would outbid all other producers in the world in the cheapness of her products.

Novel Folding Scissors.

Many travelers who return from abroad bring home to their friends, as a novelty, a pair of folding scissors. But travelers can no longer astonish their friends with this novelty, for Marx Brothers, of 430 Broadway, New York city, are manufacturing, under patent issued May 28, 1872, a superior quality of folding scissors, which are five inches long when in use, but fold into a length of two and a half inches for the pocket, highly finished and neatly put up in leather cases, which they offer in competition with the imported articles

Walking in the Fiery Furnace.

In London, on August 8 last, experiments were made in the grounds of the Alexandra Palace with an extraordinary invention, by which results somewhat analagous to those recorded as miraculous in Jewish history were achieved. Mr. Oersberg, a Swedish mechanician, claims to have invented, and Captain Ahlstrom, a compatriot, to have matured and fitted for practical use, a dress which will enable the wearer to dash with impunity into the fiercest fire for the purpose of saving life and property. At the east end of the Palace, between the circus and the banqueting hall, huge piles of old dried wood were heaped up, intersected by narrow avenues, and the wood was drenched with petroleum. The consequence was that, the moment a light was applied to the pyre, the whole blazed up with a flame so fierce, and sending forth a heat so intense, that the thousands who had gathered around to witness the scene were forced to retire to a more respectful distance. The sun's rays, which had hitherto been inconveniently felt from above, were quite forgotten in the glow which now flamed up from below, and it really seemed as if there was malice in the tongues of fire that spat out on every current of passing air. Standing 40 yards to the windward of this fierce fire, the heat was all but intolerable; and even the firemen of the Palace brigade, under the command of Captain Archer, the chief officer, were fain to give a wide berth to the burning center. Then it was that Captain Ahlstrom, clad in a dress not at all unlike that worn by Captain Boyton when he paddled himself across the Straits of Dover, made his appearance on the scene. His costume consisted, so far as it was possible to ascertain, of an overcoat of fustian, covering an inner garment of wool and felt. Between the two skins, so to say, is a network of veins, through which are pumped continuous supplies of air and water, the main air tube, before it reaches the body, being enclosed in the larger water tube, and by such means kept perfectly cool. The escape for the cool air is through orifices in front of the face, and the current so made forces back the flames, and leaves perfect breathing space. Assurance was given that the clothing itself is in no way chemically prepared, and is simply protected against the action of the flames by the torrents of water that pour over the man from head to foot. With the greatest possible nonchalance Captain Ahlstrom walked into and through the fiery furnace, not only free from discomfort, but apparently with enjoyment. After spending about ten minutes in about the warmest climate it is possible to imagine, enveloped at times so as to be hidden by flames, he carried out a chair which was on fire, sat coolly down upon it, and, to the amusement and astonishment of a crowd of spectators, smoked a cigar.

New Artesian Well, Charleston, S. C.

A new artesian well is in progress and has now reached a depth of nearly three hundred feet. The drills are still digging their way through the eocene marl of the Ashley River beds, and at a depth of two hundred and sixty feet a stratum of silicious rock, about three feet in thickness, was struck and passed through without much difficulty. In this stratum are found millions of little microscopic shells, which are almost invisible to the naked eye, but upon being viewed through a magnifying glass are clearly seen as beautiful nautilus-shaped shells, perfect in formation and color. The work is creating much interest, and numbers of scientific gentlemen visit the well every day for the purpose of inspecting the fossils.

Scientific American.

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THE GREEN FIELDS OF THE MOON.

When the moon is at the full, the unassisted eye readily distinguishes on her face certain dark gray spots more or less sharply separated from the brighter portions. Through the telescope these spots appear as broad level spaces, resembling terrestrial seas. Indeed the earlier observers mistook them for seas, and by that name (Latin, *mare*) they are known to this day. They are not seas, however, but ancient sea beds, now probably nearly, if not quite, destitute of water: vast arid basins like the Sahara, or the great interior Utah basin of our own continent.

Examined more closely, these dried-up sea beds—to which Nelson applies the irregular but convenient plural *mares*—are seen to have a rolling surface like some of our western prairies, or to be traversed by numerous long ridges, resembling the wave-like sand hills which give so marked and peculiar an appearance to the deserts of Western Australia, the leveler portions being dotted with low mounds interspersed with small crater pits. In many places formations of an apparently alluvial character abound, while the ancient coast lines show distinct traces of water action. Two of these lunar plains—*Mare Humorum* and *Mare Chrisium*—are walled in completely by lofty mountains, presenting stupendous precipices to the vanished sea. The larger mares are more like ocean beds. They run together as terrestrial oceans do, and sometimes merge into the brighter continental regions, without a distinct line of demarkation. In other places they show a rugged coast line, rising into cliffs and peaks, and pierced at times by valleys and ravines.

One of the most conspicuous of these lunar ocean beds, also one of the deepest, is known as the *Mare Serenitatis*. Its area is nearly 125,000 square miles. Within its dark gray border, from thirty to eighty miles wide, is an extensive inner plain which at times presents a fine clear light green tint with a central streak of pure white, the green area lying lower apparently than the gray exterior. The green tint is difficult to catch, except under favorable conditions, and is much weakened by the effect of numerous small white round spots and gray ridges.

Another of the moon's green plains was discovered by Mädler in the *Mare Humorum*, already mentioned. This is one of the smallest as well as most distinctly bordered of the dark gray plains. Its area is 50,000 square miles. The greater portion of its interior is distinctly tinged a dusky green, sometimes very marked, affording a strong contrast with the pure gray of the borders and high enclosing ridges. On the west the green area extends nearly to the edge of the mare, but elsewhere, as in the *Mare Serenitatis*, it is separated from the border by a narrow darker gray fringe, except on the northwest, where the gray and green areas merge insensibly into each other.

Still another area of green is observed in the *Mare Chrisium*, one of the most conspicuous of the moon's dark plains. It is completely enclosed and is, perhaps, the deepest of the lunar *mares*. Its area is 78,000 square miles. Its general tint is a gray mixed with an unmistakable tinge of green, especially under high illumination. This verdant hue is seen to best advantage for several days before and after the moon is full.

These and other color changes on the face of the moon—as, for instance, the darkening of the great ring plain of Plato with increasing light, and like changes in certain long winding lunar valleys—led Beer and Mädler to suggest that they would indicate vegetation, were vegetation possible on the surface of the moon. But having accepted Bessel's conclusion that there could be neither air nor water on the lunar surface, and consequently no life, those much respected selenographers could not entertain the hypothesis of lunar vegetation, however strong the evidence might seem.

But Bessel's opinion, as our readers already know, is inconsistent not only with the conditions on which he based his calculations, but also with the results of more recent studies of the state of the moon's surface. So far from being an airless, waterless, unalterable desert, a changeless mass of dead matter, like so much volcanic scoria, the moon is now known to have an atmosphere of considerable volume and density, to present abundant evidence of physical activity and change, and to have in all probability water enough to make life easily possible on its surface.

The moon is dying, but very far from dead. Being so much smaller than the earth, it has run its course more rapidly, but is still a good way off from that goal of ultimate deadness to which so many astronomers have theoretically assigned it. There is not the slightest adequate evidence, Neison says, of the popular view, and "its truth would be admitted by no astronomer who had devoted sufficient attention to selenography to enable him to thoroughly realize the probable present condition of the moon."

Such being the case, the hypothesis that the moon's green plains derive their color from vegetation ceases to be impossible or absurd. The evidence is not of a character to justify a positive assertion that the mythical man in the moon may have abundant pasturage for his cattle; but his case ceases to be absolutely hopeless when a thorough-going selenographer can say, as Neison does, that the moon may possess an atmosphere that must be regarded as fully capable of sustaining various forms of vegetation of even an advanced type; that it does not appear how it can justly be questioned that the lunar surface in favorable positions may yet retain a sufficiency of moisture to support vegetation of many kinds; and that in a very considerable portion of the entire surface of the moon, the temperature would not vary sufficiently to materially affect the existence of vegetable life.

Who can tell but that the aforementioned man in the moon may not follow the plan of the African tribe which Livingstone tells of, and keep himself and his cattle in extensive lunar caverns, where the temperature is uniform and water abundant; driving them forth upon these great green fields for a fortnightly feed when the sun is up for its long days and the grass in good condition? Jules Verne ought not to neglect so inviting a field of exploration.

WORKMEN AND THEIR TEACHERS.

For examples of the lack of definite knowledge upon simple practical subjects, by those who act as judges of workmanship, we need not look far. For instance, if we find in a mechanical newspaper a discussion on the proper manner of putting wheels upon axles, we shall perhaps read as follows "Make them parallel and bore the hole parallel." "We have tried that, and we had more wheels come loose than we do now when we put them in taper," says another. The truth is that "make them parallel" is correct *for good workmanship*, and "make them taper" is suitable for inferior workmanship. Who ever heard of a properly designed and constructed parallel axle becoming loose in its wheel, unless from a fracture of the one or the other? If the boring and turning were either out of parallel or out of round, if the tool marks were left too deep, or if the sizes had not allowed the proper amount for shrinkage or the hydraulic pressure, as the case may be, the parallel shaft will come loose; but these defects have no business to exist, and can only exist from a lack of either surveillance or practical knowledge on the part of those in charge of the work.

Another cause for the common ignorance of certain and accurate methods is the unwillingness of a great many of our expert mechanics to impart their knowledge to others. This undoubtedly exists to a deplorable extent, and we have heard it defended upon the plea that business men are not in the habit of bruiting to the world any advantages they may happen to possess in their business facilities; and why should mechanics do so in their business? This is indeed a difficult question to answer upon a business basis, and brings us to the main question, which is how to utilize the knowledge possessed by our most expert artisans, and, by imparting it to our apprentices for their guidance, make superiority and rapid workmanship the rule and not the exception. Much effort has been expended in this direction by various publications, but we regret to say that we very rarely find a book in a machine shop; and need we look far for the reason, which lies not in the backwardness of the press in utilizing the materials at hand, but in the quality of the materials themselves, which do not as a rule commend themselves to those they are intended to benefit? The reasons for this are that, as we have before remarked in these pages, we must look for the science of practice to those who are known from their practical skill; and this course we have endeavored to take in the SCIENTIFIC AMERICAN and the SCIENTIFIC AMERICAN SUPPLEMENT, which have drafted into their service the best known talent in each branch of practical education upon which they have treated. That our efforts have been appreciated is attested by the freedom with which the scientific newspapers of both the United States and of England have drawn upon our columns.

Of the importance of imparting to others the results of the experience of the skilled workman, we will cite the following: Some four years ago there was introduced, from England, a special tool steel, possessing the peculiarity that it did not require any hardening. It was however difficult to forge, since it would crumble to pieces if heated to more than a bright red, and also if hammered at a very low red heat. The writer was one of the first men in this country to try it, and found no noteworthy advantage possessed by it for light lathe or other work. It had no advantages, in fact, as a finishing tool, and but very few for such roughing purposes as the shop in which it was tried afforded. Its cost, too, being sometimes as great as that of ordinary tool steel, its use was not considered advisable. A year afterwards it became known that a certain printing press manufactory had adopted this steel, and had speeded up its machinery faster in consequence of the superiority of the new steel. A visit to the establishment failed to elicit from its manager any data or opinion; but first the speed and feed of some of the tools, communicated to the writer by workmen, disclosed that there was "nothing in it," as mechanics say, and a tool made of that steel and at the manufactory in question, lent by one of the artisans to the writer, showed upon experiment that its superiority was confined to heavy cuts on hard metal, circumstances sufficiently unusual to show that the steel was suitable for special purposes only; and hence it was no surprise to learn that its general use had at that factory been discontinued at a subsequent date. However, it was tried, at the suggestion of the writer, upon pulleys, by Messrs. Laffan and Edgar, of New York, who, finding it served excellently well, applied it to turning shafting, and they were so well pleased with its adaptability to their purposes as to adopt it and recommend it to others. On another occasion, the writer was requested to visit one of the United States navy yards to see the excellent results obtained from a certain brand of American tool steel, for which universal merits were claimed; but on inspection, he found the cutting speed on small work to be only about 25 feet per minute, and that on larger work to range between 9 and 12 feet per minute; so that in neither case was the duty obtained from the tools sufficient to form any criterion of their cutting value.

If we turn to written instructions, we shall find that for no kind of iron work is a speed of more than 25 feet per minute recommended, while in most cases 23 feet per minute is not exceeded. On small work, however, 35 feet per minute is easily attainable, and is by far the most economical. Two

out of every three "authorities" give the cutting speed for cast iron as being less than that for wrought iron, whereas the exact contrary is the fact. Now wherein does the fallacy lie? We have been asked that question by expert workmen, many times over, and we could find no reasonable answer, except that they did not properly forge or temper their tools. No doubt that, in many cases, defects in the shape of the tools may have had something to do with it; but be the cause what it may, one thing is painfully apparent, that the author of the information was ignorant of his subject: as ignorant as the mechanical correspondent who visited Sheffield in England, and came back and exposed his mechanical ignorance a few weeks ago by writing a long article upon the want of progressive ideas among Sheffield manufacturers, adducing as proof that they forged the blades of fine cutlery instead of rolling them, all unconscious of the fact that to the forging belonged a superiority of quality that can under no circumstances be attained by rolling processes.

IS RARE BEEF DANGEROUS?

For several years past hygeists and pathologists have been closely studying the progressive invasion of the *tæniodea* or tape worms in the human species, in order to discover all the causes which lead to the presence of these terrible parasites and the means of preventing them. While many vital points relating to the subject are still in controversy, it has been demonstated that we are attacked by the armed tænia (*tænia solium*) and by the non-armed tænia (*tænia medio canellata* or *inermis*), that the germs of these two entozoa are introduced into the intestinal canal through flesh food, and that the germs of the first usually come from pork and those of the second from beef and mutton. It has furthermore been pointed out, by M. Régnault, that, while the number of attacks of the armed tænia has not notably augmented, those of the non-armed worm are becoming more and more frequent.

The cause attributed to this increase is first the therapeutic use of raw beef, and second, the habit of eating that meat, as well as mutton (the latter, however, in a less degree than the former), in a very rare state. Both beef and mutton contain morbific germs, which might well escape the scrutiny of a much more rigid inspection of market food than obtains here: and these, lodged in some organ of the body, speedily develope into the mature worm. Cooking the meat through thoroughly is a sure safeguard; but on the other hand, there are many who have no relish for well done beef or mutton, and, among the Germans especially, the meat is prepared in various ways without being cooked at all. We have frequently seen raw beef steak served and eaten with the simple accompaniments of pepper, salt, and vinegar. Butchers in New York city chop finely the good meat which is trimmed from joints or bones, and sell it in its hashed state, at a low price, to the poorer classes, who likewise eat it raw, and thus save the fuel required for cooking. As indicated above, physicians often prescribe raw meat to the weak and debilitated, and it is no very uncommon thing to see infants sucking tender pieces of raw steak. Of course all this is dangerous, and the fact, we have reason to believe, is not entirely unknown to those who favor the practice; but on the other hand, there is a general idea that if meat be cooked ever so little, merely warmed through, all peril is obviated. That this is a subtle error will be clear from a brief consideration of the cooking process.

The *rationale* of broiling is the subjection of a large surface of meat to a sudden high temperature. Coagulation of the exterior albumen succeeds, and the juices are prevented from escaping, so that they are cooked with the fibrous part of the meat, enclosed as it were between two shells. Roasting, or rather baking, as it is practised in this country, is virtually the same process, the hot oven being substituted for the coals. Frying accomplishes the same end by the action of highly heated fat. Boiling is just the reverse, as the heat in that case is applied gradually, so that the albumen can be coagulated uniformly through the mass. Now albumen coagulates at 142° Fah., and further heat reduces it to a firm transparent body, so that a piece of beef which is left "unbasted," that is, unmoistened, during the cooking process, and its exterior temperatures not thus kept down, or a steak allowed to cook slowly over a slow instead of a brisk fire, is likely to become encased in a close crust, not inaptly termed "leathery," which tends to prevent the further penetration of heat. It will readily be perceived that thus, although the meat has been subjected to cooking a proper length of time, and although its exterior may appear overdone, a part of its interior may be practically raw, and may never have reached the temperature of 140°, beyond which it has been proved germ life cannot exist. Hence, in such portion of the meat thus prepared, the germs are none the worse for their warming, and enter the body in an active state.

It does not follow, however, from this that we are to interdict that most noble of all dishes, the rare cut of sirloin, but it does follow that we should exercise some greater care in its preparation. And in this respect we have a very safe and simple guide in the two temperatures noted above, or rather in their close approximation. Everybody knows the difference in color and general appearance between meat nearly raw and meat cooked, and is capable of observing the glairy, flabby condition of the former as compared with the firmness of the latter. In one case the albumen has not coagulated, in the other it has. But in the latter instance we know that a temperature of 142° has been attained, and that that is two degrees higher than the germ death point; hence we are thus rendered certain that the danger is obviated, on simple inspection of the condition of the meat, which still is rare enough to satisfy any healthy taste.

It is not difficult to perceive that the ravages of that other fearful parasite, of the hog, the *trichina spiralis*, have been the cause of greater care in the preparation of pork; and as the same thorough cooking which destroys the *trichina* likewise destroys the tænia germ, both evils are obviated at once. Hence we find another cause for the diminution in cases of armed tænia noted by Régnault, while the prevalent neglect of precautions regarding beef and mutton may likewise account for the spread of the affliction attributable to those meats.

It is a curious fact in this connection that a prominent French medical journal (the *Abeille Médicale*) strongly recommends horse flesh to be used raw therapeutically, and asserts that it is much more nourishing than either beef, mutton, or pork. We doubt whether this last assertion will meet with general acquiescence; but if it appears, as our contemporary states, that the horse is not subject to the parasitic affections common to the cattle now used as food, there can be no question but that, from a sanitary point of view, the food value of our superannuated chargers is greatly enhanced. At all events, for some reason the consumption of horseflesh in France is rapidly increasing, as recent statistics show that nearly 30 per cent more of the animals have been slaughtered, for the markets in Paris, during 1876 than were killed last year.

THE "THUNDERER" EXPLOSION.

It will be remembered that, in our recent account of the disastrous boiler explosion on board the new English war vessel Thunderer, we stated, on the authority of the London *Times*, that the casualty was owing to the gross carelessness of not removing the wedges which had held down the safety valves during a previous hydraulic test. Such negligence seemed almost inconceivable, and therefore we are glad to welcome the flat contradiction given by *Engineering* to the *Times* report. The valves were not wedged down, and the similar valves in the unexploded boiler were all in working order when tested cold. Our contemporary points out that the valves of the burst generator, when cold, were $\frac{1}{100}$ inch free in their seats. Around the latter, except at the steam connection, there is a broad flange not heated by direct contact with steam, its under surface being in contact with the air of the fire room, and its upper surface forming the inside of the bottom of the valve weight box. This cool flange, therefore, tended to prevent the expansion of the cast iron chamber. So that the brass valve seat must have had an increased radial expansion inwards. Now taking into consideration the dimensions of the parts, the temperature of the steam, and the coefficient of expansion of brass, it is found that the valve, after the seat had expanded inwards, would be 0 005 inch larger than its seat. The valves were thus obviously fitted too nicely, and through the unequal expansion they set fast. In addition to this the stop valves were shut, and it is known that the steam gage was badly out of order, and these three causes are, in *Engineering's* opinion, amply sufficient to account for the explosion.

LIGHTNING RODS.

"Professor Wise, the balloonist, who has had rare opportunities for studying and observing storms as well as calms, has repeatedly expressed his convictions that lightning rods are useless in electrical storms, but that metal roofs are an absolute protection. He says that during a recent storm several flagstaffs were shivered down to the point of contact with the metal roofs, when the damage ceased, the fluid dispersing over the expanse of metal. This corresponds to hundreds of other cases that he has examined; and he declares his conviction that 'the lightning rod, as a protection in itself, is of no more value than a bodkin would be to ward off the ball fired from a Columbiad.'"—*American Architect and Building News.*

A metallic roof may, in some cases, avert damage to an unrodded building, by facilitating the passage of the electricity to the best wetted portions of the exterior of the structure, to the water leaders, etc., down which the lightning may pass to the earth; a well wetted wooden roof may assist to the same result. Hundreds of unrodded houses, with and without metal roofs, have been struck, and not seriously damaged. But it is nonsense to assume that a good lightning rod, properly connected with the roof and with the ground, has no value. Although unrodded buildings may by chance escape, they are always in danger, and the lives of inmates are in jeopardy.

On the other hand, all experience, the world over, from the year 1752, when rods were first invented by Franklin, to the present time, has shown that conductors are an essential means of safety in thunderstorms, that they preserve human life, and prevent the destruction of property whenever properly applied.

Formerly, when ships sailed without rods, the loss of life and property at sea was appalling. Nearly all vessels now carry rods, and such an occurrence as serious damage to a rodded vessel by lightning is almost unknown. If, like ships, our dwellings and buildings could have the broad expanse of the sea for their rod terminals, they would be as universally exempt from injury by lightning.

We except, however, buildings and vessels containing petroleum, or other substances from which inflammable gases exude. The latter mix with the surrounding air and form an explosive atmosphere of large extent, often reaching above the points of the electrical conductors; and such mixtures will be set on fire by the electricity on its way to and before it can reach the conductor.

In nearly all cases, our house rods are defectively connected with the ground. They are simply stuck down for five or six feet into dry earth; whereas they should be soldered to a water or gas pipe, or be connected with some large extent of conducting material placed underground.

The following valuable and practical hints, as to the proper arrangement of lightning rods, are given by Mr. John T. Sprague, in his excellent treatise upon "Electricity; Its Theory, Sources, and Applications:"

It must be remembered that lightning is not a mere thread of flame, or confined to the visible line; a large space all round the line takes part in the discharge, and gives up the force previously accumulated in it as tension.

"These principles settle conclusively all questions as to the construction of lightning conductors. Their object should be to connect to earth every portion of a building; and as this is actually possible only with metal buildings, they should connect every salient point and as much of the surface as possible, so as to extend around the building the area of low tension, or artificial "earth" surface opposed to the cloud. Chimneys require especial attention, because they are tubes lined with conducting material, containing warmer air: and if with fires, then extending a comparatively good conducting column of warm air towards the cloud and so inviting a discharge; hence it is that lightning almost always enters a house by the chimneys. All doors and windows causing currents of air should be closed during a thunderstorm.

'The prime essential is a good connection to water; water and gas mains provide the best if the conductor is well secured to them; next to them is the metal shaft of a good pump, in a well constantly supplied by springs; then ponds or ditches. What is required is a large metal surface terminating the conductor, and in contact with a stratum of moist earth, so that a hole sunk into wet gravel, into which the conductor is led, and surrounded with a quantity of coke to increase its surface of contact, will answer, but dry clay, or rock, is not safe. This connection should, if possible, surround the building by means of rods from its various corners, either led to different earths or else continued by a rod round the house to one earth connection. Every piece of metal work above the building should be utilized, such as ridge caps, guttering, and water pipes. They cannot be trusted as conductors because of the joints in them, which offer great resistance, and therefore prevent reduction of tension, but they will help to form a protecting network around the building, especially if strips of copper are soldered across each joint. For the same reason a connection should be led from the bottom of the down pipes from the gutters to the nearest suitable earth, though a very good but variable earth connection is set up from these by the water itself during heavy rain. The lower parts of the bell wires may also be advantageously connected to an earth, such as the nearest gas or water pipes, as several accidents have occurred from their having either received a direct charge through the walls, or having a violent current induced in them.

"The terminals should be attached to all high or salient points, most particularly chimney stacks; if these are wide, and contain several chimneys, it is safer to have two points, though usually one is sufficient; but the kitchen chimney, or any one commonly used, and therefore lined with soot, and containing warm air, should be specially attended to. The points may be made of rods of 1-inch iron drawn out to a point, rising 2 or 3 feet above the building; they are better also for galvanizing. There is no advantage in any of the fancy points, patented or otherwise. The conductor depends upon the size and hight of the building. A factory chimney or church steeple should have a copper conductor of at least $\frac{1}{2}$-inch section, either as a rod or as a wire rope, well protected against injury; for smaller buildings, iron rod may be used instead of copper. In ordinary cases galvanized iron wire of about $\frac{1}{4}$-inch diameter (such as is used for telegraphic purposes) will answer perfectly, if led separately from various salient points, and carried down the different sides of the house and connected as above described, to the guttering, etc., but for a single conductor at least $\frac{1}{2}$ inch rod should be used. Solid rod is best, as it exposes least surface to rust, for it is the mass or weight of metal which conducts, not its surface, as some suppose; but every joint must be carefully made and soldered, to secure metallic continuity and low resistance.

"It will be seen that conductors should never be insulated from the building, but, on the contrary, as much of the surface as possible should be connected to the conductor. Electrometers, etc., are often surrounded with a cage of wire connected to the earth or to the negative pole of the active source of electricity, in order to prevent them from being affected by external electric disturbances. That is exactly what we require to do with our buildings; an iron house well connected to earth would not only be perfectly safe, but its inmates would scarcely feel any of the effects usually produced on the nervous system by "thundery" weather, except so far as these are due to heat. The object aimed at in a lightning conductor should be to approach that condition as nearly as possible; to obtain an enclosed area within a conducting envelope provided with points and connected to earth."

Life on the Earth.

Professor P. G. Tait, of the University of Edinburgh, in his lectures on recent advances in physical science, lately published, considers the question how long life has been possible on the earth. He concludes that ten millions of years is "the utmost that can be allowed from the physical point of view for all the changes that have taken place on the earth's surface since vegetable life of the lowest known form was capable of existing there." Opposed to this is the view of the most eminent modern geologists, that at least three hundred millions of years have passed away since terrestrial life began.

BREECH-LOADING FIREARMS.

We publish the third and last series of illustrations of breech-loading fire arms, which we select from the pages of E. H. Knight's "American Mechanical Dictionary."* It shows three American and one Swiss inventions, the latter being a bolt needle gun.

U U′ are two positions of the Remington gun; the left hand figure shows the gun when fired, the right hand ready to load. The breech block, *b*, swings upon a strong pin within a mortise of the stock. *c* is a tumbler which braces the breech piece against recoil at the time of firing, and forms a part of the hammer which strikes a firing pin which passes through the tumbler and is driven against the cap or part of the cartridge case containing the fulminate.

The breech piece, *b*, and tumbler, *c*, are so formed that when the former is closed the rounded upper portion of the tumbler works in a concavity in the back of the breech piece, as shown in Fig. U; and when the hammer is drawn back to half cock or full cock, the rounded back of the breech piece works in a concavity in the front of the tumbler, as shown in Fig. U′. This mode of matching the breech piece and tumbler prevents the possibility of the hammer falling until the breech piece is perfectly closed, and so obviates the possibility of premature explosion of the charge. The extractor, by which the discharged cartridge shells are drawn out from the chamber of the barrel, works between the receiver and the breech piece, and is operated by the opening movement of the latter. The breech piece is opened by a thumb piece. A guard lever, *d*, prevents the trigger being drawn when the breech piece is open.

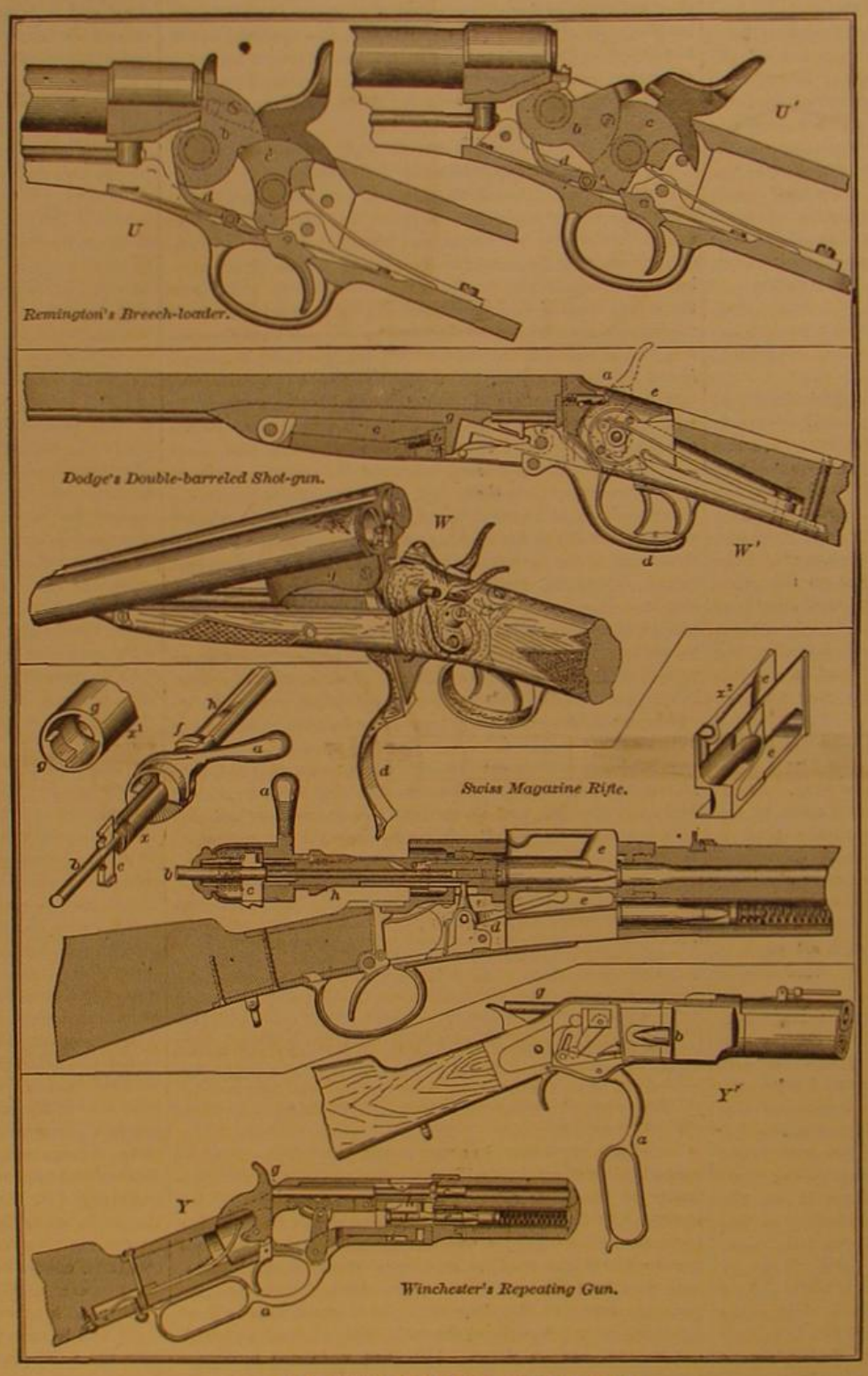
W W′ are two views of the Dodge breech loader, shown as a double barreled breech-loading fowling piece. W is a perspective view, and W′ a sectional view. The barrels are hinged to the front end of the stock, so as to tilt upwardly at the rear and nearly balance upon the hinging point, the motions being made by means of the pivoted lever *d*, which laps over the trigger guard and locks the barrels in firing position by engagement of a hook, *c*, with a pin passing through the lug, *g*. The front end of the lever extends beyond the pin on which it turns, and works in a slot in the center of lug, *g*, beneath the barrels, which it serves to elevate and depress. As the barrels are elevated, the front end of the lever strikes against a projection on the stem of the extractor, and retracts the spent cartridge capsule. The frame, *e*, is made of a single piece of metal extending from the front, where the barrels are hinged, to the grip in the rear of the breech; and the locks are fitted in recesses therein, dispensing with separate lock plates. The locks are rebounding, that is, they go forward and fire the cap and return to half cock. The hammers draw back the firing pin when fully cocked. The barrels are adjusted on the frame, and wear is compensated by means of the block, *b*. In use, the left hand need not be moved from where it is in firing; the breech is brought under the right arm, the lever thrown down, a fresh cartridge inserted, the lever returned, the hammer cocked, and the piece is ready to fire.

The gun adopted by the Swiss Federal Government has the magazine and cartridge carrier of the Winchester, with the needle exploder and bolt breech. The large figure is a longitudinal central section; *x* is a perspective view of the bolt, firing pin, and lever detached; x^1 is a view of a piece of the breech cylinder; x^2 is a view of the cartridge carrier detached.

The motions are as follows: the lever, *a*, is raised, rotating on the firing pin, *b*, and cocking the latter by the pressure of a cam upon the transverse trigger bar, *c*; the bolt is then drawn back, carrying the firing pin and the hook, which retracts the spent cartridge; the motion eventually rocks the bell crank lever, *d*, and raises the carrier *e*, which brings another cartridge in line with the barrel. The bolt, *h*, is then pushed back, pressing down the carrier, *e*, and driving the cartridge into the barrel; a partial rotation of the bolt, by means of the lever, *a*, locks it firmly by the catching of studs, *f*, on the bolt behind lugs, *g*, on the breech cylinder. The firing pin has remained on the cock since the first motion of the semi-rotation of the bolt, and is now pulled off by the trigger. The combination is known as Vetterlin's.

Y′ is the Henry magazine rifle, now known as the Winchester repeating gun. It may be used as a single loader or a repeater. As a repeater the motion of the lever, *a*, withdraws the spent shell of the previous charge, raises the hammer, recharges the gun, and relocks the breech mechanism. The magazine contains seventeen cartridges, which can be discharged in as many seconds. With single loading, the cartridge is placed in the carrier block, and a single motion puts it in order for firing. The cartridges are placed in the magazine by pressing them through the trap, *b*, on the right hand side of the gun, the magazine being easily filled while the gun swings at the side. They are fed from the magazine into the carrier block by a spiral spring.

Y is a section of the gun immediately after discharge; *c* is an empty shell; *d*, one in the carrier block; *e*, one in the magazine; by the forward motion of the lever, *a*, the links take the position shown in Y′, the piston, *g*, is withdrawn, raising the hammer to the full cock, and extracting the empty shell, *c*, which is thrown upward at the same time the carrier block, *h*, with the carriage which it contains is raised by the lever, *i*, placing the cartridge opposite the chamber. This position is seen at Y′. The returning motion of the lever drives the piston forward, leaves the hammer at full cock, forces the cartridge contained in the carrier block into the chamber, drops the carrier block to receive the following cartridge from the magazine, and places the arm in readiness to be fired.



*Published in numbers by Messrs. Hurd & Houghton, New York city.

Plant Anæsthesia.

The curious discovery has recently been made that anæsthesia may take place not only in animals but in plants, and, in brief, in all forms of life. It has been demonstrated that etherisation acts finally on all the tissues of animals and on the central nervous system. Hence, if plants have tissues, the anæsthetic should equally act on them. This substantially appears to be the case; and every vital act, whether occurring in animal or vegetable, may be anæsthetised. In plants, M. Claude Bernard, to whom is due the credit of the discovery, has found that germination ceases under the influence of ether. He introduced water cresses, which germinate from day to day, into two precisely similar tubes. In one tube he placed a little ether. The plant therein on the following day was found not to have germinated, as the other had; but after being removed from the anæsthetic, the first went on and germinated in a natural manner. The plant had literally been put to sleep.

The same is true of ferments; for beer yeast, after contact with ether for twenty-four hours, completely loses its activity, and yet regains it as soon as the etherization is stopped.

EXHIBITION NOTES.

PAPER MAKING.—The papermaking machinery is among the most attractive features of the hall, and, to most visitors, also among the most novel. It is exceedingly interesting to them to see the rags come out of the great iron drums, where they are churned and ground, in the form of a milky fluid; to watch the deposit of the snowy pulp, and to see the pulp carried forward on broad belts and between successive rollers, until, growing always thinner and drier, it finally is rolled on a drum as firm, white printing paper. The machinery is said to be the best for the purpose made.

NOVEL TYPE WRITER.—A Russian inventor, M. Alissoff, of St. Petersburg, shows a type writer which, for excellence of mechanical structure, cleanness of impression, and ability to do printing in different characters, leaves the American type writer far behind. It cannot be made to work nearly as fast, however, as its American rival; and as speed is what most people seek in such a machine, it is doubtful if it will ever come into extensive use. M. Alissoff says that he first turned his attention to making a machine for speed, but finding by observation that few men can think faster than they can write with pen or pencil, he concluded that such an invention was not what was needed, but something that would make as accurate and legible copy as a printed page. In this undertaking he has fully succeeded. His machine writes in the Russian and English characters, makes capitals, small capitals, figures, signs, punctuation points, and all the French accents. As the types are movable, it can be arranged to print Greek, Hebrew, or any other written language. The manner of working it is to move a lever on a dial to the letter desired, and make the impression with the foot upon a pedal. The speed is about that of ordinary writing. M. Alissoff also exhibits an invention for photolithographing music. The staves notes, and signs, printed on thin paper, are kept in small boxes, from which they are taken and pasted upon a large plate of glass, regularity being secured by lines on cardboard at the back of the pane. Thus the composition is built up much more rapidly than could be done with types. A negative is then taken of any size desired—the light passing through the glass—and when transferred to stone the printing is done by the usual process.

CURIOUS SEWING MACHINE CONTRIVANCES.—A French machine has a universal feed, which enables the operator to give the cloth any direction desired, without touching it—a very useful device for embroidering on stamped patterns.

Still more ingenious is an American invention for embroidering set figures automatically. By a curious arrangement under the table, the feed is set so that the machine goes on of itself, reproducing the pattern. About a dozen different simple patterns can be embroidered by changing the apparatus.

Another noticeable invention is a machine which sews with either one or two needles, as may be desired. It is especially useful for embroidery, as threads of two colors can be used and double work performed.

Three kinds of machines are shown that sew from the spools, and thus dispense with the troublesome shuttle and bobbin.

The Visit of the French Working Men.

About fifty French mechanics, who have been selected by the Government of France to visit the Centennial, recently arrived in this city. They are to make a critical examination of the Exposition, each man devoting himself to the display presented in his particular branch of art or industry, and, on their return to France, are to prepare reports of the progress exhibited in each separate branch of manufacture. Nearly every class of French industry has its representative in this commission, and the members themselves appear to be intelligent and wide-awake mechanics. There is nothing political in their mission; and in this respect they differ from a body of reputed French artisans who lately visited us, but who deservedly received no special attention, owing to their affiliations with that unfortunate class of men who are always at the head of labor agitations and communistic disturbances. We trust our American working men will give their French brethren a cordial welcome, and spare no pains in affording them every facility for acquiring the knowledge they seek.

IMPROVED PIPE CUTTING AND THREADING MACHINE.

Messrs. Joseph B. Eaton and Charles Latham, of Shamokin, Pa., have patented (July 4, 1876), through the Scientific American Patent Agency, an improved pipe cutting and threading machine, that may be worked effectively in a very narrow space, so as to produce a saving in time and labor in the digging and the working of the machine. Fig. 1 is a top view of the cutter and threader, and Fig. 2 a sectional end view of the same.

The shell or casing, A, is made of two hinged sections, which are applied around the pipe to be worked upon, and locked firmly together by a suitable device. The threading dies, B, and the cutters, C, are guided in interior recesses of the shell, and adjusted or fed forward to the required depth of cutting by means of set screws worked from the outside of the shell. The shell is cast at the ends with raised ratchet teeth, D^1, along which an operating handle, D, is guided at both ends by an outer arc-shaped part, *b*, and an inner concentric piece, *d*, that slides in a recess of the shell below the ratchet. The outer guide pieces of the handle, D, lock, by spring pawls, D^2, into the ratchets, to take hold of the shell, and turn it in one direction, while releasing it when turned back in opposite direction. A drawing pipe, with threaded end, fits into the threaded end of the shell, and is attached by clamp screws tightly to the pipe to be threaded, drawing by the screw the threading machine forward for cutting the thread on the pipe.

When the pipe is threaded, the machine is returned for clearing the thread by a semicircular handle with hook end, that is inserted into the small socket holes, *e*, of the shell.

It is claimed that thus a deep or shallow thread may be cut on water and gas pipes of different sizes with ease and rapidity while the cutting is done in perfect manner without leaving a shoulder at the end of the pipe.

Fig. 1.

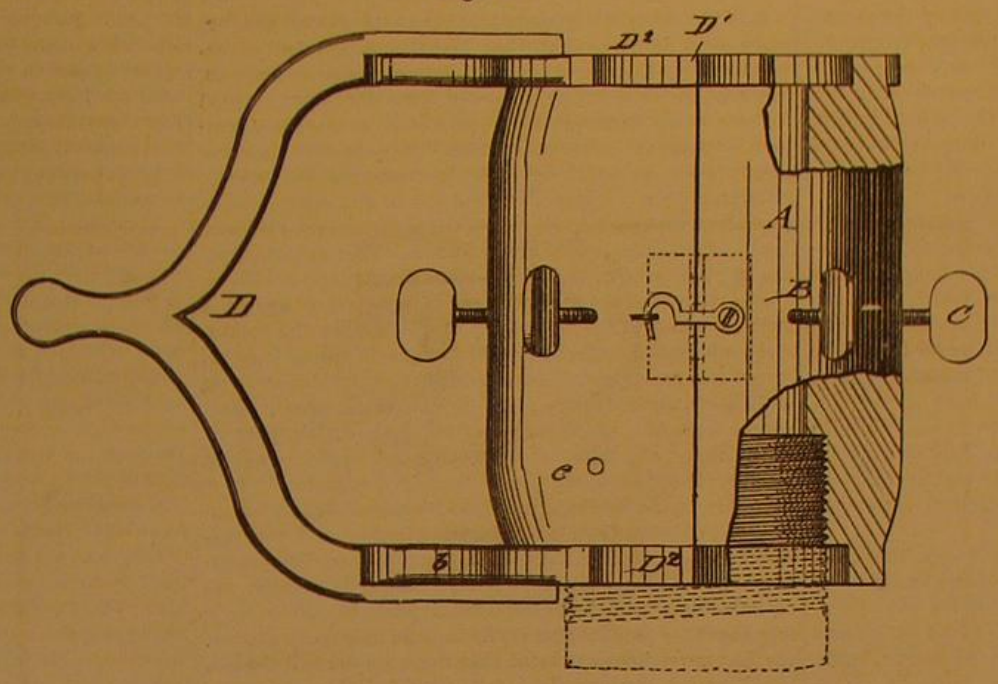
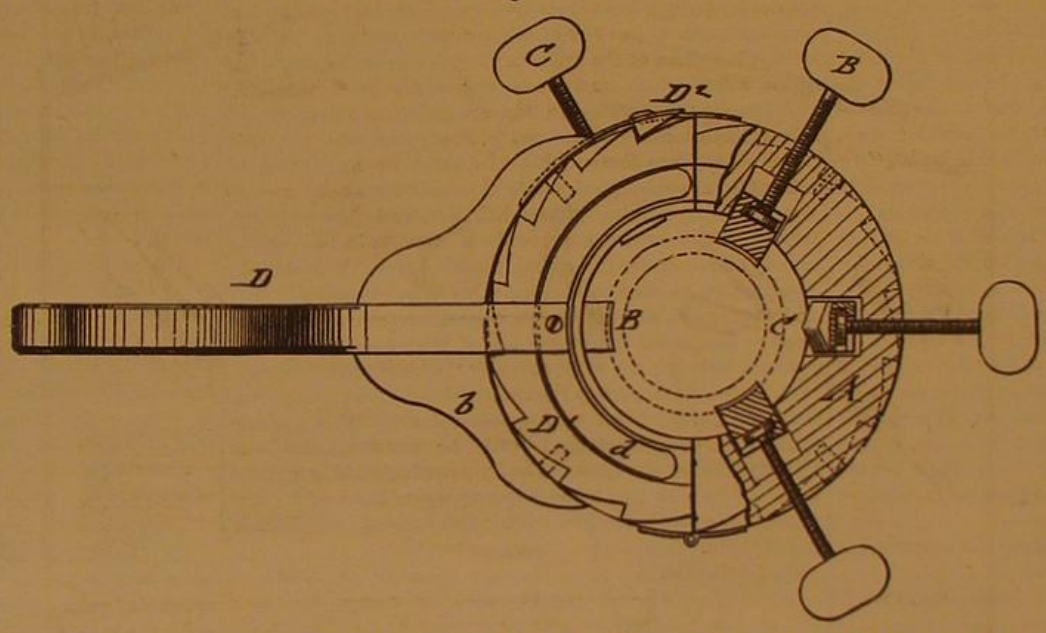


Fig. 2.



EATON & LATHAM'S PIPE CUTTING AND THREADING MACHINE.

South African Railways.

A line of railway 120 miles in length was recently opened between Cape Town and Worcester, South Africa. The road is an extension of the Cape Town and Wellington Railway, purchased by the government some years ago, and is part broad and part narrow gage. It is intended eventu ally to make the whole line of the latter description. Railway work in other parts of the colony is being vi gorously prosecuted; 65 miles of road are nearly complete on the eastern line from Port Elizabeth, 60 miles on the border line, from East London, will be ready by the end of the year, and a similar distance on the Midland line will shortly be finished. The estimated cost of the new works was about $30,000 per mile, but this has been exceeded by as much as $3,500 per mile in some cases, the increase being accounted for chiefly by the deficient supply of labor, enhanced rate of wages, and high cost of provisions.

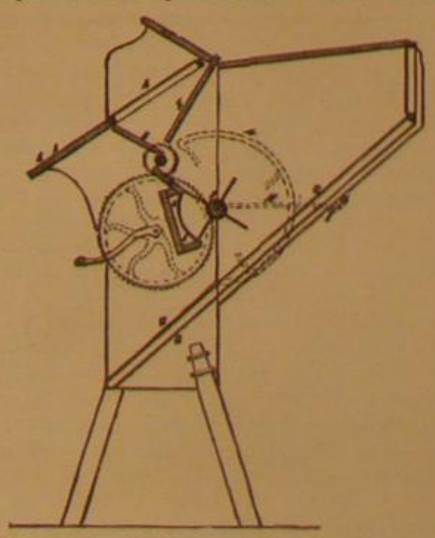
Meteoric Iron in our Church Steeples.

On August 10, the earth passed through the great belt of meteors; and on about November 13, it will again plunge into the midst of these vagrant bodies. People who are curious about meteoric iron, or who desire to investigate that substance, will probably therefore find the present a good time to look for it. M. Tissandier has lately shown that the metal is constantly found in the cosmical dust, which often may be collected from rain, and which exists in the atmosphere of elevated regions. Most of the meteors which strike our atmosphere are at once dissipated by the heat of intense friction, and the iron, melting, falls like shot, in the globular or nearly globular form in which M. Tissandier has found it, and which, he thinks, is one convincing proof of its celestial origin. M. Yung recently told the French Academy of Sciences that the best places in which to look for meteoric dust is an old church steeple. Collect all the dust which has become deposited in out-of-the-way corners, where the wind has not been able to reach it, and examine it under the microscope. Apart from learning how many curious things are floating about invisible in our atmosphere, the student may be able to get together sufficient of the iron to examine it by chemical means.

IMPROVED SAND AND GRAVEL SEPARATOR.

Builders, masons, roadmakers, contractors, and others will doubtless be interested in the invention herewith illustrated, which is adapted for screening sand and separating gravel, overcoming the slow and tedious process now in use. It is claimed to screen sand, no matter how wet, when it cannot be screened by any other process. It separates the gravel entirely from the sand, and deposits the roofing gravel and coarse gravel for walks, etc., in separate places from the sand, thus saving the necessity of a second screening when roofing gravel is in demand. It can be worked to screen thirty yards a day, by one man throwing the sand and a boy to turn the crank. It works rapidly, and will supply any grade of sand.

A is a coarse screen on which the sand is thrown and which keeps large pieces from passing into the machine. The sand passes down to the feeder, B, which carries it down to the cylinder, E. The latter is made with four rows of pins, and revolves with velocity, spreading and separating the sand and gravel and throwing it against the screens, G G. These screens are placed one over the other. The roofing gravel and sand pass through the upper screen (which is made of half inch mesh or any other size needed) to the lower, which is six meshes to the inch, or any size required. The roofing gravel passes down between the legs, which are inclosed, and the sand through the fine screen. The coarse gravel passes down in front of the machine. H is a wrapper or beater, which strikes eight times with every revolution of the crank, against the under part of the screens, and loosens any sand that may stick to the screen. K is a feed



board which can be raised or lowered to regulate the flow of sand to the machine. L is a shelf for carrying off coarse gravel. A single screen is made of four meshes to the inch, or any other size required, to be used for screening sand when roofing gravel is not wanted, allowing all the gravel to pass down in front of the machine.

The manufacturers also make a large-sized machine to be run by horse or steam power, having one elevator to raise sand and another to carry the sand into bins, cars, or other places of deposit.

For further information address the manufacturers Messrs. Chambers & Quinlan, Decatur, Ill.

The Human Voice Transmitted by Telegraph.

Several weeks ago we gave a sketch and description of the thread telegraph, consisting of two small tin or wooden cylinders, each having a membrane stretched over one end, the two membranes connected by a stout thread. Two persons may readily communicate the sounds of the voice by means of these instruments over a thread fifty or a hundred feet in length. The person sending speaks within one of the cylinders, which causes the membrane to vibrate; the vibration passes along the stretched thread to the membrane of the other cylinder; which being held to the ear of the ear of the person receiving the message, the vibration is duly heard, or, in other words, the voice of the sender is made audible.

Professor Graham Bell, by a device somewhat analogous, has succeeded in transmitting the tones of the human voice by telegraph. Instead of the thread he connects the membranes of the two cylinders or drums with the armatures of the electro-magnets, one drum being placed at each end of the telegraph wire. In fact, he not long ago demonstrated the possibility of conveying vocal sounds by means of the ord nary telegraph wires and special appliances for transmitting and receiving the sounds. The apparatus used by Professor Bell is thus described: Two single-pole electro-magnets, each having a resistance 10 ohms, were arranged in circuit with a battery of five carbon elements—the total resistance being about 25 ohms. A drumhead of goldbeater's skin, about 2¾ inches in diameter, was placed in front of each electro-magnet, and a circular piece of clock spring was glued to the middle of the membrane of each drumhead. One of these telephones was placed in the experimental room, and the other in the basement of an adjoining house. Upon singing into the telephone the sounds of the voice were reproduced by the instrument in the distant room; and if two persons sang simultaneously, the two notes were audible at the other telephone.

At the time of the lecture, an experiment was made to show the transmission of articulate speech, an assistant going into the adjoining building where one of the telephones was placed. Several familiar questions were, it is said, understood after a few repetitions. The vowel sounds alone are those faithfully reproduced; dipthongal sounds and rotund vowels are readily distinguished, but consonants are generally unrecognizable. Now and then, however, a sentence comes out with almost startling distinctness, the consonants as well as the vowels being clearly audible. Professor Bell stated that telephonic effects can be produced with three varieties of currents—the intermittent, the pulsatory, and the undulatory. The first are characterized by the alternate presence and absence of electricity in the circuit; the pulsatory current by sudden changes in intensity, while undulatory currents are obtained by gradual changes analogous to the changes of density of air produced by vibrations of a pendulum.

The most recent trial of Professor Bell's instrument was at his residence, Brantford, Canada, August 11. The Toronto *Globe* states that instruments were placed, one in the porch of the residence and the other in an outhouse on the grounds, and communication between these made by ten miles of wire. Musical notes, the human voice, and songs spoken and sung before one instrument were plainly audible by placing the instrument to the ear at the other. By this invention, too, any number of messages can be conveyed over one wire in either direction, provided they have a different pitch; the tones of the voice can pass over the electric wire, enabling the hearer at any distance to hear distinctly what is said, and to distinguish the voice of the speaker. On August 10 the professor had communication made with his instrument on the common telegraph wire between Brantford and Mount Pleasant (five miles), and was spoken with, while in Mount Pleasant, by Professor D. C. Bell and Mr. Griffin from the *Dominion* office in Brantford. On the evening of August 12, the professor tried a new experiment, having had an instrument made so that three persons could sing different tunes or different parts of the same tune into the instrument at the same time. The trial was perfectly successful, the different voices coming

distinctly over the wire at the same time, so that they could be separately distinguished by the listener. The practical exemplification of the lately discovered system of telephony made by the professor afforded much pleasure and information to those present.

Correspondence.

The Moon's Longitude and Solar Retrograde Motion.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN SUPPLEMENT (page 492, volume I), you state that a paper by Professor Newcomb, on "Inequality of the Moon's Longitude," was read at the June meeting of the Royal Astronomical Society, and that several of the more notable members of that scientific body expressed themselves as being at present quite unable to tell the cause of the phenomenon. Allow me to advance the following, which, I think, points to the cause.

The sun, his planets, and their several satellites are all distinct members or wheels of the great, grand celestial machine called the solar system; and unless we look upon the whole as a machine, and trace the effects which the retrograde motion of the largest one has upon the smaller ones, and these upon the smallest ones, we shall never be able to tell the cause of the phenomenon now under consideration, nor the cause of kindred phenomena in other moons; for they all move more or less ahead of their times while in one side of their respective orbits, and lag behind while on the other side, just as the earth herself and every other planet does, and must do, although practical astronomy has not yet discovered the facts.

To explain. We take the sun, or main wheel, first: His orbit is to be considered the rim of the wheel; the center of his orbit, the center of the wheel; and he (the sun) fixed, as it were, on or in the rim. That wheel turns on its axis retrogressively; and the rim, and the sun, of course, retrograde at the rate of nearly 50¼″ annually. Now, by virtue of the earth being carried retrogressively by the sun, she, too, retrogrades annually, as it were in her own orbit, nearly 50¼″. Could we stand at the center of the sun's orbit, and view clearly the longitude of the earth at the moment she reaches 180°, we would find that she had fallen behind her sidereal place in the heavens, that is, the point at which she was when she came to 180° the previous time, say 50¼″; and when she came to 0°, she would be 50¼″ retrogressively in advance of where she was at the moment she came to the same point in her orbit one exact year before. In other words, she would be behind time on one side of her orbit, and in advance of time on the other side of it.

And it is exactly so with the moon. In one exact terrestrial year the moon retrogrades in space to the same exact amount; or, in other words, her orbit, as a whole, is carried retrogressively in space nearly 50¼″, annually, or about 4″ for every revolution she makes. It seems easy to see, then, that, in consequence of her retrogression in space, caused by the retrograde motion of the sun, she must be behind time, while on that side of her orbit which is outside of the sun's orbit, and *vice versa*.

I submit the above to the consideration and amendment of the wise and learned.

Gloucester City, N. J. JOHN HEPBURN.

Professor Crookes' Radiometer.

To the Editor of the Scientific American:

On page 116 of your current volume, Mr. Joseph Delsaux, of Louvain, Belgium, presents some interesting experiments upon the radiometer. As I have not a radiometer at hand, I assume that the described tests were correctly made; and feel that there is good cause to suspect a coaction of forces to move the electrometer vanes. Could it not be settled beyond a doubt by charging the radiometer globe from an electrical machine, to the same tension and with the same kind of electricity as the globe contained after being submitted to the radiation of the sun or any source of light, and then ascertain if the action of the radiometer were the same?

Some other phenomena could be investigated in this connection. For instance, it is well known that selenium varies in electrical resistance from 15 to 100 per cent, inversely as the intensity of light to which it is subjected. It is also an established fact that on telegraphic circuits the speed of signaling is decreased during the middle portion of the day, and improved at night. Mr. R. S. Culley, the well known English electrician, called attention, in 1872, to this retardation, and said that the cause was not clear, but attributed it to "the ordinary diurnal variation of earth currents and to the increased resistance of the wires from increased temperature." As Mr. Culley has drawn no line between warm and cold weather, it would be well for Mr. Delsaux and other skillful experimenters to take the matter up, and apply the electrometer to things in the light and in the dark. We may perhaps thus be informed of what we are seeking to know.

Chicago, Ill. F. W. JONES.

Test Colors.

To the Editor of the Scientific American:

In No. 7 of your current volume, I notice a report of a discovery of new test colors from the iris and violet. I have found the blue convolulus major, or morning glory, of considerable practical value as a test for acids and alkalies. In the first place, the flower itself is very sensitive, indicating the trace of nitric acid in rain water after a thunderstorm. The flowers show red spots wherever the rain water has wetted the surface after a shower during the night. A few of the flowers rubbed in a glass of water will give a bright blue liquid, which will instantly redden if a drop of nitric or other acid be put in; and the blue will be restored by neutralization. But if the alkali is much in excess, it will turn green and return to blue on neutralizing again. Water colored by the red convolulus will turn blue on the addition of an alkaline salt, but is not so sensitive as the blue.

Milledgeville, Ky. M. W. VENABLE.

Some Notes on Potato Beetles.

To the Editor of the Scientific American:

It is not often that you are caught napping, and you are more apt to be so caught when lounging in the field of natural history than in any other. In your issue for July 29, you copy an article from the SCIENTIFIC FARMER, entitled "Facts about Potato Beetles," in which, among the prominent statements offered as "facts," we are told that the potato beetle (by which of course is meant the well known immigrant from Colorado, and not any of the other beetles that affect that plant) does not fly till night and does not eat. Both these statements are incorrect. The *doryphora 10-lineata*, like most of the species of its family, flies readily in the daytime, but not at night; and it feeds freely upon the various plants of the nightshade family besides the potato, and sometimes does considerable damage in spring long before the larvæ appear; though it is not as voracious as these and seldom abounds on a plant to the same extent. Reasoning from his "facts," the writer of the article goes on to say that "any mode of destroying the beetle, practised by the farmer here and there, is only lost time * * * therefore let the beetle alone"—an erroneous deduction naturally following from the erroneous premise, and very unsound advice. It is in fact all important, from the practical view, to destroy the first beetles and thus prevent the laying of eggs and the subsequent injury; for while it is true that they may continue to fly in from neighboring fields, the fact nevertheless remains that the more you kill the less you have. Many experienced farmers in this part of the country justly consider the destruction of the early beetles important enough to warrant the laying of traps before the potatoes begin to put out of the ground; and they do this by dipping slices of the tuber in Paris green and laying them about a field where no domestic animal can get at them.

There are other errors in the article in question, but of minor importance. For instance, every one who has had much experience knows that the third or last brood of beetles is fully developed and flies around for weeks or even months before seeking winter quarters, and that they hybernate in the perfect state, ready to awaken in the spring and fly about again for a few weeks before procreating. The species is, also, northern, not southern, in habitat, and, while spreading east along certain parallels, has not extended south. The talk, therefore, about the insects remaining dormant through the winter merely "because the temperature is too low to perfect the insects," and about the probability that, if they reached a tropical climate, their "transmigration (transformation) will be uninterrupted"—is "misty," to say the least. The hybernating state is induced not alone by cold, and many insects prepare for it and cease multiplying months before winter sets in; and doryphora is one of them.

St. Louis, Mo. C. V. RILEY.

[For the Scientific American.]

THE CALORIMETER OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

Among the drawings displayed by this institution at the Centennial is one of the calorimeter used in the mechanical laboratory of the school, and a description of it by the professor of engineering may be found on one of the tables. A courteous attendant is usually on duty also, who takes pleasure in answering the questions of visitors. Profiting by these sources of information, the writer has prepared a description of the apparatus, which will doubtless be of interest to engineers.

The general use of the calorimeter is to measure the quantity of steam condensed in it in a given time, and the amount of heat imparted to the condensing water by the steam. In this connection it is valuable for determining the quality as well as the quantity of steam evaporated by a boiler, the steam required per horse power per hour by an engine, the condensation in the cylinder, the total and latent heat of steam at different pressures, the transmission of heat by different conductors, and numerous other problems of a similar character. Its great value in teaching the students right methods of investigation will be obvious, and at the same time practical questions of importance to steam users can be examined. The calorimeter to be described was used by Mr. Dixwell in his experiments on condensation in steam cylinders, a notice of which will be found in the SCIENTIFIC AMERICAN for March 11, 1876.

The essential features of the instrument are a tank containing a condensing coil, a tank for the condensed steam, scales for determining the weights, and thermometers for ascertaining the temperatures. Steam enters the condenser, which is arranged so as to drain thoroughly, and after being condensed is discharged into a small tank where the weight and temperature are noted. The large tank is filled with water, the weight and temperature of which are noted at regular intervals. The small tank is closed at the top by a floating cover, secured to the edges by a rubber diaphragm. The large tank is also closed at the top, but provision is made for expansion by an expansion tank placed above, and having a floating cover. Each tank rests upon a pair of platform scales, and all connections to the tanks are made by means of rubber pipes, which only change their direction slightly during an experiment, and consequently do not sensibly affect the weights. The large tank has a circulating pump which is worked at intervals during an experiment, so as to make the temperature of the condensing water uniform in all parts of the tank. To illustrate the use of the apparatus, suppose the exhaust pipe of a steam engine to be connected with the condenser, and that the consumption of steam per indicated horse power is to be determined. The large tank is filled with water, until the cover in the expansion tank floats, and the weight and temperature of the water are noted. The engine is then started, and at regular intervals indicator diagrams are taken, and the weights and temperatures of condensing and condensed water are noted, the temperature of the water in the large tank being equalized by the aid of the circulating pump before it is recorded. The result of a series of operations shows that a certain weight of steam of a known pressure imparts a definite amount of heat to the condensing water, and from these data the quality of the steam can be calculated.

The reader is doubtless familiar with other calorimeters, as they are frequently used by engineers. A large one was employed for two years at the fair of the American Institute in tests of steam boilers, the weight and temperature of the condensed water being noted, and a somewhat similar apparatus was used on a later occasion for testing the amounts of steam required for several rotary engines. The difference between these calorimeters and the one described above seems worthy of notice. In the one case the calculations are made by observing the successive changes in temperature of a definite weight of water which is used throughout the experiment, and in the other the condensing water flows away continually, so that the temperature of the discharge does not vary much during a test. It will be seen that, where a definite volume of water is heated by condensing steam, the amount of heat thus measured is not all that has been given up by the steam, since some of the heat is absorbed by the apparatus; while in the other form of calorimeter, if a definite temperature is reached before commencing an experiment, and is afterwards maintained, no more heat will necessarily be absorbed by the apparatus. Of course, in the form of apparatus used at the Massachusetts Institute of Technology, the amount of heat absorbed under various conditions might be determined, and the necessary corrections applied. Perhaps this has already been done, but it does not appear in the account given by the professor of mechanical engineering, who is quite minute in describing the tests of gages and thermometers. It may be, however, that the correction would generally be unimportant.

As appears from the descriptions of the use of this apparatus, the students are well drilled in some special tests of testing apparatus. This is one of the most important points in the engineer's practice, and it seems to be duly appreciated at the school. Experience shows that physical apparatus cannot be made free from defects, but that, if the amount of error is determined, corrections can be applied which will give accurate results. R. H. B.

Philadelphia, Pa.

A Useful Tree.

Mr. Morgan, an English consul resident in Brazil, cites, in a recent report to his government, the carnouba tree, a species of palm (*copernicia cerifera*) as one of the most valuable vegetable productions of the country. It flourishes without culture at Bahia, Rio Grande do Norte, and other well known localities, resists drought, and always appears green and luxuriant. Its roots possess properties similar to those of the sarsaparilla. The trunk furnishes a superior fiber. When the tree is young, it yields wine, vinegar, a saccharine matter, and a species of gum closely resembling sago. Its wood is excellently suited for the manufacture of musical instruments, as well as for tubes and conduits for water. The pulp of the fruit is very palatable, and the oily nut roasted and pulverized is a good substitute for coffee. The trunk also yields a flour similar to maizena. With the straw, hats, brooms, and baskets are made, and over half a million dollars worth of it are exported to England yearly. Lastly, a wax, used in the manufacture of candles, is extracted from the leaves

The Cause of Asphyxiation.

Dr. Blandet, in the French *Gazette Medicale*, denies that carbonic acid gas has any toxic effect in cases of asphyxiation, and claims that it simply suffocates by filling the lungs to the exclusion of oxygen. Persons partially asphyxiated by carbonic acid gas can usually be restored by inhalations of oxygen. The true cause of bad air poisoning, Dr. Blandet thinks, is carbonic oxide, which is disengaged prior to carbonic acid. This does not diffuse itself in the blood like the latter, but remains and destroys the hemoglobine and the hematine.

The best remedies are not only inhalations of oxygen, but friction of the skin with oxygenated water and decomposible oxides, such as those of manganese and of cadmium. It is also suggested that sulphydrate of ammonia, administered hypodermically, might decompose the carbonic oxide.

A CANADIAN sportsman declares that the speckled trout in Ontario have been killed by warm water. The woods have been cut down, and the sun, shining upon the water from morning till night, heats the streams. He asks the farmers to plant willow limbs along the water's edge to shade the brooks and give the trout a chance—to be caught by anglers

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES—Number X.

PATTERN MAKING—THE FOUNDERY

It has been already remarked that the operations of the molder are, to a large extent, predetermined by the pattern maker; hence it becomes necessary that the latter shall have a knowledge of foundery work, otherwise he is likely to make the patterns very expensive and awkward to mold. In learning the trade, an apprentice is usually put to work and distinctly instructed as to the required form of his work without knowing anything of the reasons therefor. In this way he attains a practical knowledge of how different classes of patterns should be, or are, usually made; but it takes him years to become an expert mechanic, for the reason that, having learned by rote, he is incapable of meeting new conditions to the best advantage, until his experience has included both observations in the foundery and, in some cases, consultations with founderymen. Before entering, therefore, into the method of putting together different kinds of pattern work, it will be well to take a glance at the foundery, and examine the contrivances and the operations of the workmen, so that our operations in pattern work may be intelligently made from the beginning.

The floor of the foundery first demands our attention. It is composed of a layer of molding sand of sufficient depth to imbed patterns of the size usually cast in that foundery. For exceptionally large work, there is usually a place where the natural earth has been excavated to a greater depth; the cavity is filled with molding sand. This place is usually within easy reach of the crane (which commands almost every part of the floor) and the threshold of the melting furnace or cupola. We next observe the capacious oven for baking cores and drying molds for such special work as may require these operations; but the particular contrivance with which the patternmaker has now to concern himself is represented in Fig. 67. It is called a flask, and is composed of two or more parts (two only being shown in the engraving). The lower part is called the nowel, and the upper the cope. Each part is simply a strong rectangular frame of wood or iron. The sides, being continued past the rectangles, are roughly shaped for use as handles. The cope is provided with several crossbars, which embrace the pattern as it were, being roughly shaped like it in contour and approaching it in size, being about half an inch larger all round. These bars, by their adhesion, support the body of the sand in the cope, and in this they are frequently assisted by nails driven in nearly half way into them. When an intermediate part is used with the two parts shown in Fig. 67, the contrivance is called a three-part flask; with two intermediates it is called a four-part flask, and so on. As the cope is provided with crossbars, so also the intermediates, having to lift a ring of sand, are provided with wings; that is to say, as much crossbar as will extend from the sides to within about half an inch of the pattern. The parts are guided, in their position one to the other, by taper pins on one part fitting into eyes fixed to the other part, as shown in Fig. 67, in which the cope is shown with the side having the two pins exposed to view, while the opposite side of the nowel, having one eye, is visible. In many cases and for large work, the nowel is dispensed with, and the foundery floor is used in its stead, in which case the cope is guided to, and retained in, its place by stakes driven into the floor sand, as shown in Fig. 68, so that, when lifted to admit of the pattern being drawn from the mold, the cope may be returned again to its exact proper and former position. In Fig. 68, A represents the pattern whose impression in the floor sand, at M, forms part of the mold. B represents the cope; for the word cope is usually applied to the upper part of the mold as well as to that portion of the flask which contains it. The top print, C, of the pattern, has formed its impression in the cope at P. R is a round taper peg, which leaves a hole in the cope at *r*, through which hole the molten metal is poured. It also leaves an indentation at *r'*; and from this latter a gutter is made by the molder to communicate with the mold, M, as shown. The stakes referred to above are marked S. The dots, shown around the impression of the top pattern print, C, in the cope, are small holes made in the sand (after the molding is finished) by a piece of fine wire, and are for the purpose of giving vent to the air and gases which must escape when the metal is poured in.

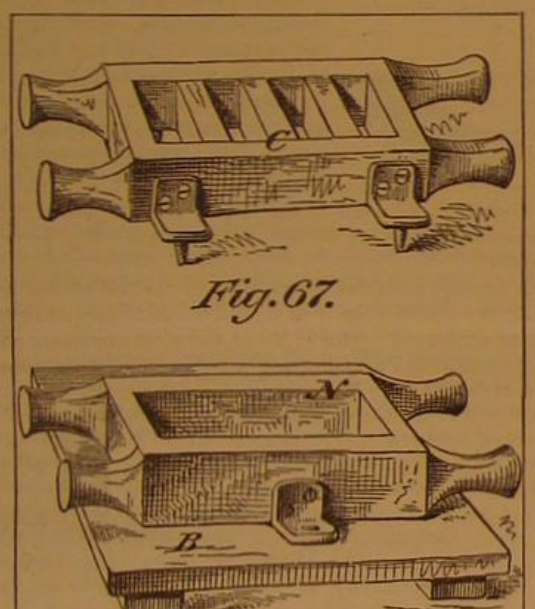


Fig. 67.

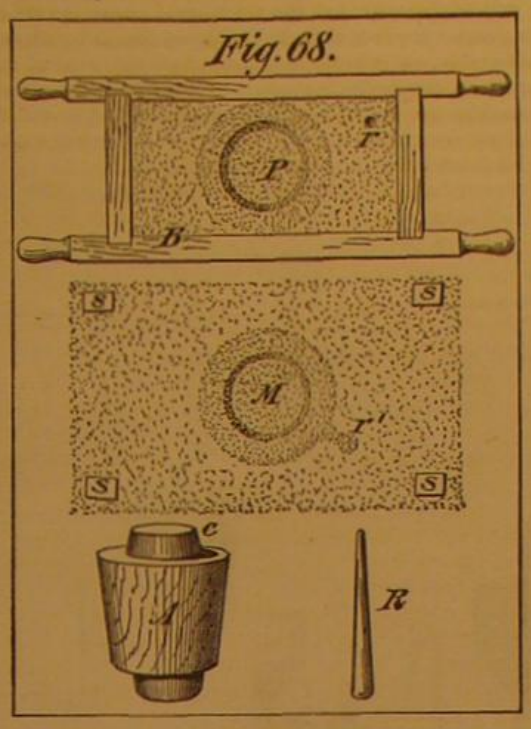


Fig. 68.

It will be seen that, when a mold is made in the flask we have described, it can perform no further duty until the casting has been made; for every mold, therefore, we require a flask, and hence the pile of these appliances we always see in a foundery. For light work, however, a comparatively modern and greatly improved device has come into general use. It is termed a snap flask, each part having a hinge at one corner and a latch at the diagonally opposite one; so that, after the mold is made, it can be detached from the perfected mold and can be used to make another. For the details of its construction and use, the reader is referred to page 111, Vol. XXVIII., since it is not our purpose to here discuss the merits of such contrivances. Sometimes, though rarely, it happens that a casting is required of such form that the patterns cannot be constructed so as to be molded with a flask of the ordinary kind. The flask requires to come to pieces and the mold to be parted sideways; this adds greatly to the labor of the molder, and the patternmaker should so construct the pattern as to avoid this whenever he can devise any means of so doing. Even when the pattern is molded in the floor, the mold is sometimes of necessity made to part on one or more of its sides, and these partings are termed drawbacks. An example of this class of work will be given hereafter.

By matching the operations of a molder, we shall observe that, in the case of a solid pattern, that is to say, a pattern not made in halves, he always endeavors to have as little of the pattern in the cope as possible, and in this respect the patternmaker should supplement his efforts. The reason is obvious: the cope has to be lifted while as yet there has been no opportunity to loosen the pattern in the mold. It is true that, in some cases, a bar is passed through the cope and driven into the pattern, and by rapping it the loosening is accomplished; but it is not well to have recourse to such an expedient, because, wherever the bar passes, the cope is damaged, and must be mended; and when a mold has to be mended, it is doubtful if the correct form, such as the pattern would have given it, will be left. Furthermore, it is all work in the dark; for the effect or extent of the rapping cannot be scrutinized, and it may therefore produce an undue distortion in one direction, while in another it may not have been effectual. Perhaps the bar may have descended at a place in the pattern where it is comparatively weak, from crossgrain of the wood or from some other cause. This measure is, therefore, on account of these difficulties, seldom resorted to; and it may be generally disregarded in the calculations of the pattern maker. The cope, then, being, as we may say, a dead lift, and with nothing to guide the operator in moving it, either horizontally or vertically, any part of the mold contained in it is much more liable to break down than is the other part of the mold. In extracting the pattern from the lower part of the mold, the eye lends to the molder great assistance. The pattern can be loosened in the sand before extraction, and is furthermore less cumbersome to handle than is the cope: all of which circumstances tend to preserve the lower part of the pattern. Rapping a pattern tends to alter the form of the mold from that calculated upon. A circle becomes slightly oval, a square becomes an oblong, and so on: and this cannot in most cases be avoided, because it is necessary to rap the pattern so as to enable the molder to extract the pattern without drawing out the sand with it; all that can be done in this direction is to rap the pattern as little as possible, and equally in all directions.

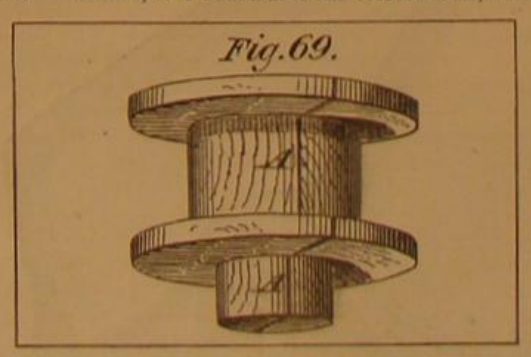


Fig. 69.

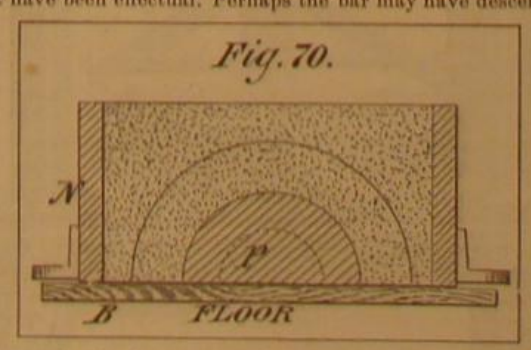


Fig. 70.

When a flask nowel is used, the labor involved in making a parting of the mold is facilitated. Fig. 67 shows a board cope and nowel for an ordinary straight parting; but it is evident that the parts of the flask may be made to show a crooked, a curved, or irregular line at the joint, if it is required, in which case the bed board must be made of similar conformation. The process of molding with a flask independently of using the floor, instead of a flask nowel, is illustrated in Figs. 70 and 71. If it be required to mold the pattern illustrated in Fig. 69, which is made in halves, the joint being denoted by the line, A A, one of the halves is taken and laid with its flat face upon the molding board, B, shown in Fig. 70. The nowel, N, is then placed upon the board, so that the half of the pattern will be in about the middle of the flask nowel. Sand is then rammed tightly in the nowel; and when the latter is filled with the sand, it is turned upside down, showing the flat face of the half pattern, the rest of the half pattern being imbedded in the sand. The other half of the pattern is then placed upon the one in the sand, its proper position being determined and regulated by pegs fitting into holes, provided in the first part, to receive them. The next operation is to put on the cope, as shown in Fig. 71, the taper pins being fast to the cope lugs shown on the sides, fitting into holes provided in the nowel lugs, similarly shown, serving to hold the cope in position and prevent it from moving. The cope is then filled with sand, lightly rammed, the taper pin, R, Fig. 68, being inserted to leave in the mold the hole, R, Fig. 71, through which to pour the melted metal. The cope is now lifted vertically; and as the pattern is made in halves, the top half lifts with the sand in the cope. In some cases a screw is fixed into the top half of the pattern, the head of the screw projecting into the cope: the object being to insure that the top half of the pattern shall lift with the cope. The next procedure is to extract the two halves of the patterns from the molds, and perform any trimming or repairing that the mold may require, after which the cope is again placed upon the nowel, and the mold is complete, ready to have the metal poured in.

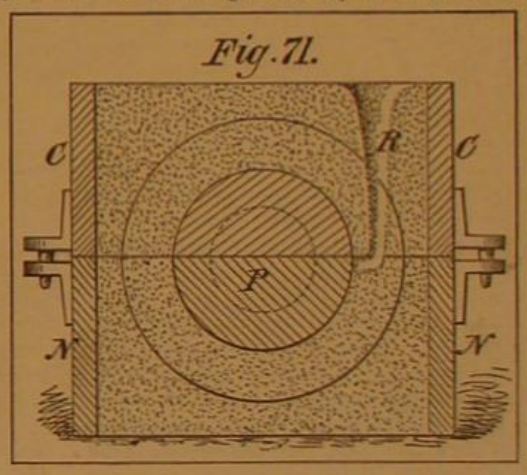


Fig. 71.

Simian Sagacity.

The sagacious monkey, who, according to the time-honored story, used the reluctant paw of a cat to withdraw hot chestnuts from the fire, is outdone by the performance of another member of his tribe, which is recounted by a French resident of South Africa, in a letter to *Les Mondes*. The writer is the possessor of a large coffee plantation, and his crops have suffered severely from the ravages of a large species of baboon, which greedily devours the fruit of a small tree which grows among the bushes. The best safeguards against the depredations are the wasps which make their nests in the lower part of these trees, for, of the fierce attack and painful stings of these insects, the baboons have a wholesome fear. One morning, a hideous chorus of yells and howls was heard from a portion of the plantation where the wasps had most thickly congregated, and where the fruit trees consequently were heavily laden. On searching for the cause, the writer saw from afar a venerable and ancient baboon busily engaged in throwing infant monkeys at the trees. These living projectiles thus knocked down the nests and of course were objects of the keen attentions of the infuriate occupants. Meanwhile the baboon quietly made his way to the upper branches, gorged himself, and then added insult to injury to the badly stung monkeys by pelting them with the rinds and pits of his repast.

THERE is no royal road to learning; its acquisition without study is like the acquisition of wealth without labor. It is as necessary for the mechanic to study out his problem, when it comes to him to be studied, as it is for him to finish his task by his handicraft.

IMPROVED CLOTHES LINE FASTENER.

We have had washing machines innumerable, sadirons, ironing tables, etc., in endless variety, until we had almost reached the conclusion that there was nothing connected with the laundry but that some ingenious inventor had, of late years, improved upon its construction, and that the end of improvements in this line was near at hand. The present device shows us, however, that, in one respect at least, the laundress's work has not been perfected, namely, in the operation of hanging out the clothes to dry.

The invention illustrated herewith offers a way of doing this easier than any previous plan that has come to our knowledge, and we recommend it to the favorable consideration of our housekeeping readers.

With the tenement houses of large cities, where building space is economized to the utmost, there is very little or no yard in which clothes can be dried. Consequently the roof is utilized, and where its accommodations fall short, as usually is the case, since professional washerwomen, as a rule, dwell in such localities, the expedient adopted is to reeve lines leading from the various windows to through pulleys on adjacent buildings, and to fasten the clothes on these. It is obvious, however, that only one part of the endless rope can be utilized; and that as soon as that is full, the nearest garment enters the further pulley, and so chokes it. Hence just half the double line is empty. The present invention supplies a means by which both parts of the rope can be utilized, by simply substituting, for the block which may constitute the distant pulley of the endless rope, a roller so constructed that the clothes, while attached to the line, can easily pass around it. The shape of this roller is shown at A, Fig. 2, where it is represented as attached to a post by simple devices which allow of its angle being adjusted so as to tauten the rope. This thus doubles the capacity of the drying accommodations afforded, and may, for this reason, prove a really valuable invention in the localities we have noted.

The lower engraving, Fig. 1, represents more clearly how the device is arranged both to economize room as well as to save labor. The line, instead of being attached rigidly to several posts, passes over the pulleys of the shape shown, on their summits. The arrangement of two pulleys on one post is shown on the right. The line again forms an endless cord; and as the clothes easily pass around all the pulleys, it follows that the laundress can stand still and fasten on one piece at a time, pull the rope along for a short distance, fasten on another, and so on until the line is full, when the first garment, after traveling around all the pulleys, will have returned to its starting point. This saves carrying a basket of heavy clothes, for the circuit of a yard during hot or very cold weather. To render the endless rope easily moved, its bight passes over a horizontal roller at B, which is turned by a belt from the drum, C. This part of the device may, if desired, start from the kitchen window or just inside the same, so that the operator need not go outdoors at all, but, standing in the house, may fill the line without risking injury to health caused by passing suddenly from a warm laundry to the cool outer air. There are various minor details for adjusting the pulleys and tautening the line, which are plainly shown in the engraving, and need no further description.

Patented through the Scientific American Agency, July 18, 1876. For further particulars address the inventor, Mr. George Almont, 604 Grand street, Jersey City, N. J., where the device may be seen in operation.

Fig. 2.

Fig. 1.



ALMONT'S CLOTHES LINE FASTENER.

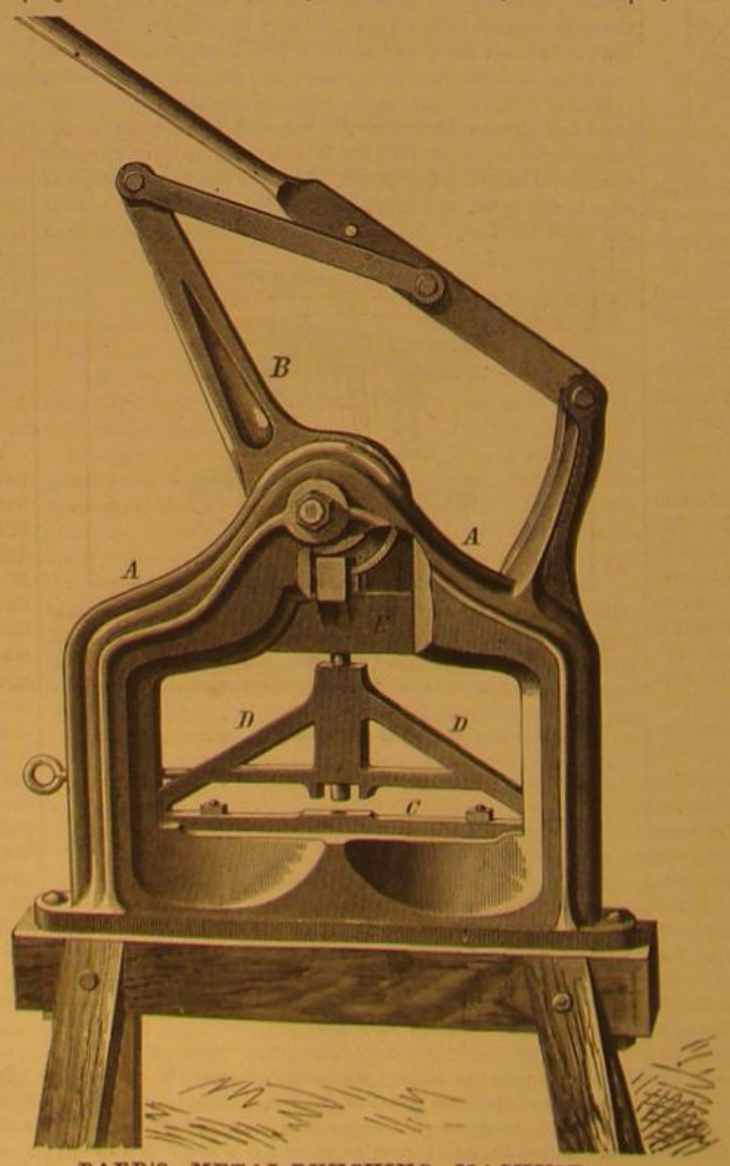
IMPROVED METAL-PUNCHING MACHINE.

The invention herewith illustrated, besides being of novel mechanical construction, includes a simple and efficient arrangement for putting in and removing interchangeable dies and punches of different sizes. It is sufficiently powerful, we are informed, to punch readily a five-eighth inch hole in plow steel, and it has been practically tested with excellent success during the year which has elapsed since it was patented.

The operation is as follows: At A are the housings, near the top of which a cam lever, B, which forces down the punches, is pivoted. C is the die block, which slides freely in between the housings and is locked by a suitable spring pin. D are guide plates for the punch over the die. A head block, E, serves to connect the punches to the cam lever, the attachment being effected by lugs which engage the lever by its grooves. The punch is secured in place by sliding the head into a channel above the slotted plate through which the shank hangs, the lower end being in the guide plates, D.

It will be observed that the mechanical power is very advantageously applied, that the punch and die, although easily removable, are tightly held, and that the general construction of the device is strong and durable. Two sizes of the machine are made, weighing respectively 175 and 275 lbs. They are excellently adapted for use in ironing wagons and blacksmiths' ordinary jobbing work.

Patented July 13, 1875, by Mr. Daniel W. Baer. For further particulars address Clayton Bush, Sextonville, Richland county, Wis.



BAER'S METAL-PUNCHING MACHINE.

To Analyze German Silver.

Take a weighed quantity of the clippings or trimmings of the alloy, and dissolve in a limited quantity of aqua regia (one part nitric and three parts of hydrochloric acid) at a temperature of about 70° Fah. When complete solution is effected, add sulphureted hydrogen water until, after standing for half an hour, the liquid smells distinctly of it; then filter, and wash the precipitate on the filter with distilled water containing a little sulphureted hydrogen several times, and dry. When dry, remove it as completely from the filter paper as possible, and boil until completely dissolved in strong nitric acid. Then dilute the acid with water, filter from the yellow sulphur that has separated in the operation, add solution of pure soda or potassa (in water) until no further precipitate forms, boil the suspended precipitate with constant stirring until it is of a brownish-black color, then filter it, wash several times with distilled water, and dry. When the oxide of copper thus obtained is perfectly dry, remove it completely from the filter paper, place it carefully in a previously weighed porcelain crucible, and heat to reduce gradually over a spirit or gas lamp. Then suspend it in the crucible over strong sulphuric acid in a tight glass vessel until cold, when it is ready for weighing. The weight thus obtained, multiplied by 0·79849, will give you the weight of the pure copper contained in the given weight of the alloy. The zinc and nickel, which were contained in the alloy, are to be found in the first filtrate from the first sulphureted hydrogen precipitate. To separate them from each other, add to the solution some pure ammonia until the solution is quite alkaline, and then sulphide of ammonium; heat gently for a short time, filter, wash the precipitate with water containing a little sulphide of ammonium; dry, separate from filter, and heat for some time with aqua regia. When the solution is effected, dilute considerably with water, and add drop by drop a strong solution of pure carbonate of soda, with constant stirring, until evolution of gas ceases (be sure you add sufficient); then boil for a few minutes and allow to subside. When this has taken place, decant the supernatant liquor (through a filter, so as to avoid loss), and wash the precipitate several times with water, decanting, as before, each time; gather the precipitate on to the filter, wash with hot water, and dry perfectly at a temperature of about 212° Fah. When dry, dissolve the precipitate (in an excess of pure acetic acid) by the aid of heat, and to the solution add some strong sulphureted hydrogen water, and allow to stand at a gentle temperature for several hours. By these means the zinc will all be precipitated, and the nickel will remain behind in the solution. To separate the nickel, evaporate the filtrate, from the last zinc precipitation, nearly to dryness in a porcelain vessel, add some nitro-hydrochloric acid (aqua regia), and heat gently until a clear solution is obtained; then mix the solution with pure potassa or soda in excess; heat for some time nearly to boiling, decant three or four times, boiling up at each time; wash the precipitate thoroughly with hot water, and dry perfectly. Then place the precipitate in a porcelain crucible, heat to redness, place the crucible with its contents in a desiccator to cool, and finally weigh. The weight obtained, *minus* the weight of the crucible, multiplied by 0·78667, equals the amount of nickel contained in the given weight of the alloy. The weight of the copper, *plus* the weight of the nickel deducted from the given weight of the alloy, equals the amount of zinc it contains.

Mocking Birds at the Centennial.

Two hundred and fifty mocking birds from Texas lately arrived at Agricultural Hall, Philadelphia. These birds were raised by Miss Antoinette Christi, of Denison, Texas, and made the journey in about two weeks. After a ride of five hundred miles to Galveston, they were transferred to a steamer and brought two thousand miles by water, without accident, until the ship encountered a gale off New York, when, as the cages were on deck, over fifty of the birds died from the effects of the sudden change of temperature caused by the storm. All the rest, however, reached here in safety, and evidently in perfect health. Though most of them are young and can be taught any tune desired, there are among the number many trained birds which whistle all the popular airs of the day.

Rubber Shoe Making.

Among the interesting processes shown in the Centennial is the making of india rubber shoes. The operation consists in stretching the flat patterns upon lasts, joining them together at the heels, and pasting on the soles. The shoes are left on the lasts until they take shape. Machinery for purifying the rubber, by passing it between toothed rollers under water, and for rolling it into sheets, is shown in operation

THE RADIATA.

The zoölogical class termed the *radiata* was comparatively unknown until within the past century, and its species were considered to be connecting links between the animal and vegetable kingdoms, being known as zoöphytes; and Linnæus defines them as "composite animals which appear to rank between animals and vegetables; though they are true animals, and possess sensation and voluntary motion."

The radiata are entirely aquatic, and are mostly marine. They are divided into three classes. These are: 1. Polyps—sea anemones, nearly all the corals, etc. 2. Acalephs—jelly fishes, medusæ, Portuguese men-of-war, etc. 3. Echinoderms—sea cucumbers, star fishes, crinoids, etc.

The structural plan of all the polyps is so nearly similar that a single illustration will answer for all, although they differ greatly in size, shape, and minute particulars. Let us suppose an orange with a small portion of the stem end removed, and a hole descending to a little past the center from this end. Now the skinny partitions which, like longitudinal planes, extend through the fruit will divide it into chambers. We must suppose a similar wall surrounding the cavity which runs down from the end of the fruit, but communicating freely with all the inner portions of the orange, through the lower end of this opening. Polyps have but this one orifice, which is the mouth. Into this all the food is taken, and from this all rejected matter is thrown out. The digested food passes from an opening in the lower portion of this cavity or sack into all the chambers of the polyp, and finally into the delicate, hollow tentacles with which the upper part of the body is fringed. This is the general form of life of all the polyps, some of which, like the corals, are stationary, while others are nomadic, and still others are parasites, living in the mouth folds of still larger radiata. The polyps vary quite materially in shape, some being almost saucer-like, others pyramidal, cone-shaped, etc.

In the lower polyps the eggs are formed on all the inner edges of the vertical partitions, and when these are ready for exclusion they drop to the bottom of the digestive sack, whence they pass outward through the mouth. In the higher order of polyps not all of these partitions are fruitful, the limitation increasing as the species rise in organic superiority. Some of the polyps also increase by buds similar to fruit buds, others by subdivision. Polyps may be cut into several pieces, and the majority of these will each become a perfect animal. They vary in size from a foot in diameter to mere microscopic mites.

From what has been said of the growth of these polyps it will be seen that coral insects have too long enjoyed the fellowship of bees, ants, etc., as hardworking creatures, with some knowledge or method of architecture. They produce coral no more ingeniously or laboriously than a fish produces bones, and cannot help it if they would. Coral is only what is left after the death of a whole community—a village of individuals whose bones, not their houses, are fashioned by cunning artisans into such beautiful adornments for our fashionable belles.

The acalephs are perhaps more interesting to the student and naturalist than the polyps. In these we find exemplifications of the curious law of alternate generations. The egg of a butterfly produces a caterpillar, which in turn becomes a chrysalis, and from this the perfect fly is in due time hatched. In some of the jelly fishes different but no less wonderful changes take place, while in others the method of reproduction is similar to that of the budding polyps. In some cases two generations intervene between the parent and a progeny which resembles it in form or mode of life.



THE DISK-BEARING JELLY FISH

The jelly fishes, with few exceptions, are short-lived in comparison with other radiates, some of the polyps living many years, while star fishes and sea urchins are sometimes ten or a dozen years in attaining their maturity. The acaleph's cycle of existence is only about twelve months. The eggs, laid in the fall, become hydroids in the winter, jelly fish in the spring, and, having made the necessary arrangements for a continuance of the species, die during the autumn. Great numbers of jelly fishes are annually killed by the severe storms of that season, and are washed upon the beach, where they almost literally melt into jelly, and leave no trace behind, there being none but the most perishable elements in their physical construction, nearly the entire animal being water. Mention is made of one specimen, which when alive weighed thirty-four pounds, being left to dry for some days, and then weighed five and one half ounces. The radiate partitions of the polyps are changed into tubes in the jelly fishes, but the general law of radiation is strictly followed. Excepting a few species they are all jelly-like in their construction; the *discophoræ* have a trifle more solid structure, but all are exceedingly soft and frail.

Very many of the more delicate species are so transparent that the casual observer often fails to see every portion of a specimen, even in the still water of the aquarium, until a movement of the animal presents its parts in a different light.

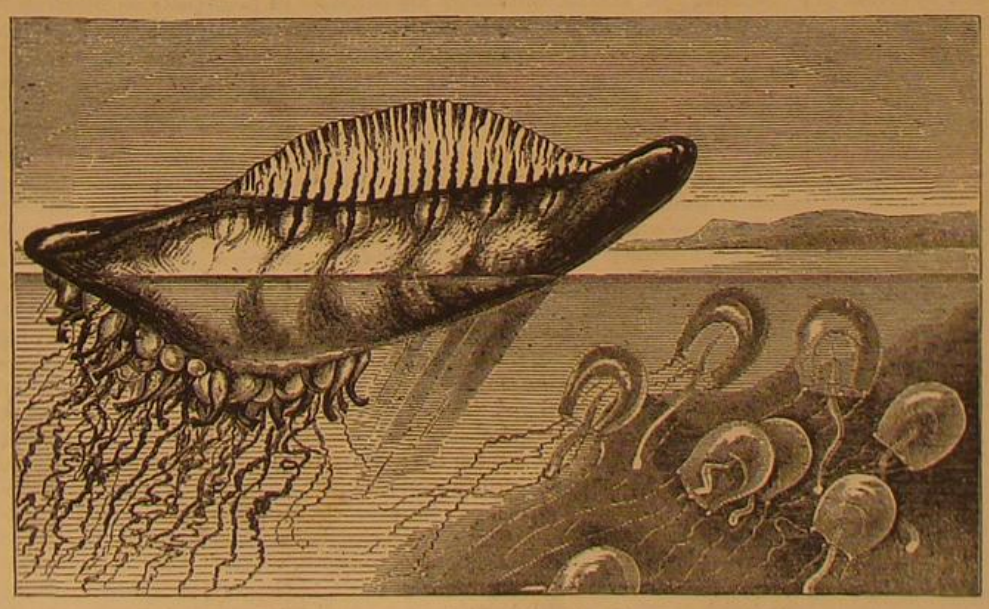
A great variety exists in the shape of these animals, and they vary no less in size, some being so small as to be entirely overlooked by the casual observer, while Agassiz mentions one, a *cyanea arctica*, a sea blubber, whose umbrella-shaped disk measured seven feet across, while the tentacles which streamed behind him measured roughly about one hundred and twelve feet. The parent of this monster is one of many from a single egg, transformed first into a stalk not unlike a cabbage stump in shape, but which subsequently changes into a tolerable representation of a pile of saucers, open side up. Each saucer, when cast off, turns over and is then a perfect cyanea. Yet the stalk which produces all these, when fully grown, is but an inch or so in hight. Were it not for their delicate structure these creatures would be as dangerous as sharks, for each of these long tentacles is capable of producing a severe smarting sensation by mere contact, while their nearly perfect transparency renders their noiseless approach almost imperceptible. Bathers along the coast of the Atlantic often encounter these unawares, and lose no time in extricating themselves from the dilemma, while large, red swellings, not unlike those produced by nettles, attest the truth of the contact. It sometimes happens that the jelly fishes which are possessed of these stinging threads—for many of the species are without them—find themselves entangled with a too formidable antagonist. In such an event they drop or shed the tentacles, and escape with all possible haste; but notwithstanding their separation from the body of the jelly fish, contact with the dead tentacles is equally painful as when living.

The stinging property is used by the jelly fish not only for defence but also for the purpose of paralyzing and retaining its prey, which consists of small crustacea, fish, and other jelly fish, or polyps. Captured individuals often show the remnants of a meal, their transparency affording the most perfect study of their internal organisms. These tentacles are covered by minute cells, lasso cells as they are called, each one of which contains a whip finer than the finest thread, coiled in a spiral within it. These are thrown out at the will of the animal, and their movements are so instantaneous that their irritating power is very great.

The Portuguese man of war is also an acaleph, belonging to a prominent genus. This individual, *physalia arethusa*, is one of the most remarkable of the group. The pear-shaped sack, ornamented with a sort of shirt ruffle fringe or crest, and filled with air, gracefully floats upon the surface of a calm sea, while beneath it trail numerous appendages of various functions. These may be compared to the members of a military or communist organization. Each pendant has its own peculiar duty. Some are the providers, commissaries; others are the locomotive organs, while still others are charged with the duty of growing new medusæ buds for the perpetuation of the race. Those tentacles which belong to the transportation department often extend to a distance of thirty feet from the main body of the animal, which is usually but five or six inches in length. This hydroid is properly an inhabitant of the tropical seas, but occasionally, having drifted into the Gulf Stream, it is borne along the shores of the Atlantic far away from its native home.

The hydroids are not all free to move about at will. Agassiz and Vogt have thrown the two together, this simple difference not warranting distinctive groups in which earlier naturalists had placed them. Many of the hydroids bear a close resemblance to some species of vegetation growing on the bottom, where at low tide they are taken by the casual observer for marine plants. Some of these are exceedingly minute; and the little bells or buds, in which the diminutive embryo creatures are imprisoned, are, to all casual observers, flower buds or seed vessels. This is also true of the polyps, which, in structure and colors, resemble nearly every form of vegetable life.

The colors of the jelly fishes are as varied as are their forms and dimensions. In the *bolina*, for instance, there is a marked resemblance to a beautiful white flower. The *cyanea* is a dark, brownish red with a milk-white margin, and tentacles of purple, yellow, and pink. *Idyia* is mostly of a bright pink, while red, yellow, orange, green, and purple chase each other rapidly along its undulating fringes. Other varieties appear in no less beautiful and different shades of beauty; while at night, if the sky be overcast or the moon is not a disturbing witness, the slightest movement, of the depths where these delicate beauties are, brings out the most resplendent flashes of green and gold and liquid phosphorescent flames that seem almost to kindle the entire waters. Myriads of the lesser varieties, scarcely noticeable in the bright light of day, thus disturbed, become globes of brilliant gold, and the oars of the boat, as they rise from the water, drip with liquid flame given out by these and other minute inhabitants of the deep, while the glistening particles extend far in the diverging wake of the passing craft.—*Home and School.*



THE PORTUGUESE MAN-OF-WAR AND THE SEA BLUBBER.

Cheese Factories in England.

British farmers are notoriously slow to accept innovations, and this may be said without fear of hurting their feelings, as they are well aware of it, and in fact rather pride themselves on their conservatism. But they are now moving in a direction which possesses some interest to Canadian farmers. The United States and Canada may be said to have absolute possession of the British cheese market except for certain fine brands with which we do not compete. Our factory system has already made its way into Britain, and is as successful there as it is here. And now they are going to adopt another of our institutions, the Dairymen's Association. Certain leading spirits think it a shame that English cheese makers can be beaten in their own markets, and they are going to leave no stone unturned in the attempt to regain possession. Dear land and high taxes will operate against them just as distance will against us. The future will show whether the new British Dairymen's Association, which was formally instituted at Birmingham recently, will enable the farmers over the water to drive us out of their markets. We opine, says the *Canadian Farmer*, that it will not. Nevertheless, it is never well to have only one string to one's bow. The move of our English brethren should teach us to be on the alert for new markets. And if it should also direct our energies more to the manufacture of butter by the factory system, it will benefit us as much as it will them.

AMERICAN CREMATION.—A citizen of Washington, Penn., has built a large stone house on a hill for the reception of dead bodies, and a furnace scientifically constructed, in which they are to be burned. He has given strict injunctions to his executors that his own body be burned in the furnace.

[For the Scientific American.]

CHEMICALS AT THE CENTENNIAL.

It is generally admitted that the German section at the Centennial Exposition is far inferior to what it ought to be, and does not adequately represent the present state of manufacture and industry in that empire. Be this true or not, it certainly does not apply to the chemicals, for in this department Germany is *facile princeps*. She supasses France, is far beyond England, and finds a worthy competitor only on this side of the ocean. In quantity, Philadelphia chemists far excel; but in rare chemicals, new compounds, and interesting preparations, Germany leads. Entering by the main entrance on Elm Avenue, and passing up the center cross nave, we have on our right the magnificent display of Powers & Weightman, Rosengarten, and Pease; on our left the smaller black show cases of the German exhibitors, Brohme, Trommsdroff, and others.

THE GERMAN EXHIBIT.

This department has an advantage over all others in having a complete and instructive catalogue, which enables the visitor to examine with greater ease and understand more readily what is to be seen here. An intelligent attendant is also ready at all times to explain more fully whatever is of interest The chemicals in this department may, for our convenience, be arranged under three heads, namely, chemicals largely employed in the arts, rare and curious chemicals chiefly of theoretical interest at present, and coal tar products, including the aniline colors. This division is, of course, very imperfect, because new substances are so rapidly passing from the second to the first class, while the third class belongs to both the others.

The most interesting of the commercial exhibits, because the newest, are the samples of carbonate and bicarbonate of soda made by Moritz Honigmann at Aix la Chapelle, by the ammonia soda process of Solvay (see SCIENTIFIC AMERICAN, June 24, 1876). This establishment employs 35 men and 3 steam engines of 25 horse power in the aggregate, producing 6,600 lbs. of soda ash per diem. The operations are performed in large wrought iron vessels at a pressure of ¼ to ½ atmosphere. Chloride of sodium obtained from the saltpeter works (SCIENTIFIC AMERICAN, January 22, 1876) is decomposed, at a temperature of 95° Fah., by carbonic acid and ammonia, into bicarbonate of soda and chloride of ammonium. The ammonia is recovered from the latter by means of unslaked lime, at a temperature of 212° Fah.; the lime is obtained by burning mountain limestone with coke, and the carbonic acid utilized for converting the salt into a bicarbonate of soda in the presence of ammonia, as above stated. No use has yet been found for the waste chloride of calcium. The calcined soda ash contains 98 to 99 per cent of the carbonate; and, being free from iron, sulphur, and sulphuric acid, is largely employed in dye works and glass houses. This process will attract our notice again in the chemical sections of France and Belgium.

Vorster and Grueneberg, of Kalk, exhibit potash and saltpeter made from the Stassfurt salts.

There are several exhibitors of glue, gelatin, and phosphates from animal refuse.

Xanthate and sulpho-carbonate of potassium, the new insect destroyer, is exhibited by J. F. Hayl & Co., the well known manufacturers of bisulphide of carbon. This establishment, which covers over 7 acres and employs 12 men, is chiefly occupied in the extraction of fatty oils by means of bisulphide of carbon. They exhibit oil cake and oils. They claim for the oil cake that it contains 6 to 15 per cent less oil than those which have been pressed, but are better as fodder because the nitrogenous principles remain in the residues.

Paraffin and paraffin candles made from peat are exhibited by two stock companies, one at Rehmsdroff, the other at Halle.

The Nuremberg Ultramarine Works have a pyramid over ten feet high, around and on which their products are arranged. Green, blue, and violet ultramarines are exhibited. Several smaller exhibits of ultramarine, both blue and green, were also noticed.

The exhibition of mineral colors, although varied and pleasing to look at, requires but little to be said about them Zinc and cadmium yellows, umbers, ochers, siennas, lampblacks, etc., filled the list.

Brohme & Co., Bergen, exhibit soda and potash water glass in solid and liquid form, composition for artificial stone, water glass whetstones, etc.

Oxalic acid and oxalate of potash are exhibited by R Koepp & Co. and Kunkeim & Co. The latter also exhibit the rarer substances, tungstate of soda, naphthaline yellow, and phthalic acid.

The largest exhibit of alkaloids is by Fried. Jobst, Stuttgart, and includes also opium grown in Würtemberg and Silesia. Here we notice a dozen different salts of quinine, including the anetholate, and several salts of other cinchona alkaloids. The new preparations made since the Vienna Exposition of 1873, and never before exhibited, are the muriate, sulphate, and salicylate of phenyl-quinine, sulphate of phenyl-cinchonidine, oxalates of cinchonicine and of quinicine, santoninic acid, cotoine, echicerine, chinamine, echitine, and echi eine.

The exhibit of alcoholic preparations, by C. A. F. Kahlbaum, Berlin, is deserving of special notice, showing as it does how soon chemical compounds pass from the class of rare and curious chemicals to commercial articles. These works, which are under the direction of Drs. G. Krämer and Bannow, were the first to manufacture artificial mustard oil (from allyle alcohol) on a large scale, and now it is capable, by excellence and cheapness, of competing with the natural oil. The other staple productions are methyl, ethyl, and amyl alcohols, iodoform, acetone, aldehyde, ether, acetic acid, and acetates The most interesting portion of this exhibit is, however, a series of scientific preparations, made in the laboratory connected with these works, and in many cases from waste products. A list of these curious and new compounds would exceed our present limits, and we may only mention a few, such as metaldehyd, a white solid crystaline substance having the same percentage composition as common aldehyde, and convertible into it by heat at 112° to 115° in a closed tube. Paraldehyd, a liquid isomer of aldehyd, which boils at 124° and crystalizes below 10°, is also exhibited. Resorcin, phenylacetic acid, phloron, phthalic acid, azobenzol, methyl and ethyl iodides, zinc methyl and ethyl, sulpho butylates, methylates, propylates, and vinates are among the things seldom, if ever, seen before in America.

In the case adjoining Kahlbaum's exhibit is the far smaller but equally interesting one of Dr. Wilhelm Haarmann, Holzminden on the Weser. Here is exhibited the new artificial vanillin, discovered by Drs. Haarmann and Tiemann; also a glass of coniferine, a glucoside contained in the cambium of coniferous woods, and from this the vanillin is made. The latter is identical in composition, melting point, flavor, and all other properties with vanillic acid from the vanilla bean. Vanillinic acid (a by-product), vanillinic sugar, vanillinic alcohol, and vanillinic glycerin are also exhibited. These works were established in 1875, and employ in the summer months about 46 workmen.

Next to this is the exhibit of the Berlin Stock Company, formerly E. Schering. The exhibit is large and handsome, including salycilic acid in large quantities, salicylates of ammonium, quinine, sodium, and zinc, also chloral hydrate, both in cake and crystals. Just around the corner is the curious little exhibit of Dr. F. Wilhelm, Reudnitz-Leipsic. He exhibits the artificial bitter almond oil (not, he says, nitrobenzol), of which he claims to be the inventor and only manufacturer. He also exhibits benzoic acid, Niobe essence (?), benzyl chloride, and some manganese salts.

The well known house of H. Trommsdorff, Erfürt, makes a very large and interesting show. It includes 50 different alkaloids, glucocides, and bitter principles, 30 organic acids, various physiological preparations, such as glycocoll, allantoine, cholestrine, taurine, etc. Among the rare metals and metallic salts, we noticed selenous, tellurous, and vanadic acids, sulphate of beryllium, cæsium, and rubidium alums, sulphates of cerium, lanthanum, and didymium, bichromate of rubidium, bivanadate of ammonium, and metallic tellurium, thallium, titanium, tungsten, molybdenum, etc.

Another fine display, in close competition with Trommsdorff and Kahlbaum, is that of Dr. Theodor Schuchart, Görlitz. There are 110 preparations of purely scientific interest, and 20 for technical purposes. Among the former are included nearly all the rare metals and their salts. One of the most beautiful things here is the double cyanide of yttrium and platinum, which consists of dichroitic (red and green) crystals. We also noticed some handsome crystals of boron, also specimens of nitrate of roseo-cobalt, chloride of purpureo-cobalt, sulphate of xantho-cobalt, crystals of nitrate of uranium, metallic chromium, nickel salts, sesquichloride of titanium, chloride of niobium (columbium), and blue oxide of tungsten. A few organic preparations, thymol, anthracene, alizarin, etc., completed the list.

Salicylic acid and its derivatives are exhibited in large quantities by Dr. F. von Heyden, Dresden, who manufactures, under Professor Kolbe's patent, from the best English carbolic acid. The collection contains wintergreen oil, pure and crude salicylic acid, crude and pure salicylicate of soda, and sodium phenylate.

Dr. L. C. Marquart, Bonn, has a very good display, including salicylic acid, cæsium, and rubidium alums, ethyl sulphate of lithium, ethyl benzol, bibrom-benzol, and dichlorhydrine, the curious chlorine derivative of glycerin.

Chloral hydrate is the specialty of Saame & Co., Ludwigshafen. The works cover 17 acres, and originally were devoted to the production of chloral hydrate only; but since the fall in price of that article, they have begun the manufacture of the mineral acids, of which they produce 13,200,060 lbs. annually. They also manufacture and exhibit chloroform, made from chloral and absolutely free from other chlorine compounds, chloral alcoholate, chloride of sulphur, bisulphite of soda, used in making the new reducing agent hydrosulphurous acid, chlorate of potash, etc.

The third class of chemicals, coal tar products, form the most beautiful and interesting part of the chemical section. (See SCIENTIFIC AMERICAN SUPPLEMENT, page 496, volume I.) There are several exhibitors of these goods, the largest and best being those of Fried, Bayer & Co., at Barmen and Elberfeld, and the *Actien Gesellschaft für Anilin-Fabrikation* at Berlin. The former is especially interesting, as showing all the steps of the process, and all the intermediate products from the coal to the finished dye, all numbered and labeled, the formulas being given, too, in most cases. Among the rarer substances, we noticed the new and beautiful cosine and silks dyed with it, also fluorescin, resorcin, phthalic acid, benzyl chloride, cumol, xylol, rosolic acid, iodide of ethyl and methyl, coralline, and a full series of anthracene derivatives, bibrom-anthracene, anthraquinone, sulphanthroquinonic acid and its barium and sodium and sodium salts, alizarates of sodium, potassium, barium, and aluminum, alizarine itself, and samples of dyeing. The Actien-Gesellschaft present even a better show of the aniline dyes and dyed specimens, many of the dyes being in much larger quantity, and the whole well mounted and catalogued. The Frankfurt Anilin Color Works exhibit 25 specimens, including cosine, phosphine, indigotine, phenyl-yellow, indigo carmine, aniline blue, green, and violet.

Taken as a whole, the exhibit of German chemicals does credit to the manufacturers and to the committee who organized and executed this difficult work. E. J. H.

[For the Scientific American.]

BOILER NOTES.

We have just received the last annual report of the Hartford Steam Boiler and Insurance Company, and, in accordance with our usual custom, proceed to present a synopsis of it to our readers.

The present report is one of unusual interest, as the President, in honor of the completion of the first decade of the company's existence, gives a review of the work done since the organization. The task undertaken by the company, as most of our readers doubtless know, is to institute such a system of inspection of the boilers under their charge as to render them reasonably secure against explosion, agreeing to pay the owners the *amounts* of insurance stated in the policies, in case explosions do occur. The company's record for two years shows a list of 848 boiler explosions in the United States, by which 1,768 persons were killed, and 1,904 injured. Of these boilers that exploded, 18 were insured by the company, and a careful examination of the causes shows them to have generally been such as no inspection could have prevented. Thus, in one instance, a boiler being under repairs, the workman drove a plug into the steam pipe, and neglected to remove it when the work was completed. As might naturally be expected, in getting up steam in the boiler, it exploded. Several other cases of explosion occurred with long boilers, supported only at three points of their length, and fired by the waste gases from iron furnaces. The President states that it cost the company $10,000 to learn that such boilers should have supports not more than 10 feet apart—though, if we mistake not, considerable attention has been paid to this subject in England in former years, resulting in the adoption of a method of supporting long boilers which seems to give good results. During the period covered by this last report, from August 31, 1874, to December 31, 1875, the company have made 44,763 inspections, discovering 24,040 defects, of which 5,149 were classed as dangerous, requiring immediate attention. Some of these defects may be briefly recounted and discussed. Their nature is clearly illustrated in the report, by a series of well executed engravings.

Furnaces become distorted, and plates are fractured, chiefly by bad management, such as suddenly introducing cold water into an overheated boiler. These distortions and fractures are frequently hastened by the method of construction, the plates being overstrained by using drift pins to bring the rivet holes in line. A sheet may be nearly fractured by this mal-construction, and yet appear to be uninjured, when viewed from the outside.

Plates become burned from forcing the fire too fiercely, or on account of the deposition of scale or sediment. Comparatively few manufacturers seem to realize the danger of using a boiler that is too small for the work, and forcing it to the utmost extent. When a blister forms on a plate, it is generally due to the uneven character of the iron, and the whole plate should be renewed, the application of a patch being only a temporary expedient. Sheets may be corroded on the outside by leaks at the seams, in places which are not readily accessible for examination. Such defects can only be discovered by careful inspection. The use of impure water frequently causes the rapid destruction of a boiler by internal corrosion; and unless this is discovered by internal inspection, a so-called mysterious explosion may be the result.

Careless engineers allow water gages to become clogged, blow valves to leak, and safety valves to stick fast. The following simple rules should be observed by every one in charge of a boiler.

Blow through the water gage at least once a day, and several times, if the water is dirty.

Before starting the fire in the morning, always try the water in the boiler, and do not raise steam until assured that it is at the proper level.

Raise the safety valve, at least once a day, and observe whether it works freely. Attach a stop to the lever, so that the ball cannot possibly be moved out beyond the proper position; and never hang any additional weight on the lever.

Among the steam gages examined by the company, 649 were found to be dangerously defective, having errors ranging from —45 to +70 with inoperative safely valves. What splendid chances for "mysterious explosions" were presented!

A number of boilers were found without gages, and 19 of these were considered dangerous, because a high pressure was carried.

Several boilers were examined, in which there were no hand holes for removing the sediment, and in many boilers the bracing was very insufficient. When such boilers explode, there ought to be little difficulty in finding the cause. The experience of the company, with boilers in which some of the sheets were made of Bessemer steel, seems to show that this metal is quite as reliable as iron, all cases of distortion or fraction of steel plates being traced to overheating or sediment

During the time covered by the last report, 139 boiler explosions were reported in the United States, by which 191 persons were killed, and 267 injured. An investigation of a number of these by the company has served to clear up all mystery in reference to their causes.

In the above brief synopsis of this interesting report, we have endeavored to give prominence to such matters as will be of especial interest to those in charge of steam machin-

ery. We think the operations of this company show clearly that safety from boiler explosions can be obtained by careful inspection at frequent intervals, and careful management at all times, neither plan by itself constituting a sure preventive. Not the least among the results of the company's work is the clear demonstration of the fact that the hydraulic test alone will not reveal all the defects of a boiler; and, as we have frequently pointed out, when it is made with cold water it sometimes produces defects which did not formerly exist.

[For the Scientific American.]

OCCUPATION AND THE DEATH RATE IN ENGLAND.

A comparative study of the death rate in seventy-three of the principal employments in England and Wales has lately been made in the British Registrar-General's office, based on the mortality returns of three years. The results show, among other matters of interest, the mortality among all the males aged fifteen years and upwards, in each of the specified employments, and also the relative mortality in each, the mean death rate of the whole being taken as one hundred.

For example, in the three years under examination, the deaths among grocers amounted to three thousand one hundred and sixty. Had their death rate been equal to the mean death rate for all the employments during those years, as many as four thousand one hundred and seventy-three grocers would have died. The relative death rate of that class, therefore, in comparison with the whole, was only seventy-six.

But the grocers were surpassed in healthfulness by the members of two learned professions, the lawyers and the clergymen. The barristers head the list, with a death rate of only sixty-three; the clergy of the Established Church follow, with a death rate of seventy-one, while the independent Protestant denominations stand at seventy-five.

It is scarcely probable that the immunity of the barristers is altogether due to the lightness or wholesomeness of their work. That counts for much, but we must not forget to allow for the fact that in England a large number of independent gentlemen adopt that calling, not to make a living out of it by hard work, indeed not to work at all in it; but simply for the nominal professional rank it gives. If the working barristers only were counted, it is doubtful whether the class would stand so high in the sanitary list. Perhaps the refuge which the Established Church affords for many men of culture and leisurely regular life may similarly help to account for its lower death rate as compared with that of other Protestant clergy.

Next after the barristers and the Protestant clergy come the grocers, already mentioned, followed by men of the combined occupation of grocer and shopkeeper, with a death rate of seventy-seven. After these we find gamekeepers, with a death rate of eighty; farmers, one of eighty-five; civil engineers, eighty-six; booksellers and publishers, eighty-seven; wheelwrights, eighty-eight; silk manufacturers, eighty-nine; carpenters and joiners, and common laborers, stand together in the list, at ninety-one; bankers at ninety-two; domestic servants, ninety-three; sawyers at ninety-five; musical instrument makers, paper manufacturers, and brass workers, at ninety-six; blacksmiths and gunsmiths at ninety-seven; tanners and curriers, shoemakers, and workers in iron and steel, ninety-eight; and bakers at ninety-nine, completing the group of occupations in which the death rate is below the mean.

Machinists and woolen workers die at the mean rate for all, one hundred. Then follow half a hundred employments, more and more destructive to life. Manufacturers in iron, copper, tin, and lead, with bakers and confectioners—probably what would be classed as fancy bakers here—exceed the mean mortality by one. The schoolmaster's calling, and the solicitor's, rank next in unhealthiness, their death rate being one hundred and two. Millers and Roman Catholic priests stand next, with a death rate three above the mean, and thirty-two above that of the clergy of the church of England: a notable circumstance, to say the least.

Why should the mortality among the Roman Catholic priesthood exceed so largely—nearly fifty per cent—that of the English clergy? Are celibacy and asceticism the unsanitary conditions? Or shall we attribute their higher death rate to a more arduous and exposed life among the sick and squalid poor?

After the priests come watchmakers, one hundred and four; tobacconists, one hundred and five; physicians and shipbuilders, one hundred and six; messengers and porters, coach makers and rope makers, one hundred and seven; drapers, one hundred and eight; tailors, one hundred and and nine; and workers in cotton, flax, and silk, the same. Chemists, druggists, and commercial travelers exceed the mean death rate by ten; clerks, insurance men, and butchers, by eleven; carvers and gilders, by twelve; farriers, by thirteen; miners, printers, and manufacturers of cotton and flax, by fifteen. It will be noticed that weavers and workers in silk are much the most healthy of all who have to do with textile fabrics, their death rate being eleven below the mean. Those that handle wool exhibit an average vitality, compared with all grades of working men. With the addition of cotton and flax to the fiber used the death rate rises to one hundred and nine; while those who handle flax and cotton without silk or wool die at the rate of one hundred and fifteen. Which is the more destructive to life in its working, cotton or flax, the statistics do not show.

Bookbinding is a degree more unhealthy than printing, the death rate of this class of workers being one hundred and sixteen. In glass manufacturers and fishmongers it rises to one hundred and nineteen; and in printers and plumbers to one hundred and twenty. Quite a number of callings show a death rate of one hundred and twenty one; namely, railway employees, dock laborers, tool makers, file makers, and saw makers. For the diverse causes of high mortality in their occupations, it is not needful to enquire. In hatters, coppersmiths, and needle makers, the rate rises to one hundred and twenty-three; and in manufacturing chemists, and dye and color manufactories, to one hundred and twenty-four. In hair dressers the mortality is more than double what it is in the legal profession, that is, one hundred and twenty-seven. Bargemen die at the rate of one hundred and twenty-nine, or twenty-nine above the standard death rate. The employments of carmen, dray men, horse-keepers, and grooms are still more fatal, the death rate being one hundred and thirty-one. In the next group, embracing potters, innkeepers, licensed victuallers, the mortality is thirty-eight above the standard; while in cabmen and coachmen (not domestic), the death rate rises to its highest, one hundred and forty-three, or twice that of the English clergy.

These figures show with practical accuracy the comparative mortality of the men engaged in these various employments. To considerable extent also, they represent the comparative healthfulness of the several callings; but the reader will readily see that many outside conditions conspire to affect the death rate in each. An easy and healthful calling may show a high death rate, simply because it is easy and comparatively favorable to life, and consequently attracts to itself the feeble and disabled. For example, the statistics of the Medical Department of the Provost Marshal General's Bureau, during our late war, shows that proportionally more watchmen were rejected for physical unfitness than men of any other employment. Yet the watchman's work is easy and not specially unhealthful: so easy, in fact, that the worn-out and crippled and diseased naturally gravitate to it.

That cabmen should show excessive mortality is rather to be expected. Their working hours are long and irregular; and they are exposed to all weathers under unfavorable conditions. It is not so apparent why the unexposed innkeepers and victuallers should die almost as rapidly. The clever author of "Diseases of Modern Life" charges their high death rate to drink. No doubt excessive indulgence does cut short the lives of very many. But we are inclined to think that the selective action of the business has much to answer for. A large proportion of the English innkeepers are men whose working days are past: men who have earned a little money as butlers, stable keepers, small traders, and the like, and find the inn, or "saloon," as we would call it, a sort of hospital for the physical incapacity.

Again, the mortality of hair dressers is relatively high, thirty per cent higher than that of blacksmiths. It can hardly be that their business is in itself so much more killing, notwithstanding the hot and ill ventilated rooms they usually occupy. It is another case, we think, of natural selection. Out of a hundred boys fated to be blacksmiths and barbers, there is little doubt that the majority of the sturdy ones will gravitate to the blacksmith shop, the majority of the undersized and feeble ones to the barber's.

In another article we propose to examine the relative healthfulness of the different employments of men in this country. The results are in many respects curiously unlike those derived from the English statistics. R.

The Meeting of the American Association for the Advancement of Science.

The annual meeting of this association convened at Buffalo, N, Y., on August 23. There is a remarkably large attendance, not only of American scientists, but of scientific men from Europe, who are on a visit over here to the Centennial. The proceedings were formally opened in the Common Council Chamber of the City Hall by a speech by the retiring president, Professor G. S. Hilgard. This was followed by a brief address by the new president, Professor William B. Rogers, after which a formal welcome was extended to the Association by the Mayor of Buffalo and influential citizens. These proceedings, together with the work of electing a standing committee and the reading of a few papers, which will be referred to in the abstracts which we shall publish next week, occupied the attention of the scientists for the first day. On the ensuing morning Professor Huxley arrived, and, after receiving an enthusiastic welcome, addressed the assembly substantially as follows. After gracefully returning thanks for the reception accorded him, he stated that he had no scientific matter to communicate, and in that respect was unprepared, but that, to satisfy a curiosity which he had noticed to be especially developed among us, he would state briefly his impressions of the country.

PROFESSOR HUXLEY'S ADDRESS.

"Since my arrival," he continued, "I have learned a great many things, more, I think, than ever before in an equal space of time in my life. In England, we have always taken a lively interest in America; but I think no Englishman who has not had the good fortune to visit America has any real conception of the activity of the population, the enormous distances which separate the great centers; and least of all do Englishmen understand how identical is the great basis of character on both sides of the Atlantic. An Englishman with whom I have been talking since my arrival says: "I cannot find that I am abroad." The great features of your country are all such as I am familiar with in parts of England and Scotland. Your beautiful Hudson reminds me of a Scotch lake. The marks of glaciation in your hills remind me of those in Scottish highlands.

"I had heard of the degeneration of your stock from the English type. I have not perceived it. Some years ago one of your most distinguished men of letters, equally loved and admired in England and America, expressed an opinion which touched English feeling somewhat keenly—that there was a difference between your women and ours after reaching a certain age. He said our English women were "beefy." That is his word, not mine. Well, I have studied the aspect of the people that I have met here in steamboats and railway carriages, and I meet with just the same faces, the main difference as to the men being in the way of shaving. Though I should be sorry to use the word which Hawthorne did, yet, in respect to stature for fine portly women, I think the average here fully as great as on the other side. Some people talk of the injurious influence of climate. I have seen no trace of the "North American type." You have among you the virtue which is most notable among savages, that of hospitality. You take us to a bountiful dinner and are not quite satisfied unless we take away with us the plates and spoons. Another feature has impressed itself upon me. I have visited some of your great universities and meet men as well known in the old world as in the new. I find certain differences here. The English universities are the product of Government, yours of private, munificence. That among us is almost unknown. The general notion of an Englishman when he gets rich is to found an estate and benefit his family. The general notion of an American when fortunate is to do something for the good of the people and from which benefits shall continue to flow. The latter is the nobler ambition.

"It is popularly said abroad that you have no antiquities in America. If you talk about the trumpery of three or four thousand years of history, it is true. But, in the large sense, as referring to times before man made his momentary appearance, America is the place to study the antiquities of the globe. The reality of the enormous amount of material here has far surpassed my anticipation. I have studied the collection gathered by Professor Marsh, at New Haven. There is none like it in Europe, not only in extent of time covered, but by reason of its bearing on the problem of evolution; whereas before this collection was made, evolution was a matter of speculative reasoning, it is now a matter of fact and history, as much as the monuments of Egypt. In that collection are the facts of succession of forms and the history of their evolution. All that remains to be asked is how, and that is a subordinate question. With such matters as this before my mind, you will excuse me if I cannot find thoughts appropriate to this occasion. I would that I might have offered something more worthy; but I hope that your association may do what the British Association is doing—may sow the seeds of scientific inquiry in your cities and villages, whence shall arise a process of natural selection by which those minds best fitted for the task may be led to help on the work in which we are interested. Again I thank you for your excessive courtesy and, I may almost say, affectionate reception."

The Traveler Ropes of the Brooklyn Bridge.

The joining of the two ends of the first traveler rope, whereby the material for constructing the East River Bridge is to be transported over the river, was recently accomplished. The endless chain is now complete, passing over grooved pulleys on the towers. It is operated by the engine formerly used to elevate stone during the process of erection of the piers. At the time we write, the first section of the second traveling rope is about to be carried over the river. This is made fast to the rope now in position and run over by it. It is lashed to the first rope at regular distances of 50 or 60 feet, as it leaves the Brooklyn anchor pier; and when it is across, these fastenings will have to be cut. This is done by a man sent over in a "buggy," which is a small platform hung upon the traveler rope by deeply grooved wheels. It is surrounded by a railing, inside of which the workman will stand, cutting the lashings as he rides across. The ride down to the center of the traveler rope will be controlled with a hempen rope, and the "buggy" will be hauled up the opposite incline with another. There will be nothing perilous in the process if the workman can keep from dizziness, nor more danger than in a great many other stages of the work.

In order to inspire confidence in the men who are to perform the undertaking, Mr. E. F. Farrington, master mechanic of the bridge, recently crossed from the Brooklyn anchorage to the New York pier, seated on a boatswain's chair, or swing, attached to the moving rope. The trip was rapidly and safely accomplished in the presence of a large and enthusiastic crowd. Mr. Farrington, now the first man who has crossed the bridge, was also the first who traversed the spans at Cincinnati and Niagara.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVEMENT IN FEEDING PULVERIZED FUEL TO FURNACES

Allin Cockrell, Lamar, Mo.—This consists of a fan blower combined with a furnace in such manner as to feed it with a constant and regular supply of fuel, and having a conveyer for supplying the fuel to it from a mill in which it is ground, or from a feeding hopper to be supplied with previously pulverized culm, tan bark sawdust, or the like.

IMPROVED EXPANDING METAL DRILL.

Patrick Duffy, New Bedford, Mass., assignor to himself and James F. Powers, same place.—Two cutters, fixed in the stock to slide forward and backward transversely, are slotted obliquely and reversely to each other. The fastening bolt by which they are secured to the stock is fitted in said slots, and also fitted in a vertical slot in the stock, so that, by shifting the bolt along the slots in one direction, the cutters will be adjusted onward; by shifting the bolt the other way, they will be adjusted inward.

APPARATUS FOR CUTTING AND ORNAMENTING SHOE UPPERS.

Edwin B. Stimpson, Brooklyn, N. Y.—This consists essentially of a series of small punches, one or more large punches, a bed die, and a stripper, contrived in the ordinary way of punching machines, for making ornamental figures in the uppers of shoes. The steel die plate is riveted to an iron plate, the object of which is to combine with the die plate a sufficient body of metal, that will not crack in cooling. The stripper is suspended from the head of the press by springs to raise it out of the way of handling the goods after the goods are cut. The marking plate has small points for marking imitation stitches, and there are broad punches for cutting out long strips made concave on the cutting end.

IMPROVED LUBRICATOR

Simon Smith and Isaac S. Collins, Mauch Chunk, Pa.—This is a horizontally feeding oil cup for parts of steam engines, which can be regulated to feed a greater or less quantity of oil when the engine is in motion, but which discontinues the oil supply when the engine is stopped. It consists of a horizontal cup of cylindrical shape, with tightly seated glass head. The feeding mechanism consists of a horizontal reciprocating pin, guided in suitable manner, and having recesses that take up the oil from supply perforations and convey it to the feed tube at each oscillation of the part of the engine to which the lubricator is attached.

IMPROVED GRINDING MILL.

Enoch Moore and David Moore, Mooreville, Iowa.—These inventors propose to provide a supporting plate, with a recess, on which they locate the rocking plate resting on the pivots in the bottom of the recess. The stone on the under side of it rests on other pivots. By this arrangement, sufficient space is secured between the beams without cutting or weakening them.

IMPROVED COMBINATION LOCK.

Isaac D. Sibley, Huntsville, Ala.—This consists of two systems of bars and springs, arranged one on each side of the guard bolt to slide toward and from it, and so contrived that the bars of one side being adjusted against the block lock it, and in that position are unlocked by sliding up the bars of the other side.

IMPROVED LARD PRESS.

Pusey Pemberton, Newark, Del.—Devices are provided whereby the follower may be held level, and may thus be kept from binding, even should there be more scrap or cracklings in one side than in the other, and the mechanical construction is new and well calculated to render the machine efficient.

IMPROVED LEATHER-TAPERING MACHINE.

John Settle, Lebanon, Oregon, and George W. Settle, Oakland, Oregon.—This invention relates to certain improvements upon the patent granted the same inventors, January 19, 1875, for a machine for tapering leather, in which a pivoted frame carrying a knife moves over a hinged adjustable curved block to taper the end of a strap, belt, or other piece of leather, preparatory to attaching the same to another piece, and it consists in the construction and arrangement of a device for clamping and holding the piece of leather in a convenient and effective manner.

IMPROVED TWEER.

Mark Lester, Bellaire, Ohio.—The object of this invention is to prevent the accumulation of sediment in the annular water space of a tweer for blast furnaces, and to prolong the life and utility of the latter. To this end the invention consists in providing the overflow pipe of the tweer with an outlet cock, located near the bottom of the water space, through which the mud and sediment may be washed out, and extending the supply pipe to the nose or hottest part of the tweer, whereby the cold water is first brought in contact with the part of the tweer which most needs the cooling effect, and whereby also the accumulated mud and sediment may be readily washed out by the natural passage of the water.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVEMENT IN ORNAMENTING BUTTONS.

Samuel S. Moyer, Berlin, Ontario, Canada.—This process consists, first, in printing the figures upon the face surface of the button by means of type coated with an impermeable composition, then applying the coloring matter, after which the composition is removed by polishing or otherwise.

IMPROVED DIFFUSION APPARATUS.

Charles Neames, New Orleans, La.—The object of this invention is to improve the Julius Roberts diffusion apparatus, in such a way as to secure a more perfect extraction of the saccharine matter from the material used, and at the same time simplify the apparatus. It consists in a diffusion vessel of a diffusion apparatus, gradually increasing in size from its top or inlet, opening to its bottom or outlet opening; in the wood packing interposed between the rim of the doors and the door frames of a diffusion vessel; in a division plate extending from the top to the bottom of the vessel to form the heating chamber, and having its lower part perforated with numerous small holes to serve as a strainer. Finally, heating pipes are placed within the diffusion vessels of the apparatus; and there is likewise a combination of the circulating wheel and its pipe with the diffusion vessel.

IMPROVED CUFF AND COLLAR BOX.

Ernest Scheel, New York city.—This consists of a box divided by a lateral partition into two sections or compartments, of which one is intended for the cuff, and provided with a central tubular post with sliding top. The other is divided by horizontal supports into two parts for inserting a receptacle and storing the collars, neckties, and other articles.

IMPROVED HOMINY KNIFE.

John Outcalt, Spotswood, N. J.—This consists in improved knives of hullers for hominy mills, made with their blades curved with a constantly increasing curvature from their forward to their rear ends. They are also made wider toward their rear ends, inclined upon their upper sides, flat or inclined upon their lower sides, and provided with rasp teeth above, and file or rasp teeth below.

IMPROVED HARNESS SADDLE.

Robert Spencer, Brooklyn, N. Y.—The object here is to afford a broader bearing for tree plates of a given size. The under bearing of wood is made broader than the tree plate, and the flap and jockey are attached to the margins of the face or outer side of the pads. The tree plate is made of sheet metal, with a transverse ridge and corresponding groove or depression.

IMPROVED PACKAGE FOR PAINTS, ETC.

George Sidey, Brooklyn, N. Y.—This invention consists in causing the upper edge of the can body to bear in a groove and against the center of a strip, and providing a flat headed screw working in a nut on the bottom of the can, in order to form a close joint. The article placed in the can is thus hermetically sealed.

IMPROVED PAPER BAG FASTENINGS.

Henry S. Gillette, New Preston, Conn.—A string of suitable length and strength is attached to the bag by means of a piece of paper which is pasted to the bag over the string. This little clip of paper secures the string permanently, so that the clerk need waste no time in seeking for a string to tie the bag.

IMPROVED TOY MARBLE RAKE.

Alfred Gurny, Robert H. Piper, and Henry E. Waite, Bridgeport, Conn.—This is a rake or notched bar employed in marble playing for determining the gains by the numbered notches through which the marbles pass. There is a spring tablet to each notch, with the number of the notch upon it, and contrived to be set in the way of the marble passing through the notch, so as to be tripped by the striking of the marble against it. On being raised, it exposes the number of the notch to view, thus showing the count toward game, the number being concealed while the tablet is set.

IMPROVED AWNING.

Anthony Hesselis, New York city.—This consists of a swinging stretching frame and outer curtain, that is wound up by a roller and cord. The roller is supported on a second swinging frame, to be lowered and adjusted to any position for regulating the hight. When the awning is lowered entirely, it serves to close the window like a curtain, forming a protection against heavy rain, hail, etc.

IMPROVED CIGAR BOX.

Simon Hood, New York city.—This cigar box admits the convenient arranging of the cigars in bundles, the exhibiting of the same, and the ready taking out for selling them. The body is made of diagonally tapering shape, with steps and guard strips, and is closed by hinged side and front parts and lid.

IMPROVED SHEARS AND SCISSORS.

George H. Taylor, New York city.—This invention consists in constructing shear or scissor blades with a curved shoulder at the rear end of the cutting edge of the blades, to adapt them for use in ripping goods.

IMPROVED HARNESS BUCKLE.

Benjamin F. Frazier, Grand Rapids, Wis.—By suitable construction, when a strain comes upon the strap, the tendency is to draw a frame back, and clamp the said strap between cross bars. The strap is thus held securely without holes being punched in it.

IMPROVED CAMP STOOL

Charles M. Lungren, Toledo, Ohio.—This invention consists of a double ferrule and hook attachment for the top of the legs, comprising in one casting the hook and the ferrule for connecting the hook to the leg, and also a socket for the attachment of the back support. This forms a stool which may be folded into small compass, and which, nevertheless, when extended, gives a comfortable seat. At the Centennial Exposition, where chairs or seats of any kind are few and far between, portable devices of this type are found very useful.

IMPROVED BEER PUMP.

Philip Krumscheid, Boston, Mass., assignor to himself, J. Krumscheid, and John R. Foley, same place.—This invention consists of a beer pump in which a float shuts off, when raised to a certain hight, the water supply, and draws off a certain quantity of water, sufficient to lower the float and re-establish the water supply. The air is forced through and retained in the barrel by a check valve, and drawn into the pump through an air pipe with another check valve, on the falling of the water level.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED GIN SAW FILER.

Frank Charter, Little Rock, Ark.—This is a machine for filing gin saws without removing the saw shaft from its frame, and in such a way as not to leave angular or wiry edges upon the surface of the saw teeth, to cut, chop, or nap the cotton fiber, and thus injure it. The noveltics lie in the mechanical construction.

IMPROVED PILE SAW.

David Bean, Le Sueur, Minn.—This consists of a standard for supporting the saw frame, with a clamping device for attaching it to the upper end of the pile to be sawed off under water. There is also a vertically adjustable arm, on which the frame swings, and on which arm the frame is adjustable to feed the saw up to the pile as the work progresses, and to measure its depth in the water.

IMPROVED BILLIARD TABLE LEVELER.

Samuel May, Toronto, Ontario, Canada.—This consists of a long nut, with an enlarged head at the lower end, screwing on a rod projecting from the bottom of a socket in the end of the leg, in which the nut works so as to conceal the screw rod. Said rod is either a short one, screwing into the leg at the bottom of the socket, or it is formed on the rod used to screw the leg to the table. In both cases it has a collar screwing against the bottom of the socket, and is secured by wood screws screwing into the wood through notches in the edges of the collar.

IMPROVED WHIFFLETREE CONNECTION.

George W. Ingersoll and Harvey L. Fisher, Toledo, Iowa.—This consists in an inclined whiffletree coupling, composed of two unequal bars connected by an eye bar. The inclination of the coupling causes either end of the whiffletree that may swing back to pass above or below the double tree, according as the longer arm is placed above or below the shorter arm, so that there can be no rubbing and wear between said double tree and whiffletree.

NEW HOUSEHOLD INVENTIONS.

IMPROVED MEAL BIN.

John Hunter, Ashland, Pa.—This consists of a kneeding trough, kneeding board, and a flour sieve, contrived in connection with a flour chest, so as to be more convenient and easier to use than as commonly arranged.

IMPROVED BED SPRING.

John Reardon, New York city, assignor to Orville D. Lovell and Frank H. Lovell, of same place.—This is a bed bottom spring formed of a rabbeted U-frame, a flanged crosshead, a guide pin, and a spiral spring, constructed and arranged so that the bedstead can be put up, taken down, and carried from place to place with as much ease as if the slats rested upon cleats, and the various parts of the spring are so arranged that they cannot cut or injure the mattress.

IMPROVED CARPET STRETCHER.

Lewis W. Rivers, Salt Lake City, Utah Ter., assignor to himself and Hanson J. Rivers, of same place.—In using the device, the carpet is placed between jaws, and a lever is arranged with its sharp lower end resting upon the floor, and its upper part inclining forward over a bar. The upper end of the lever is then forced back or from the carpet, which draws the said carpet to its place. When the carpet has been strained sufficiently a pawl, holds the lever in place until the stay tacks can be driven.

IMPROVED SNOW SHOVEL.

Eugene Campbell, South Westerlo, N. Y.—This shovel is provided with a face plate extended beyond the edge of the shovel plate. It also has, on the under side of its front end, and in one piece therewith, the runners arranged to keep the edge of the plate from coming in contact with the surface upon which the shovel is being used.

IMPROVED WEATHER STRIP.

William Watkins, West Joplin, Mo.—This weather strip is formed of a metallic plate, having its edges bent over upon themselves to form grooves to receive a strip of flexible metal, said flexible strip is made wider than the said metallic plate, to give its middle part a U-form.

IMPROVED WASH BOARD.

John S. Washburn, Yonkers, N. Y.—This invention consists in an improved washboard formed of grooved side bars, over which a rubber plate is passed, so that a rubber surface and a wooden surface may alternate with each other to form the rubbing surface of the board.

NEW TEXTILE MACHINERY.

IMPROVED TENSION DEVICE FOR TWISTING MACHINES.

Paul A. Chadbourne, Williamstown, Mass.—This is a contrivance of guide eyes and a roller with the spool stand, from which the threads are supplied to the twister, whereby the tension of all the threads is more uniform than in the common arrangement.

IMPROVED FEEDER FOR CARDING MACHINES.

William C. Bramwell, Terre Haute, Ind., assignor to himself and Edwin Ellis, of same place.—The invention consists of a tilting scale for weighing the wool deposited upon it by a toothed traveling apron, the two (scales and apron) being so connected by a clutch mechanism that the apron is stopped intermittingly, thus shutting off further supply until the scale has deposited or discharged the wool which it already contains. The wool having been thus deposited on the feed table, and the scale returned to its original position, and while the elevating apron is delivering a fresh supply to the scale, a loosely pivoted rotating scraper is at work removing the pile of wool just dropped by the scale, and pressing it up to the edge of that which has already been fed on and is about to enter the feed rolls of the carding engine. By this operation the wool is removed out of the way, and a clear place given to the next lot, so that it may not, by piling up, obstruct the proper action of the tilting pan of the scale, and that all the wool may be dropped each time. The tilting and emptying out of the wool from the scale is entirely independent of the time it may take the scale to turn its balance, as this time is constantly varying. It is by this means that the apparatus is caused to run itself out of wool when desired, and yet keep the work even to the last.

NEW AGRICULTURAL INVENTIONS.

IMPROVED PLOW STOCK.

Lemuel H. Davis and Irvin Aycock, Morgan, Ga.—This consists in a plow stock formed of three iron bars, constructed and combined with each other, and with the handles, so as to form a strong and serviceable device.

IMPROVED COMBINED LISTING PLOW AND SEED DRILL.

Alonzo M. Coston, Maryville, Mo.—This is an improved machine for preparing the soil and planting the seed at one passing over the ground, which is left in a deep furrow and ridge alternately. The subsoiler runs in the rear of the main plow, thereby loosening the soil in the bed of the furrow, forming a suitable place to deposit the seed, and dropping the seed and covering it.

IMPROVED CORN PLANTER.

Nathan H. Meeks, Salado, Tex.—This consists of a circularly vibrating dropper slide contrived to be attached to a plow beam or other object to be drawn by a single horse, and be worked by the whiffletree, which has the requisite vibratory motion from the shoulder of the horse.

IMPROVED HOG TROUGH.

Newton A. Clark, Harveyville, Kan.—The object here is to keep the hogs away from the trough when putting in food, to prevent the hogs from putting their feet into the trough when feeding. The mode of operation is as follows: A lever being raised into a perpendicular position, boards are thrown against the back of a frame, so as to allow the hogs to have access to the trough by passing between ribs. On the other hand, when the lever is brought to a horizontal position, or nearly so, the boards are thrown out in front of the trough, so as to exclude the hogs therefrom.

IMPROVED FERTILIZER DISTRIBUTOR.

David C. Brown, Log Town, La.—This is a device for attachment to the rear end of a wagon body for distributing cotton seed as a fertilizer. It may be used for distributing other fertilizers, and which will enable the material to be placed wherever desired. In using the device, a man is placed in the wagon to keep the hopper filled with the fertilizer. The amount of fertilizer distributed may be regulated by increasing or diminishing the number of pins which feed out the material, and by varying the relative size of the driving pulleys.

IMPROVED ANIMAL TRAP.

Homer S. Davis, Camp Brown, Wyoming Ter.—This improves the well known spring trap used for catching animals of large size, such as beavers, foxes, otters, etc., so as to prevent the throwing out of the leg or foot, or the breaking of the same by the action of the spring, in consequence of which the animals frequently escape.

IMPROVED CORN-PLANTING ATTACHMENT FOR SOD PLOWS.

Sanford M. Scott, Stockbridge, Wis.—This is an attachment for breaking-up or sod plows, so constructed as to plant the corn as the sod is turned, and close to the outer edge of the furrow. The corn will thus come up between the sods of two furrows. The device is not in the way of turning the plow over to file or sharpen the share.

IMPROVED POTATO PLOW.

Tubal C. Baxter, Monticello, Kan.—This consists of a forked beam, with a landside and cutter to each branch of the fork, between which is a shovel plow fixed on an easy incline, for the potatoes and the earth to be forced along over the rear end. From said end extend a number of rods, suitably arranged to let the earth sift through, and to carry the potatoes back and discharge them in a row on the top of the earth.

IMPROVED PLOW.

Alva A. Preston, New Troy, Mich.—This is an improved iron beam plow, light, and at the same time strong, which may be easily adjusted to take or leave land, and to run deep or shallow, as may be desired.

IMPROVED MILK PAIL.

Newton McKusick, Stillwater, Minn.—This is a pail with a cover having an opening closed by a strainer, and a detachable funne with a second strainer, through which the milk passes into the pan. The double strainers prevent any foreign substances, however small, from passing into the milk.

IMPROVED HARROW.

William C. Moore, Cairo, Pa.—This is formed in three sections hinged to each other by bolts and straps. The middle section is made rectangular, and the side sections oblique, having their forward corners beveled off. Shoes are attached to the forward sides of the front cross bars.

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Planing Machines—For the best and cheapest traveling-bed or "Farrar" Planers—24, 27, and 30 in.—also 15, 18, and 24 in. stationary-bed machines, address Lane M'f'g Company, Montpelier, Vermont.

Machinist wanted in every town, as Agent; terms liberal. Address Knight & Knight, Washington, D.C.

For Sale—Machinists' Tools, nearly new: One Planer, one Lathe, and one Drill Press. $300, Cash. W. Crabb, Nassau Works, Newark, N. J.

A Responsible Patent Right Manager Wanted—Carriages and R. R. Cars can be run without oiling. Address or call on Geo. Beck, Charlotte, Monroe, Co., N. Y.

Models for Inventors. H. B. Morris, Ithaca, N.Y.

Steel Name Stamps, post paid, for 18c. per letter. Marks on Wood, Iron, and Steel. Agents wanted. Steel Stamp Works, 213 Chapel St., New Haven, Conn.

Handbook of Useful Information for Lumbermen, Millwrights, and Engineers (152 pages) sent free by Lane M'f'g Company, Montpelier, Vermont.

Horse Nail Machines—Wanted Machines for finishing and pointing Horse Nails. J. W. Britton, 18th Ward, Cleveland, O.

Jethro Wood.—If any of our readers can send or refer us to any publication containing a portrait of Jethro Wood, the plow inventor, we should be obliged. Munn & Co.

For the cheapest and best Small Portable Engine manufactured, address Peter Walrath, Chittenango, N. Y.

Walrus Leather, Walrus Wheels, and Polishing Material. Greene, Tweed & Co., 18 Park Place, N. Y.

Blake's Belt Studs, Belting, Packing, Hose and Manufacturers' Supplies generally. Greene, Tweed & Co., 18 Park Place, New York.

For 2d Hand Portable and Stationary Boilers and Engines, address Junius Harris, Titusville, Pa.

Yacht and Stationary Engines, sizes 2, 4, 6 and 8 H. P. Best for price. N. W. Twiss, New Haven, Conn.

Circular Saw Mills of the celebrated and popular "Lane" pattern, made under direct supervision of inventor by the Lane M'f'g Company, Montpelier, Vt.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

Patent Scroll and Band Saws, best and cheapest in use. Cordesman, Egan & Co., Cincinnati, Ohio.

M. Shaw, Manufacturer of Insulated Wire for galvanic and telegraph purposes, &c., 259 W. 27th St., N. Y.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water Street, New York.

Pat'd Graining Stencils—J. J. Callow, Clevel'd, O.

Lathe Dogs, Expanding Mandrels, Steel Clamps, &c., for Machinists. Manufactured by C. W. LeCount, So. Norwalk, Ct. Send for reduced Price List.

"Abbe" Bolt Forging Machines and Palmer Power Hammers a specialty. Send for reduced price lists. S. C. Forsaith & Co., Manchester, N. H.

400 new & 2d hand Machines, at low prices, fully described in printed lists. Send stamp, stating just what you want. S.C. Forsaith & Co., Manchester, N. H.

Lane's "Monitor" Turbine Water-Wheels are not perpetual motion machines, but they combine more and greater advantages than any other water motors offered the public. Address Lane Mfg Co., Montpelier, Vt.

Driving Belts made to order, to accomplish work required. Send full particulars for prices to C. W. Arny, 146 North Third St., Philadelphia, Pa.

Scientific American—The early Volumes for Sale—very cheap—either bound or in numbers. Address A. F. R., Box 773, New York City.

Hydrant Hose, Pipes, and Couplings. Send for prices to Bailey, Farrell & Co., Pittsburgh, Pa.

"Dead Stroke" Power Hammers—recently greatly improved, increasing cost over 10 per cent. Prices reduced over 20 per cent. Hull & Belden Co., Danbury, Ct.

Power & Foot Presses & all Fruit-can Tools. Ferracute Wks., Bridgeton, N. J. & C. 27, Mchy. Hall, Cent'l.

Shingles and Heading Sawing Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Steel Castings, from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

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

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Clapboard Machinery—Sawing, dressing, and trimming—a specialty of the Lane M'f'g Company, Montpelier, Vermont.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon, 470 Grand Street, New York.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Temples and Oilcans. Draper, Hopedale, Mass.

Notes & Queries

W. H. H. will find directions for preventing rust on iron on p. 169, vol. 33.—C. W., Jr., will find directions for calculating the proportions of compound gears on p. 107, vol. 34.—A. K. will find that good glue is the best material for fixing sand on belts.—W. A. G. can make and use leather pulp by following the directions on p. 105, vol. 25.—R. S. will find a description of a cold tinning process on p. 154, vol. 34.—J. R. C. should consult the makers of his fan.—E. G. A. is informed that the sand blast (see p. 195, vol. 27) has been used for cutting iron; but whether it is now in practical use for that purpose, we do not know.—C. W. L. will find directions for making artificial meerschaum (not ivory) from carrots, etc., on p. 307, vol. 34.—H. H. L. can make a good indelible ink for stamping by following the directions on p. 129, vol. 28.—H. S. can polish Britannia ware by the method described on p. 57, vol, 34.—N. S. W. will find answers to his queries as to the SCIENTIFIC AMERICAN SUPPLEMENT on p. 124, vol. 35.—H. W. C. will find a recipe for a hair stimulant on p. 138, vol. 33.—J. P. G. will find directions for tempering springs on p. 11, vol. 34.—E. H. B.'s query as to eggs is a schoolboy's problem, of no practical value.—C. E. C. can clean rust from tin by following the directions on p. 57, vol. 34.—E. W. H. will find a recipe for artificial coral on p. 307, vol. 34.—C. B. R. will find a description of phosphor bronze on p. 315, vol. 30.—C. A. will find directions for etching on glass on p. 203, vol. 33.—H. H. L. will find directions for gilding on glass on p. 313, vol. 34.—B. will find a recipe for a depilatory on p. 186, vol. 34.—J. M. will find full directions for stuffing birds on p. 159, vol. 32.—H. T. will find directions for making fulminating powder on p. 250, vol. 31.—J. D., Jr., will find directions for japanning tin ware on p. 132, vol. 24.—D. M. L. can cement glass to brass with the preparation described on p. 117, vol. 32.—R. I. G. is informed that there can be no such instrument at a needle that will point to buried gold.—F. W. S. will find a description of the underground telegraph wires in London and elsewhere on p. 294, vol. 30.—G. K., of Highgate, London, England, will find directions for nickel plating on p. 235, vol. 33.—A. F. will find directions for getting rid of fleas on p. 217, vol. 27.—C. & S. will find directions for making pickles on p. 155, vol. 31.—J. H. K. can prevent mildew on sails by the process described on p. 90, vol. 31.—A. D. L. will find a formula for calculating the centrifugal force of a body on p. 378, vol. 30.—J. O. S. can render his windows opaque by the process described on p. 264, vol. 30.—H. W. G. will find an article on chlorophyll on p. 247, vol. 29.—W. A. D. will find directions for making artificial stone on p. 124, vol. 22.—H. J. can silver brass and copper, without a battery, by using the preparation described on p. 299, vol. 31.—D. D. W.'s letter has been placed in the hands of several chemists, who may take action in the matter.—A. H., E. W. M., F. C. L., W. J. B., C. F., W. M., N. J. O., C. J. C., H. M. L., W. B. W., B. H., R. B., C. R., J. W. F., W. B., E. P., W. H. B., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) F. R. Jr. asks: How can I find the diameter of one of four equal circles inscribed in a large circle, of given diameter? A. Multiply the given diameter by 0·414213.

(2) W. H. S. says: I enclose a specimen of deposit taken from my heater reservoir, which I am unable to get rid of and which is very troublesome. The heater is 14 feet long and 22 inches in diameter, and in it are three pans 12 feet long by 14 inches wide, with partitions in middle. The cold water runs into the top pan on one side at end, and along the length of pan; it returns and falls through holes into next, and so on through, lastly falling on bottom of heater, and is then conveyed to a reservoir 6 feet deep and 22 inches in diameter. The exhaust comes up into my heater at the end at which the cold water comes in and goes out at the opposite end, so that the water gets boiling hot before it leaves the heater. I use water from the top of the reservoir, and the deposit seems to float on top, and will not mix with the water after it is precipitated. Can you suggest any means of getting rid of it? A. By the use of a surface blow, you could probably discharge the most of it. It would be still better to filter the water after leaving the reservoir. Probably a box filled with sponges would answer every purpose; and the sponges could be removed and washed, from time to time, as they become stopped up.

(3) A. O. says: I have an engine of the following dimensions: Cylinder 3 inches in diameter, stroke 6 inches. The boiler is 5 feet long by 2½ feet in diameter, made of ¼ inch boiler iron, single riveted. It is to run, if possible, at about 200 revolutions per minute. Is it big enough to run a cylinder journal printing press, generally run by hand power, and a printing press run by foot power? Is the boiler big enough to generate steam enough to run the engine and heat a building of 30 x 60 feet? A. We think the machinery will answer, and that you can heat the building with the exhaust steam. It must be evident to you, however, that an opinion, based on the data you have sent, cannot be of any great value. It only amounts to saying that if the machinery is properly designed, constructed, and set, it will give satisfaction.

(4) J. H. B. asks: What should be the diameter of a propeller shaft, to transmit with safety an actual thrust of 10 tuns, the strain to be a pulling instead of a pushing one, as is generally the case? Length of shaft after leaving propeller boss to connection with engines is only 4 feet. Propeller is supposed to revolve in water constantly, never to be thrown out of it and thus subjected to the undue strains of racing on its return. Material is to be steel. A. A shaft 2 inches in diameter will answer for the conditions stated.

Suppose cold water to be kept in constant circulation on the exterior of a cylinder with shell 1½ inches thick. What is about the highest temperature to which the interior may be exposed as long of that of the interior circumference of shell does not exceed 700° Fah.? A. There is no limit to the temperature, if, as we understand you, it is assumed that the temperature of the iron can be kept at or below 700°

(5) P. R. asks: Please give me a simple rule for calculating how much weight a horizontal spruce beam will bear. A. If the beam is rectangular, and supported at both ends, the breaking weight, applied at the middle, will be:

$$\frac{(\text{Depth in inches})^2 \times (\text{breadth in inches}) \times 400.}{\text{Length between supports in feet.}}$$

If the load is uniformly distributed over the beam, it can be twice as great as the above.

(6) C. C. asks: How can I make a dark colored chalk, suitable for lining purposes on light colored wood, having the same cohesion as the common white chalk used for that purpose? A. Grind the pigment into an impalpable powder, thoroughly moisten with a little dilute solution of dextrin in hot water, knead the mixture well, and dry thoroughly at a gentle heat.

(7) T. M. H. asks: Can any use be made of dross from tin and lead? A. If there is any considerable quantity of the material it would probably pay to treat it for the recovery of the metals in the following manner: Mix thoroughly with almost an equal weight of anthracite coal, spread evenly on the bed of a small reverberatory furnace, and smelt, with a gradually increasing temperature, until the reduction of the metal has begun. Then throw in a little lime, increase the temperature for a short time, draw off the reduced metal into a large iron vessel, and stir with a piece of wet wood to raise the impurities to the surface; remove these by skimming and pour the metal into a stone or iron mold to cool.

(8) C. G. L. asks: Is there any way of getting a press copy from thin writing ink, or from writing too old to copy from moisture only? A. Try the following: In a half pint of water dissolve about a tablespoonful of white sugar, and to the solution add a sufficient quantity of the ferrocyanide of potassium to distinctly color it, also about half a gill of pure muriatic acid (free from iron). Moisten white tissue paper with this, partially dry it with a blotter, place the writing to be copied in contact with it, and keep under pressure for about five minutes. With most inks this recipe will give very good results.

(9) H. A. P. L. says: Would an electrical machine with one glass cylinder and two round silk cushions, electricity being conducted to a Leyden jar or a prime conductor, be powerful enough for experiments? A. As far as we may judge from your description, the machine is properly constructed; but to obtain good results, it will be necessary to rub on the cushions an amalgam, which may be prepared as follows: Melt together in a crucible 2 ozs. zinc and 1 oz. tin; when fused, pour the alloy into a cold crucible containing 4 drachms dry mercury; when cold the amalgam is ready for use. Before applying the above amalgam, the cushion should be rubbed over with a mixture of tallow and beeswax. In pouring the fused metals into the cold mercury, do not inhale the mercurial vapors that may be formed, as they are very poisonous.

(10) C. A. R. asks: Is there a cement or fluid which will fasten together two straps of sole leather a yard long, which will not be affected by moisture? A. Melt together equal parts of pitch and gutta percha. Apply hot.

What will remove stains from a shirt bosom? A. Try touching the spots with a little benzole, and afterwards pressing for several hours with warm pipe clay.

(11) A. B. says: Some plumbers use muriatic acid with no zinc in it. I would like to know what effect this acid has on iron and brass. A. Dilute muriatic acid will answer, but a strong acid solution of chloride of zinc is much better, as it not only cleans the metallic surfaces but protects them, by the formation of a coating of the fused chloride, which excludes the air.

(12) J. S. M. asks: How large a pipe will it take to give sufficient blast to a cupola 22 inches in diameter, distant 80 feet from a common fan? A. About 2 or 2½ inches in diameter.

(13) A. F. J. asks: Can water be raised by an ordinary suction pump below a level of 33 feet by the aid of check valves placed below the suction? If so, how far? A. If, as we understand it, reference is made to the hight to which water can be raised by atmospheric pressure, 33 feet is about the practical limit, and one which is seldom reached by ordinary pumps.

(14) J. F. asks: What is the rule fo ascertaining the proper amount and form of space underneath and at the back end of the boiler? A. There is no definite rule for this proportion, so far as we know.

(15) C. & T. ask: If you found that the piston of your engine was striking the bottom or top of the cylinder, what would you do to stop the pounding? A. If the pound were serious, we would put linings in one of the connecting rod boxes. In case it was not possible to stop, we would work the engine slowly, and cushion the steam, if any means for so doing were available.

(16) R. asks: How can I coat, easily and cheaply, the inside of an iron pipe so that the water passing through may not be affected by the metal? A. Try melted paraffin.

(17) P. V. T. and others.—There is no specific for catarrh. Temperament, habits, etc., must be taken into account, for which reason a course of treatment suitable to one person would be entirely unsuited to another. We cannot advise anything but continuance under the care of a regular practitioner.

(18) J. G. Q. asks: In what non-freezing liquid can phosphorus be kept from combustion? A. In naphtha.

(19) S. W. T. says: How can I make a first class waterproof blacking, that does not require brushing? A. Vinegar 1 quart, ivory black and molasses, each 6 ozs., oil of vitriol and spermaceti, each 1½ ozs. Mix the acid and spermaceti first, and then add the other ingredients.

What is the best way to clean a copper boiler? It is used in a kitchen; the boiler is 18 inches diameter and 5 feet high, the burnish on the outside gets dull and of a mauve color. A. Clean with a little dilute oxalic acid solution, wash, dry, and polish with a little tripoli.

How can I make soap bubbles so that they will last long, or at least not break so soon as those made with soap and a pipe in the ordinary way? A. Use a fatty soap, preferably one made with fish oil, and to the solution add a little glycerin.

How can I find a number which, multiplied by its half, will make 20? A. Let x=the number; then $(\frac{1}{2}x)x=\frac{x^2}{2}$, $\frac{x^2}{2}=20$, $x^2=40$, $x=6{\cdot}32455$, $\frac{1}{2}x=3{\cdot}16228$, $x\times\frac{1}{2}x=19{\cdot}99999719$. If you carry out the square root of 40 until you obtain the root complete, and multiply this number by one half itself, then the result will be 20 instead of the result given.

How can I darken my hair, which is a light red, without using a dye? A. You cannot.

What is a good substitute for gum arabic for sticking on labels? A. Use a boiled solution of dextrin in water.

Is there anything that will keep the snow from lying on the ground in winter? It is a patch 40 yards square that is required to be kept clear. A. No.

(20) H. A. G. says: I have a coat which was originally of a dark blue color; but owing to exposure to the sun's rays, it has faded to a reddish hue. How can I restore the original dark blue color? A. Try treating the fabric with strong ammonia water for a few minutes, and then wash thoroughly with clean water. If this does not suffice, it will be necessary to have the material re-dyed.

(21) W. C. W. says: You published a recipe for making black varnish by mixing oil of turpentine and sulphuric acid. I tried the experiment, which cost me a loss of some clothes, nearly the loss of an eye, and about two weeks' labor, brought about by an explosion which burnt my face severely. I purchased what a druggist said was oil of turpentine (spirits of turpentine). I mixed the ingredients in various ways, with no results as predicted; and then, having a phial partially full of each, I poured one into the other, and then shook the mixture, when an explosion took place. What was the matter? A. The recipe, as given, is perfectly correct; and if you had closely and carefully followed its directions, all would have been well. Instead of dropping the sulphuric acid into the turpentine, it would, perhaps, be better to slowly drop the turpentine into the strong acid. The only precautions necessary are to mix the reagents slowly, so as to avoid a too rapid rise in the temperature of the mixture, and to keep the mixture cool by surrounding the vessel with cold water during the operation. The viscous and dark red body obtained consists principally of a mixture of terebene and colophene. The proper proportions are about 1 part of strong sulphuric acid to 20 of oil of turpentine.

(22) I. N. R. R. says: I have charge of some coal mines, in which there is a great deal of gas. In one part of the pit the gas shows a blue flame on the safety lamp gauze; and in another part there is a fault in the coal, and the gas shows the blue flame, and on the top of the blue flame a white flame. Please explain this. A. It may be due to some peculiarity in the oil, an unusual quantity of carbonaceous matter in the atmosphere, or to the fire damp itself becoming intermixed with some higher carburet of hydrogen. You do not furnish sufficient data to enable us to answer the question more positively. In case the latter suggestion should prove the correct one, and, inadvertently, the mixture should become ignited, the explosion that would follow would be very severe, much more so than that of ordinary fire damp.

(23) A. K. says: We have a small stage and want to supply it with gas, using 4 cubic feet per hour. How large a pot would it take to produce this amount, and how much coal would it take to produce 4 cubic feet per hour for three hours without refilling the pot? Can the gas be led to the purifier and from that right to the burners? A. This is not practicable, as, when the temperature reaches a certain point, the gas comes over quite rapidly and not at all uniformly. It will be necessary to pass the purified gas to a reservoir (a large gas bag will answer your purpose) that will adapt itself to the volume of the gas and maintain a steady pressure. In order to avoid reducing the luminosity of the gas, it is requisite that the distillation should not proceed under pressure.

(24) R. F. asks. What is the best, cheapest, and most effectual means of removing salt water rust from boiler plate iron? A. Steep it in a weak pickle of oil of vitriol in water, and dry immediately with sawdust. It is better before placing it in pickle to go carefully over the surface with a good stiff wire brush, so as to remove as much of the oxide as possible. Brushing after removal from the acid is, in some cases, also advisable.

(25) S. D. asks: What will clarify a solution of 5 lbs. of Irish moss, boiled in 20 gallons of water, long enough to extract the gelatin? I want to get rid of the small particles, which give it a cloudy appearance. A. Mix with clean paper pulp, place in a fine linen bag, and strain. The paper and gelatin should be mixed and well stirred together while the gelatin is hot and as liquid as possible.

(26) H. S. S. C. asks: Will a house 30 feet by 30, covered with tin and having a water conductor at each corner connected with the roof, each conductor being connected with the ground by a copper wire, be sufficiently protected against lightning without a lightning rod? A. The water conductors, not being in the form of a compact body of metal, would hardly be so good as a rod: but, if provided with a pointed rod at top in connection with each, extending about three feet high above the roof, and a like rod extending some distance into the ground at the bottom, they might be considered safe.

(27) O. A. W. asks: Is there a chemical that, when rubbed on the hand, enables one to handle red hot iron or melted lead with impunity? A. No; but if the hand be damp with perspiration, or slightly moistened, it may for an instant be dipped in melted lead or white hot melted iron without burning or discomfort. The moisture is thrown into the spheroidal condition, and presents an effectual barrier against the intense heat.

(28) W. M. M. asks: How is a bichromate battery made? A. It consists usually of a large glass jar having within it a cup of porous unglazed porcelain. The intermediate space, between the sides of the vessels, is filled with dilute sulphuric acid (1 to 20), and contains a sheet of zinc shaped so as to conform to the curve of the inner cup, which it completely surrounds. A stick of gas carbon is placed in the porous cup, and surrounded with a fluid made by adding strong sulphuric acid to a saturated aqueous solution of bichromate of potassa until the chromic acid begins to separate in flakes, it is afterwards diluted a very little in order to redissolve the precipitate. The proportion of the several ingredients in this mixture should be about as follows: to about 10 ozs. of bichromate of potassa in 1 gallon of water, add 1 pint of strong oil of vitriol.

(29) S. asks: Is the common arsenic of the drug stores the kind that can be fused with block tin? A. No, use metallic arsenic.

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

W. Z. J.—No. 1 is blue clay. No. 3 is a piece of slate. No. 4 is a variety of steatite. No. 5 is basalt. No. 6 is a piece of bituminous shale. No. 7 is chalcopyrite (sulphide of copper). A smaller specimen numbered 6 is an agate. No. 2 did not arrive.—P. & B.—It is nodular iron pyrites.—B. M. R.—No. 1 is a limestone fossil, but has been so badly damaged that we cannot classify it. No. 2 is a piece of shale.—S. S.—It is a broken quartz crystal.—S. L.—It is partially reduced oxide of copper.—W. E.—The color on the window blind does not contain arsenic. It is an organic pigment.—C. C.—They are garnets, of considerable value when large and perfect.—J. A. C.—It is a bituminous shale, and might be used for heating purposes.—S. J.—The sand might, if properly screened, find a limited employment for scouring, grinding, and polishing purposes, as well as in the manufacture of glass and glazes.

S. G. C. asks: Is there anything which will restore drawing paper, which has become soft from age and use so that ink runs on it, sufficiently to ink on a few lines at a time when necessary?—O. S. says: Can you inform me what is the yield of oil to the bushel of peanuts, and what are the means of extracting the oil?—J. L. R. Jr asks: Please tell me where the character $ came from originally.

COMMUNICATIONS RECEIVED.

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

On Weight on and in the Earth. By E. B. W.

On the Polarity of the Compass Needle. By D. Y. M.

On a Rope Swing. By J. S. P.

On the Monjolo. By C. J. W.

Also inquiries and answers from the following:

A. S.—J. R.—J. A. P.—J. H. E.—C. C.—G. T. D.—J. M.—T. J. B.—J. McC.—W. B. P.—C. H. P.—H. H—T. I. B.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes machines for pressing stove blacking? Who sells electric telegraph apparatus? Who sells propeller wheels? Who makes cast steel bells? Who makes labeling machines?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

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

August 8, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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

Acid, making hydrated sulphurous, W. Maynard. 180,901
Acrometer, C. Godfrey. 180,760
Air-compressing machine, J. Sturgeon. 180,958
Animal-weaning bit, Ingersoll & Fisher. 180,885
Anvil vise, J. Bolt. 180,834
Auger, earth, C. D. Pierce. 180,787
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Binder, temporary, E. M. Phillips. 180,727
Bit stock, W. F. Curtis. 180,850
Blooms, compressing, W. Sellers. 180,798
Boat coupling, automatic, T. D. & G. E. Husband 180,883
Boats, etc., propelling, N. P. Ingalls. 180,848
Boiler, flue and tubular, A. J. Stevens. 180,959
Boiler, steam, Galloway & Holt. 180,863
Boiler, feed water heater, M. W. Hazelton. 180,876
Boot upper, J. Mohan. 180,779
Boot, instep supporter, R. Ames. 180,819
Boots, forming stiffeners for, W. C. Wise. 180,978
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Bottle washer, W. Scherenberg. 180,937
Brick machine, Seymour & Davis. 180,941
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Building block, F. Schaffer. 180,794
Burner, lamp, H. A. Chapin. 180,753
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Car brake, S. G. Smith. 180,802
Car coupling, J. Raddin. 180,728
Car door, grain, R. Brydon. 180,699
Car seat, J. Bryant. 180,751
Car starter, E. Salomon. 180,792
Car ventilator and dust deflector, A. B. Childs. 180,844
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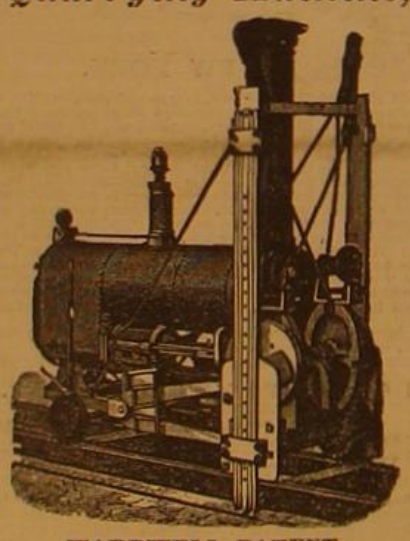
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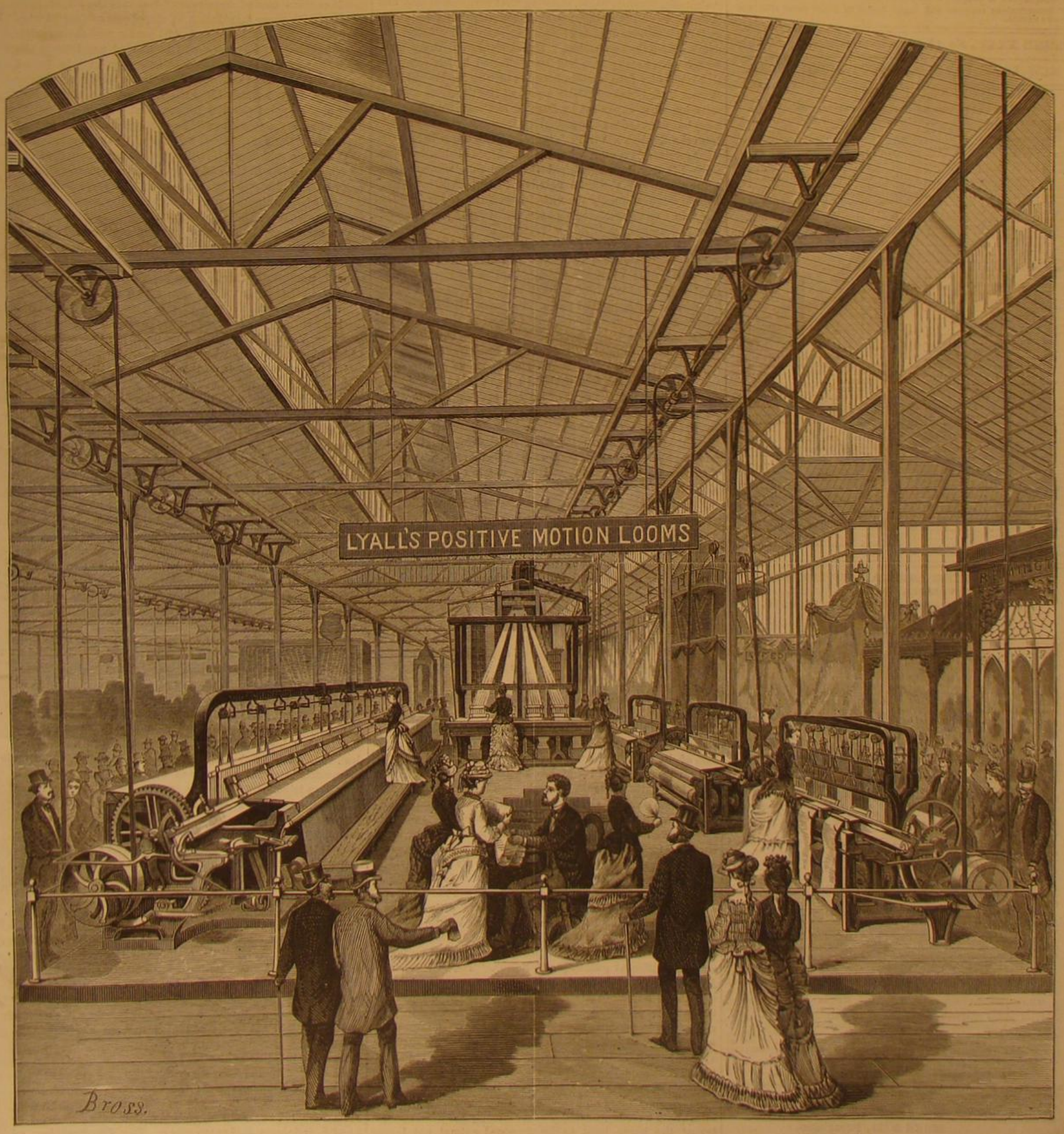
THE GREAT TEXTILE INVENTION AT THE CENTENNIAL EXPOSITION—THE LYALL POSITIVE MOTION LOOM.

To trace back the complete history of the art of weaving would be to transcend that shadowy limit where begins the existence of the human race. The oriole and the weaver bird wove together twigs and rushes, to form their pendent nests, ages before the foot of man trod the earth; and from these, probably, the primeval savage learned to knit together fibers of plants and hair of animals into the rude prototype of the fabrics which have replaced the skins of beasts as human clothing. It is a marvelous fact, unparalleled elsewhere in the record of human progress, that, from the period when the loom was first devised—a period which we know to be earlier than the time of Jacob, for stone inscriptions of the era of that patriarch, in which weaving is referred to, have been deciphered—no great improvement or even modification in its mechanism was made until the year 1678, when De Gennes, a French naval officer, conceived the idea of a loom, driven by power other than that of the weaver himself. De Gennes started a current of invention, sluggish but onward in its tendency; and since his day, innumerable improvements in loom machinery have been made, keeping pace in large measure with advancement in other arts. But neither original invention nor the addition of improvements has uniformly affected all parts of the loom. We can point to marvels of ingenuity in the methods for producing intricate and curious tissues for guiding and regulating the motion, and even to a wonderful application of electricity in a device for superseding the Jacquard apparatus in its present form; but when we look for a means of producing apparently so simple a result as carrying the shuttle through the open warp, there has been no universally practicable improvement since John Kay, in 1740, invented the flying shuttle still in use in the great majority of looms.

EARLY SHUTTLE MOTIONS.

That to substitute a positive, absolute, and uniform motion in the shuttle by means of an external appliance

Continued on page 180.



LYALL'S GREAT TEXTILE EXHIBIT AT THE CENTENNIAL.

Scientific American.

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AMERICAN CONTRIBUTIONS TO THE DEVELOPMENT THEORY.

The address which has deservedly attracted the greatest share of attention, out of the many learned essays delivered at the recent meeting of the American Association for the Advancement of Science, is Professor E. L. Morse's masterly summing up of all that America has done to promote the growth of the development theory. Professor Morse is an ardent evolutionist, a naturalist of great learning and ability, an indefatigable investigator, and, like most prominent men in the scientific world, has no hesitation in assuming the offensive in support of doctrines of the truth of which he is deeply convinced. Hence there is nothing resembling trimming in his discussion of the evolution question, the opponents of which receive scant mercy at his hands; but still very many of those whose scientific faith is thus attacked are among the Professor's warmest admirers, for he possesses the happy faculty of being always instructive, always original, and of lifting his topics out of the slough of technical pedantry in which too many of our learned scientists seem over inclined to bury modern acquisitions to our knowledge, especially of natural history.

Professor Morse tells us that the first clear premonition of the doctrine of natural selection came from an American, William Charles Wells, borne at Charleston, South Carolina, in 1757. In 1813 Wells read a paper before the Royal Society, in which he attempted to account for the color of dark-skinned races of men by citing the changes of animals under domestication, showing that varieties of men and animals were occurring, not exceptionally, but constantly, and that different breeds of animals were thus obtained by man's selective supervision. Hence he argued that a similar selection among men had been effected by the comparative immunity from certain diseases of those who had dark skins. This is substantially a part of the theory of natural selection now expanded by Darwin and credited wholly to him; but the verdure of originality, it seems, must now fade from the English naturalist's laurels. The honor belongs to an American inventor, who, like hundreds of his brethren since his day, has furnished the thoughts whence have sprung some of the most noted of foreign "discoveries." This is unquestionably the most important fact brought forward in Professor Morse's paper, and it will provoke universal comment.

Classifying the work of various American investigators, Professor Morse tells us that in producing new evidences for the doctrine of natural selection, Drs. Burt G. Wilder, Englemann, and W. K. Brooks and Professor Charles V. Riley have borne distinguished parts. Professor Riley's proof of the inter-dependence of flower and insect in the case of the yucca moth is a scientific triumph. The late Professor Jeffries Wyman completely ruined the beautiful theory that the cells of bees were of such construction as to use space and material to the best possible advantage. He found by close study that the cells of all cell-making insects are of all grades, from shapeless masses to those which approach but never reach perfection. The late Professor Chauncey Wright also did admirable work in showing that the arrangement of leaves of plants along their axis, was due to circumstances of growth, and was not a circumstance of blind law.

Professors S. F. Baird, J. A. Allen, and Robert Ridgway severally have found that marked differences in birds and mammals are due solely to their surroundings. Thus, for example, Western birds have longer tails than Eastern ones of the same species, and on the Pacific coast birds acquire a darker hue. Large numbers of like changes, when tabulated and shown on a geographical chart, were found coincident with variations already ascertained in the amount of rainfall in the different regions. The total number of species of birds was reduced about one fifth by these investigations, and the number of species of squirrels decreased one half or more.

As evidences of the transmutation of species, Mr. James Lewis has discovered that a truncate form of mussel, which, by the loss of one of its segments, had been distinguished from another form, takes its peculiar shade from the circumstances to which it had been exposed, namely, the abrasion of its edges and consequent retarding of its growth in the rapid currents of the Mohawk River. Mr. A. G. Wetherby has called attention to changes in snails under like conditions; and Dr. Cooper and Messrs. Stearns, Bland, and Birney, have all described instances in which changes in animals have followed altered circumstances of heat or moisture. Among the examples of the survival of forms by adaptation to changed environment, the discovery by Mr. Ernest Ingersoll of marine mollusks and living salt water crabs, high up on the Rocky Mountains, is the most remarkable. Professor Marsh has made a series of brilliant researches concerning the siredon, an animal of the salamander kind, that loses its gills, and becomes, when removed from its natural habitat, one previously recorded under an entirely different genius (*amblystoma*). The researches of Drs. Packard and Putnam have overthrown Agassiz' theory that the blind fish of the Mammoth Cave are of a race created in their present condition by showing that a whole series of fishes, ranging from those with perfect eyes to those without any, including between them various deficiencies of vision, have been found in American caves and secluded waters. The discoveries of Professors Leidy, Marsh, and Cope, among the tertiary mammals of the West, have filled wide gaps between older and existing forms, showing all the intermediate animals, so that we have nearly the whole ancestry of the horse, back to the five-toed animal, not larger than a fox, in the eocene period.

The remainder of Professor Morse's admirable address sets forth the present theories of Darwin and the evolution school, and more especially dwells upon the gradual development of the intellect of animals. The earliest mammals had the smallest brains; and as we go upward in the strata, the size of the brain gradually increases. Its development in the monkey tribe was regarded as the means by which these animals were enabled to escape from the carnivora which formerly abounded; and intellect even in that early era thus proved its superiority to brute force.

In his conclusion, Professor Morse showed how perfectly the evolution doctrine accounts for the fatalism of the Turks, the cruelties of savages, and the outrages generally among civilized people, attributed to the total depravity of humanity. He considers all such manifestations as simply relapses to the savage nature which we all inherit from animal progenitors; and that where such relapses in any individual become constant, it is the duty of society to treat that individual practically as it would a dangerous beast, and so govern him as to prevent his propagating his kind.

THE COMING EXPLOSION AT HELL GATE.

General Newton has recently stated that the great explosion at Hell Gate will take place during the latter part of September. The excavations have been complete for some time past, but delays in passing the appropriation bill by Congress checked further operations, and for this reason the blow-up did not occur on the 4th of July, as for a long period was contemplated. Those who expect to witness a gigantic column hurled hundreds of feet into the air, or look forward with some trepidation to the effects of fearful concussion on adjacent buildings, will hardly find their anticipations realized. The mine will be flooded previous to the explosion; and with the possible exception of jets forced through seams in the rocks, there is no reason to believe that any very remarkable exhibition of the tremendous force of the explosives will be manifest. From a scientific point of view the occasion will be of considerable interest, as the earth in the vicinity will be shaken by the communicated vibrations, which are likely to travel over a long distance. An opportunity will thus be afforded for measuring the velocity of sound waves through earth, and preparations are being made by scientific men to observe the same at points at distances 200 and 300 miles away.

The arrangements to guard against any possible danger are being perfected, in utter disregard of the desires both of those who hope to see the great blast, and those who aspire to profit pecuniarily through the popular curiosity. Steamboats and other craft will be warned away, so that a view from the river will be out of the question; the authorities have been requested not to grant passes to would-be spectators on Ward's Island, the best point of observation; and a bluff of earth and the buildings near the works prevent seeing the operations from the rear, so that the expectant populace will probably have to satisfy themselves with a distant view from the high land on the New York shore.

How much powder, etc., will be burnt is not yet definitely stated. An approximate idea of the quantity may be gathered from the fact that there are about 4,000 drill holes, each 3 inches in diameter, and varying from 7 to 13 feet in depth. Each will be charged with a separate canister of dynamite, vulcan, and rend-rock powder, and the simultaneous explosion will be effected by the current from a battery of 800 cells. About two pounds of powder are used to one of dynamite, and the charges are inserted in the 172 piers of rock and in the roof supported thereby. It is estimated that 30,000 cubic feet of broken rock will be left under water, and this will have to be removed by dredging so as to secure a channel 26 feet in depth. The total length of tunnels, galleries, etc., excavated, is 7,425·67 feet. The amount thus far expended is $1,686,841.45.

CHEAP COAL.

The breaking up of the coal combination and the consequent throwing upon the market of half a million tuns of coal is a welcome event. The whole coal trade of the East has, for several years, been under the absolute control of a monopoly which has signalized its sway by unwaveringly maintaining high prices, without regard to the demand first, or the depressed condition of all business affairs. It is characteristic of the patience of our people that no means have been tried to mitigate this condition of things; but now that the crisis has come, it is like a gleam of sunlight through the black shadows which have fallen across the prosperity of the industrial world. When coal is once more subject to the natural laws of trade, and not until then, will its traffic rest on a sound basis; and when this comes to pass, then we may look for a revival in iron manufacture, and in all the industries in which steam is used. Too many people are undergoing the effects of long existing business stagnation not to watch eagerly for any sign, however faint, indicative of better times, and therefore the gratification felt and openly expressed, at the collapse of the combination, is undeniably great. One public sale of 500,000 tuns will not affect the whole winter's trade, however, any more than one cold day represents the whole wintor's weather; but as matters now appear, the present event is only a beginning, and predictions are freely hazarded that we shall see still lower prices.

The fall in rates at the late auction seem to have astonished every one, and none more than the coal dealers themselves. The reduction from the combination schedule for August averages about $2.10 per tun, and average prices ranged from $2.20 for Philadelphia & Reading chesnut to $3.86 1/2 Delaware & Hudson stove. The Vice-President of the Pennsylvania Coal Company asserts that it would cost $500,000 more to mine the coal than the prices fetched at

the sale amount to. The agent of the Delaware & Hudson Canal Company counts up the various expenses of handling, mining, commissions, etc., and claims that a tun of coal costs at tide water $4.15, while the average at the sale was but $2.42. In the coal regions, the operators say that either tolls and labor must be greatly reduced or they must suspend operations. Miners' strikes are feared, and altogether the prospects are gloomy for both laborers and owners.

THE SCIENCE OF MECHANICAL MOVEMENTS.

There are numerous treatises devoted to descriptions of great inventions and discoveries, and discussions of the processes of reasoning by which they were worked out. It has long, too, been recognized that there is such a thing as scientific invention, in which the mechanic, having definitely determined the result which he wishes to attain, proceeds to achieve it by a series of systematic steps. It is true that the genius for making discoveries, with which some men are endowed, gives them a great advantage over their fellows; but it is equally true that genius, properly directed, is far more certain of success than if it acts without a guide. This is sufficient to account for the great interest which has been taken in the matter by professional writers, and the number of treatises relating to it that have been published. Few of these works, however, go farther than to show the nature of inventions that have already been perfected, and to give discussions of the motions that are produced. It is a great advance when a writer offers to the public a method which is capable, not only of analyzing all existing mechanical movements, but also of furnishing the outlines of any movement that may be desired. This is the claim made by Professor Reuleaux in his "*Theoretische Kinematik*," a work which has excited great interest in Germany, and has recently been translated into English. Professor Reuleaux' method of analysis possesses the merit of great novelty, and a description of its nature may be received with favor by readers of an inventive turn of mind.

The reader who is familiar with analysis knows that the discussion of an equation is a very thorough method of determining all the conditions and variations of a given question. The well known problem of the lights, which is to be found in most elementary treatises in algebra, is a good example of this kind; and still better illustrations will occur to the reader in the discussions of some of the equations deduced in what is commonly known as analytical, but more correctly as general, geometry. A somewhat similar plan is adopted by Professor Reuleaux in his *Kinematik*. All ideas of force and time are disregarded in the consideration of a mechanism, and he merely concerns himself with the motions that are produced. The geometrical methods of determining changes of position are explained; and the nature of simple mechanisms and the manner of compounding them are fully illustrated. This part of the work may be compared with the introduction to the study of algebra, in which the idea of generalization is first presented to the student. Then the notation by which mechanisms are to be represented is introduced. The system adopted, which is entirely novel, cannot be properly explained in a limited space, but some of its characteristics may be noted. The different elements of a machine, such as screws, prisms, cylinders, cones, etc., are indicated by appropriate letters, accented in such a manner as to show whether they are hollow or solid. Letters connected by a dotted line indicate that the two elements are joined by a link, a comma shows connection by contact, an underscoring of a dotted line stands for a fixed link, an elastic link or spring is marked by a wavy line over the dotted one, etc. The notation is by no means complex, and can be mastered in a short time by any one who is accustomed to the use of algebraic symbols. It will be a surprise to many to find that the elementary parts of mechanism are comparatively so few in number. The use of the notation having been illustrated by numerous examples, properly graded, the author proceeds to the final analysis of mechanisms, or discussion of the expressions given by the notation. This is, of course, the object of the whole work, to which all that has preceded has been only preparatory. The reader who has followed the description so far cannot fail to see that the method seems to show the possibility of a thorough analysis of any mechanism that can be included in the notation. Those who feel an interest in rotary engines (and few engineers have not designed at least one of these machines) will find that this class of machines has been pretty thoroughly analyzed by Professor Reuleaux. The work is by no means exhaustive in every field of mechanical movements, but is rather intended to furnish the investigator an instrument which he can use in his own explorations. Even those who do not care to study the work thoroughly can scarcely fail to gain some useful ideas from turning over the pages and inspecting the sketches of the various movements shown.

SOME NEW LIGHT ON THE ORIGIN OF THE TRUFFLE.

The truffle is a species of underground fungus largely used in French cookery to give a peculiar rich flavor to meats. It comes principally from France, where it is always found in oak or beech woods, and can only be gathered through the agency of the keen scent of dogs or pigs especially trained to hunt for it. Both from the difficulty of obtaining the fungus, and from the fact that it is a delicacy highly prized by epicures, it brings in all markets a large price; and thus truffle hunting has long been a remunerative calling for the French and Italian peasantry. In appearance, the truffle is a blackish mass, covered with protuberances and weighing from an ounce to several pounds; when cut open it presents a marbled appearance, and its reproductive portion (it is sexless) is found in the veins in the shape of minute sacs which never open, each containing several spores, possessing spine-covered or honeycombed surfaces.

Numerous attempts have been made to cultivate these fungi, but with little or no success. Regarding their early development, comparatively nothing has been known, and the spawn or vegetative portion, which, in the case of the mushroom, is readily obtained, allowing the cultivation of that fungus to any degree, has not yet been definitely found in the truffle. Sprinkling the earth with water, in which the parings of truffles have been steeped, has resulted, it is stated, in producing them; and they have likewise been obtained by the slow process of planting calcareous soil with acorns and waiting for the saplings to reach a few years' growth, when the truffles could be gathered among the roots. Still no practical method of cultivating the truffle is in existence; and since they are found completely isolated from anything which could produce them, we are left in the dark as to how they are originated, or at best with merely the supposition that, at an early period of their development, they are parasites of the tree roots, or the theory that, like oak galls, they are due to the stings of insects. This last conjecture, however, arising from the fact that truffles are attacked by dipterous insects, like other nitrogenous cryptogams, has been refuted by the entomologists.

A very curious and recent experiment by M. Brefeld throws some new light on the subject, and may lead to the long sought method of cultivation. The *penicillium glaucum* is the well known green mold which appears on bread and cheese, and which owes its name to the fact that, in free air, it consists of chaplets of spores, in brush form, connected to a stem or pedicle. The mode of reproduction of this mold depends on the medium in which it exists. Now, by placing the *penicillium* in a closed vessel with very little air, M. Brefeld has obtained nodules which, after being buried in moist sand, fructify with internal *asci* which do not open. That is to say, they are produced in a manner analogous to truffles. The *asci*, we may explain here, are the little sacs in which the spores are contained, and are found in many complex forms of fungi, which build up a special organ called the *peridium* to hold these sacs.

It will be seen from M. Brefeld's discovery that he has noted two forms of green mold, one aerial, or *penicillium*, the other existing when partially deprived of air, or tuberaceous. The truffle through its subterranean location is always in confined air, present besides in limited quantities, and in that state is sexless. Now it remains to find its aerial form, to discover the peculiar *penicillium*, which placed under the conditions noted will produce, for its nodule, a truffle.

IS BROTHER JONATHAN SO VERY SLIM?

In our examination of the newly published medical statistics of the Provost Marshal General's Bureau of the late war, with regard to the relative hight of American men, we had the pleasure of showing, the other day, that the native born among our citizens and soldiers stood first in point of stature; while in every instance the foreign born exceeded the stature accorded them in the statistics of the nations they represented. We not only raise the tallest men, but draw from foreign countries, by emigration, men of more than average stature.

The artists are therefore quite right in always depicting the typical American, Brother Jonathan, as very tall. But they also make him very slim; and theorizing travelers have never hesitated to give a reason for his being long-legged and lank. One blames the climate; another, tobacco; another, bad cookery; another, his excessive "push" and eagerness in business; while the extra scientific Buchner was sure that the continent was altogether unfavorable to the European type of man, and would allow us no alternative but extermination or a speedy approximation to the Indian type. But is the average American really so slab-sided and lean?

Let us see what answer our statistics give. How do we compare with other nations in girth and weight? As statistics of mean weight have but little value apart from measurements of hight and girth, and age, we will first examine the records with regard to the degree of maturity of the several racial elements of our armies.

From the statistics gathered by the Sanitary Commission, Gould found the mean age of 1,012,273 men of all nativities, mostly volunteers, to be 25 years and 10 months. As a careful analysis of statistics of physical development shows that American born white men do not attain their full growth until between thirty and thirty-five years of age, it is obvious that the results obtained from these statistics will under rather than over rate the average dimensions of American men. It will be seen, too, from the following table of men enlisted toward the close of the war, when the average age of recruits was highest, that, with the exception of a small number of Canadian recruits, the native born element of the army was the youngest.

Nativity.	Number.	Mean Age.
United States	196,980	26·955 years.
British Possessions	14,954	25·352 "
England	10,103	27·855 "
Ireland	30,412	27·216 "
Germany	30,943	31·029 "

Unfortunately the instructions to enrolling surgeons did not direct them to record the weight of the men examined. Only the more energetic officers took the trouble to make their work complete in this respect; consequently the statistics on this point are less full than could have been desired. Still an idea of the relative bulk of the men of the five principal nativities may be had from the following tables, showing the relation of hight, girth of chest, an expansion of chest to increasing weight in over 10,000 men of all ages from 18 to 45 years. The men, when weighed and measured, were invariably naked.

WHITE NATIVES OF THE UNITED STATES.

Weight.	Number of men.	Mean hight. Inches.	Mean girth of chest at expiration.	Mean expansion of chest.
Under 100 pounds	14	64·000	29·714	3·071
100 and under 120	991	65·191	30·468	3·146
120 and under 140	2,968	66·856	31·997	3·238
140 and under 160	1,894	68·424	33·642	3·289
169 and under 180	427	69·920	34·988	3·289
180 and over	65	70·215	36·554	3·269
Total and mean of total.	6,359	67·297	32·491	3·242

BRITISH AMERICANS.

Under 100 pounds	2	64·000	30·000	3·500
100 and under 120	38	64·211	30·737	3·184
120 and under 140	304	66·546	32·020	3·247
140 and under 160	198	67·848	33·606	3·298
160 and under 180	41	69·512	34·439	3·402
180 and over	6	69·333	35·333	3·333
Total and mean of total.	589	67·059	32·666	3·272

ENGLISHMEN.

Under 100 pounds	0	——	——	——
100 and under 120	56	64·067	30·893	3·107
120 and under 140	243	65·835	32·453	3·154
140 and under 150	128	67·625	33·609	3·242
160 and under 180	25	68·480	34·960	3·380
180 and over	2	69·000	38·000	3·500
Total and mean of total.	454	66·348	32·749	3·187

IRISHMEN.

Under 100 pounds	3	62·667	30·667	2·167
100 and under 120	158	64·532	31·519	3·215
120 and under 140	724	66·119	32·715	3·181
140 and under 160	450	67·609	33·916	3·233
160 and under 180	74	69·270	35·357	3·338
180 and over	8	69·000	36·750	3·250
Total and mean of total.	1,417	66·589	33·119	3·208

GERMANS.

Under 100 pounds	3	63·333	30·000	2·833
100 and under 120	168	64·167	31·357	3·262
120 and under 140	675	65·532	32·601	3·226
140 and under 160	389	66·905	33·969	3·231
160 and under 180	104	68·346	35·192	3·221
180 and over	4	69·000	36·000	3·500
Total and mean of total.	1,343	65·985	33·047	3·231

Taking into account the relative youth of the American element of our armies, and the probable inferior age of the Americans furnishing the foregoing measurements, their slight inferiority in girth of chest is not at all remarkable. It certainly does not indicate any excessive lankness in the natives of this country.

Dr. Baxter has compiled a table exhibiting the mean results of a great number of sets of observations by various authorities. Most of them are too fragmentary to be of use in this enquiry; but such as are complete as regards age, hight, girth, and weight, we have brought together in the following table: Though not sufficiently complete to warrant any sweeping generalization in regard to Brother Jonathan's physical qualities, it carries evidence enough at least to satisfy one that the typical American is a fair specimen of humanity, in bulk and weight, as well as in stature.

Nativity.	Mean age. Years.	Mean hight. Inches.	Mean cir. chest, inch	Mean weight. Pounds.	Authority, etc.
United States	24·01	67·56	——	148·29	Coolidge: 1,537 recruits.
	23·94	67·05	34·99	147·50	Elliott: 1,300 army of Potomac.
	25·62	67·34	34·43	144·83	Gould: 8,349 volunteers.
	——	67·22	35·69	142·80	" 12,737 "
	26·29	67·30	32·49	136·05	P. M. G.'s Bureau: 6,359 recruits.
British America	24·94	67·06	32·67	138·69	" " 589 "
England	24·31	——	——	148·41	Coolidge: 3,439 U. S. soldiers.
	24·00	65·94	——	132·46	Dawson: 1,500 civilians.
	27·26	66·35	32·75	133·64	P. M. G.'s B.: 454 recruits.
Scotland	23 to 45	67·72	——	148·69	Beddoe: 1,982 civilians and soldiers
	25·00	68·30	——	144·08	Forbes: students.
	18 to 45	67·07	33·84	——	P. M. G.'s B.: 3,476 recruits.
Ireland	26·80	66·59	33·12	136·46	" " 1,417 "
	23 to 45	——	——	137·98	Beddoe: 1,616, nearly all soldiers.
France	30·50	64·84	34·61	143·20	Bernard: 400 infantry of guard.
	30·—	66·10	35·43	141·10	Allaire: 230 cavalry "
Germany	30·10	65·98	33·05	136·48	P. M. G.'s B.: 1,543 recruits.

It will be seen that the average American compares very favorably with the best specimens of the race, the English and the Scotch, as regards bulk and weight. The most extensive series of observations on this head ever made in Great Britain are those of Dr. Beddoe, who collected measurements of over 17,000 civilians and soldiers, between twenty-three and fifty years of age. From these he calculates the mean hight of Englishmen to be 5 feet $6\frac{5}{8}$ inches, and that of Scotchmen 5 feet $7\frac{1}{4}$ inches. From the careful measurement of one half a million men, little and big, sick and well, by the Provost Marshal General's medical staff, it appears that the average hight of the men of eight of our Northern States exceeds 5 feet 8 inches. In sixteen States, the average exceeds that of the Scotch; and in one State only (Connecticut) does it fall so low as that of the average Englishman.

In the matter of bulk, the comparison, as we have seen, is not less favorable to Brother Jonathan. He is as heavy as the heaviest even in his youth: and the apparent slimness of his immaturity, due to his superior hight, is fairly made up for by the time he reaches his full development.

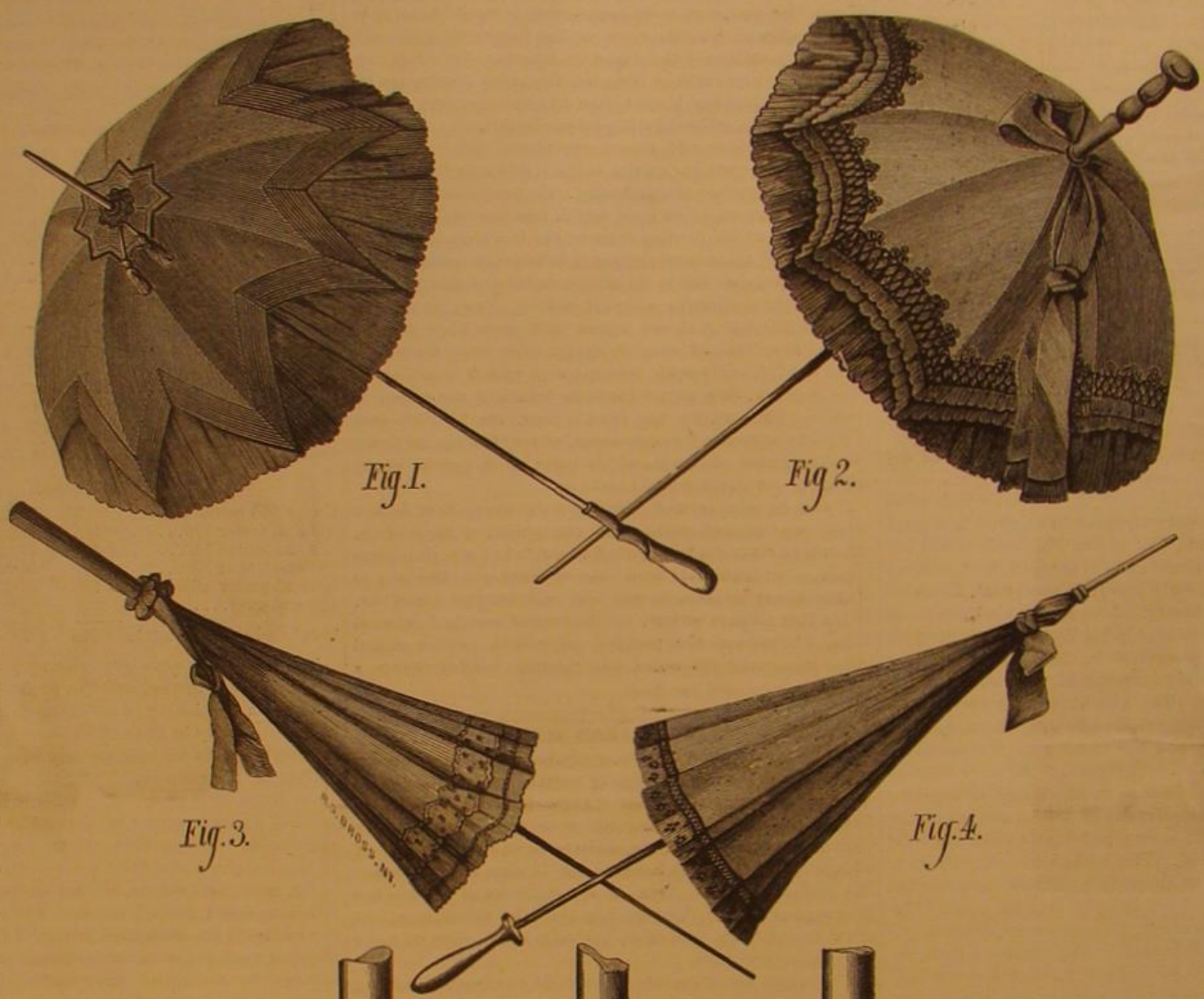
ARTIFICIAL TEETH.—Mr. Merrick Bemis, of New Haven, Conn., desires us to state, that his patent (which we quoted on page 106, volume XXXV, and which states that the plates are intended to fit over natural teeth, and in which the teeth are described as all molars) covers the application of the invention to all teeth.

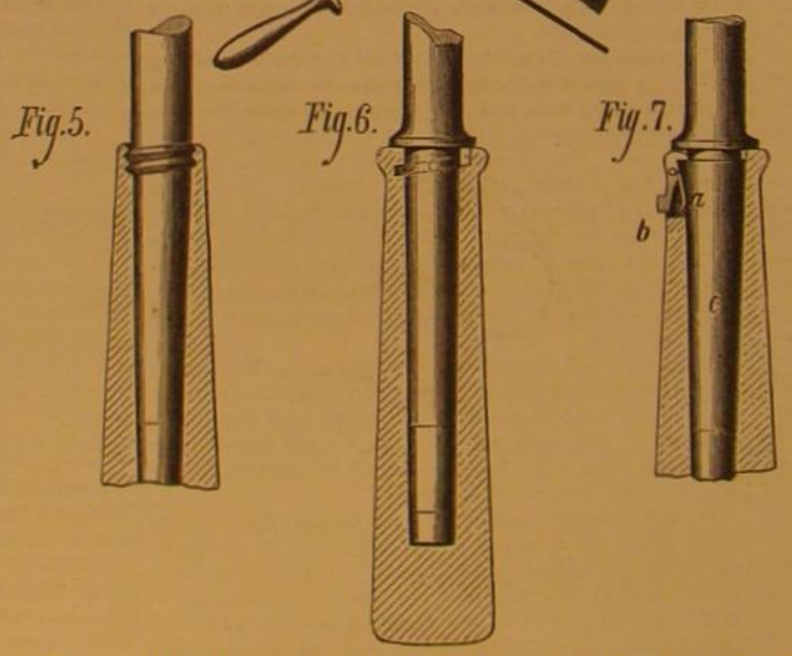
THE DETACHABLE HANDLE PARASOL AND UMBRELLA.

The annexed engraving illustrates a novel, simple, and useful improvement in this staple article of trade. The invention may be described either, *firstly*, as an improvement on the common style of parasol or umbrella, where the handle is at the "right" end of the stick, as seen in Figs. I and IV; or, *secondly*, as an improvement on the walking-stick or Alpine style of parasol, where the handle is at the "wrong" end of the stick, as seen in Figs. II and III.

The invention consists in making both ends of the stick alike, and in providing a detachable handle, capable of fitting on either of said ends; so that a lady can adjust the handle at pleasure, on either end of the stick, as quickly, and with as much ease, as she could expand or close the parasol.

The invention is, *first*, an improvement on the common style of parasol or umbrella (Figs. I and IV) in respect that—the handle being reversible — the improved article combines in itself the two styles, namely, the common and Alpine; in short, the improved parasol can be adjusted to either of the *four* different positions represented in Figs. I, II, III, and IV. Secondly, the invention is an improvement on the walking-stick or Alpine style of parasol (Figs. II and III) in respect that it effectually overcomes the objections to the Alpine style, which are these, namely, that the lady must, when desiring to hold the parasol overhead, take in the hand that end of the stick which had previously been in contact with the not-over-clean sidewalk, thus rendering the hand or glove liable to be soiled; and that, when being so held overhead, a substantial hold for the hand is not afforded, the parasol having to be held by the slender stick alone. A glance at the engravings, however, will show that, in the improved parasol, these two objections are effectually overcome; for the handle, as it has been seen, can readily be changed from one end of the stick to the other.





THE DETACHABLE HANDLE PARASOL AND SUN UMBRELLA.

Fig. VI shows a plain handle, in section, containing an end of a parasol stick, and secured to the stick by a bayonet joint. Figs. V and VII are modifications of the same, the handle in Fig. V being secured by a screw, and in Fig. VII by a spring-catch. In Fig VII the spring, *a*, pressing against the end of the stick, *c*, throws the tooth of the catch into the shallow groove in the stick and holds it in that position till released by pressure of the thumb on the knob, *b*. The above methods of securing the handle, however, are shown merely as a few of the many ways of doing so, the Patent allowing the handle to be secured to the stick by any suitable fastening device.

Regarded, then, as an improvement on the common style, or as an improvement on the Alpine style of parasol, the invention presents the following merits and advantages—it combines, in one article, the common and the Alpine styles; it effectually overcomes the objections to the Alpine parasol; and, further, it allows a lady, when choosing a parasol, to select also a handle to her taste, which can be furnished of the necessary gage. The invention is simple and effective; and, we are informed, the improved article can be manufactured at a price to compete with the unimproved article. We think the invention a practical one, and we augur for it much and lasting success.

Letters Patent for this invention were issued jointly to Messrs. George Yule, and William M. Henderson, of Pennsylvania, on the 24th November, 1874.

For information as to rights, licenses to manufacture, etc., address, by letter, Mr. George Yule, care of The Henderson Co., 258 South Third Street, Philadelphia, Penn.

Why Not?

"Can any one give a sensible reason why a person who devises a new and patentable idea should not secure a patent upon it? I have ransacked the entire field of opposition without discovering a single reason that cannot be demolished by one whisk of the horse tail of common sense. Granting that all patents are not profitable, we must acknowledge that the expense of obtaining them, especially in the United States, is quite moderate, and that the chance of realizing from a patent is always worth the amount it costs to secure it; and I might state, as a rule, that the exclusive monopoly of any invention for seventeen years (the term for which patents are issued) is worth the price of a patent whatever may be its character, unless it is based upon a foolish or incorrect theory, or is practically inoperative. I do not intend by this statement to be understood that every such patent will yield a fortune, or even an independence for its owner, but that as an investment of so much money it cannot be regarded as a bad investment. Apathy, or rather a failure to properly put the patented article upon the market, and exaggerated ideas of its value, which lead to exorbitant demands from any one who might desire to purchase, are the principal causes of inventors failing to realize from their patents. Many patentees prefer to let their patents lie unintroduced rather than dispose of them at sensible prices, when often these figures would yield a fair profit. Many a good patent is buried and forgotten until it runs out, and then some one, more sensible in such matters, as likely as not picks up the idea, manufactures the article, puts it upon the market, and grows wealthy upon the profits. Again, how often is it that we run across persons who regret that they did not secure patents upon their inventions or discoveries when they first made them. Many an originator of an idea has failed to secure himself by a patent when he might have done so, and has seen his ideas appropriated, and the invented device finally become a standard article of commerce and trade. As likely as not, the dilatory individual spends the balance of his life in useless regrets that he missed a chance for securing a competence and probably a fortune. It was a neglected opportunity not only to become rich but to enroll his name among the list of men of genius. A few such instances as these are necessary and valuable to point a moral to our tale. Their experience is a living example to other inventors, and is one of the strongest arguments to support our 'Why Not?'

"Again, leaving profit entirely out of the question, a patent is a national record of the genius of the people, and every man who can do so should be proud to have his name placed upon the record. Is it not a fact that we feel a glow of pride when we run across the name of some ancestor among the names of patentees in the patent record? We at once feel that we have inherited the national Yankee characteristic of an American, and we grow tenderer and more sympathetic with our next door neighbor who has been spending all his time and money for years in a vain endeavor to invent a perpetual motion machine. It is the only chance a great many of us have to send our names down to posterity linked with a noble and public ambition to help ourselves and the world along. If the invention does not promise to be speedily remunerative when it is made, it should be patented nevertheless, as we do not know how soon the necessity may arise that will call for such a device. Most of the devices which the originators failed to patent and which afterwards went into general use have just such a history.

"Many people are so constituted that they never pay out a dollar unless they see an immediate prospect of two dollars being returned for it. Such persons will most generally miss the main chance and have the pleasure of regretting their folly ever afterwards. I therefore ask again, why not patent your inventions? And I am sure every sensible person will reply 'why not?'"—*Mining and Scientific Press.*

Errata.

Messrs. S. C. Forsaith & Co., Manchester, N. H., desire us to correct an error in the description of their hand fire engine, published on page 127 of our current volume, by stating that four men, instead of fourteen, were able to throw a half inch stream 186 feet, instead of 156 feet, as printed on the page referred to. The initials of the patentee, Mr. Hall, are J. M., not A. M.

Messrs. J. A. Fay & Co.'s planer, matcher, and beader, illustrated on page 147, current volume, was entitled, by a typographical error, a planer, matcher, and bender.

THE value of the Centennial buildings is put at $5,949,000, and of their contents, $104,820,340. A large portion of the exhibits, which are not taken into account, are not of intrinsic value, though probably they could not be purchased for all that the rest of the exhibition is worth.

HANGINGS FOR SLIDING AND SWINGING GATES.

The invention herewith illustrated is an improved attachment, or iron, for that class of gates which are opened by sliding them back upon a proper bearing surface in the gate post until a balanced position is reached, and then swinging them round upon the bearing as a center. The device is composed of two cast iron brackets, a transverse slotted swivel, and a bearing wheel, all as shown more clearly in Fig. 2. The brackets, A, are provided with projections having suitable bearing openings for the iron which revolves therein. The projecting portion of the brackets, it will be observed, extends in a diagonal direction from the face of the post. The bearings are thus adapted to permit the iron held thereby to lie parallel to the side or face of the post, as may be desired. The swivel iron, B, consisting of a casting provided at each end with bearing studs, rests in the bearing openings of the brackets and turns therein. The bearing wheel, C, the circumference of which is less than the inner circumference of the circular opening in the swivel, is provided with journals which rest upon bearings at the bottom of the vertical slots.

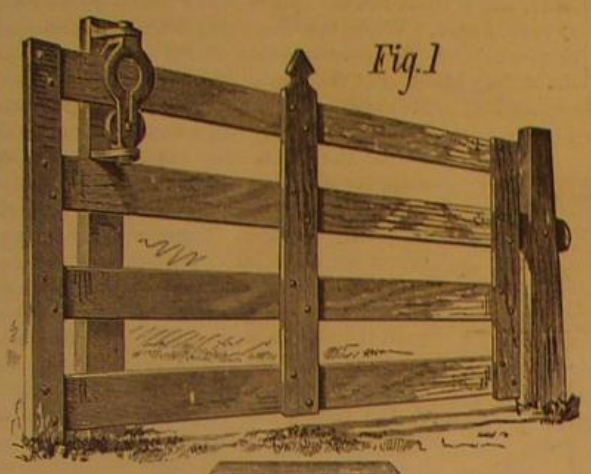


Fig. 1



Fig. 2

The gate, Fig. 1, is constructed as desired, and one of its bars is held in the slot, passing through the swivel iron and resting upon the bearing wheel. The operation of the gate is similar to others of its class already noted. It is closed, of course, by the opposite movement. Some of the advantages claimed for the described construction are as follows: By constructing the iron with the large circular opening and vertical slots, the bearing wheel may be readily inserted in its place and be securely held there without the necessity of drilling journal holes or inserting pins. The extended bearing surface, also furnished by this form of casting, serves to hold the gate bar always in line with the bearing wheel, so that the tendency to cramp or pinch when the gate is longitudinally moved is avoided. The attachment as a whole is strong, durable, and simple in its construction, it being complete and ready for use when cast, without drilling or finishing of any kind, so that it can be made at a small cost.

We are informed that farm gates put up with this device need no bolting nor bracing; and as they rest with each end squarely on the gate posts, they will neither warp nor sag. They can be raised up so that sheep or hogs can pass under them. The gate may also be placed on the side of a steep bank or over snow drifts.

This invention was patented July 25, 1876, by Elias Shopbell, of Floris, Iowa, by addressing whom further particulars may be obtained.

Coal Dust as Fuel.

The use of dust and pea coal has been thoroughly tried at the Ocean Mills, Newburyport, Mass., for the past year and a half, with the following result: For years they have kept an actual account with scales of every barrow of coal wheeled into the fireroom, and the average weekly consumption shows forty tuns of broken coal on 18,000 lbs. of cloth, average costing $7 per tun, or $280 per week, which makes the cost of fuel per pound of cloth over 1½ cents; under the present arrangement, the weekly consumption is only thirty-six tuns of pea and dust on 20,000 lbs. of cloth, costing $3 50 per tun, or $126 per week, which makes the cost of fuel per pound of cloth less than six mills, showing a saving of nearly one cent per pound. This mill is run entirely by steam, and the cost of one and a half cents per pound in burning large coal does not vary from the cost of other mills in the same vicinity. Beyond the saving of fuel, the fire is much easier on the boilers, brickwork, and fronts of furnaces, no repairs having been made on any of the above since the arrangement was put in; and the grates are as perfect as new. This one item almost pays the expenses of the arrangement. The labor is not near as hard on the firemen, and the engineer has the steam under entire control. Again, if steam is drawn down rapidly, as in dye works, it can be brought up again in a quarter of the time.

The want of market for dust, heretofore, has caused its being dumped off on to the dirt piles at the mines at a much greater cost than if loaded into cars; and the accumulation at the shipping ports has been of such inconvenience that thousands upon thousands of tuns have been dumped under the docks to get rid of it. Much of the pea coal has been thrown, also, upon the dirt piles, all of which will now be carefully saved, and shipped to market, the present arrangement developing more steam from one tun than we got from the same quantity of any larger sized coal.— *Boston Transcript.*

Action of Impure Rain Water on Lead Pipes.

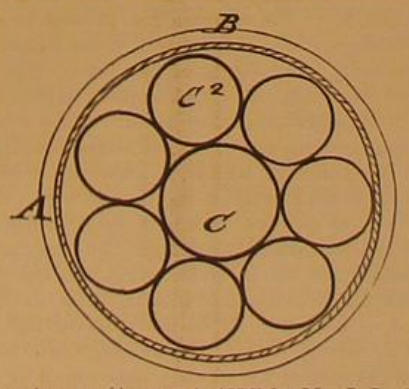
In a paper lately read before the American Chemical Society, Professor Paul Schweitzer says: The laboratory of the University of Missouri is supplied with rain water, which collects in a tank in the upper part of the Scientific Building, and is carried to the working tables of the students by lead pipes, which are furnished by brass stopcocks. In using this water for ordinary analytical work, as, for instance, saturating it with sulph-hydric acid, it was soon found to be unfit for such purposes, on account of the quantity of metals it had dissolved, after standing in the pipes only a short time. It is a well known fact that pure water attacks lead much faster than water containing a certain quantity of mineral salts, and this seems to be also the case with rain water, which contains invariably ammonia, nitrous and nitric acid: some sulphuric acid was also found in this water, derived from the smoke and cinders which fall on the roof of the building from the coal fires that heat the rooms. The following quantities of metals were found in one United States gallon, 231 cubic inches, of the filtered water, that had stood in the pipes for one month: 1·079 grains metallic zinc, 0·537 grains metallic iron, 2·503 grains metallic lead, 0·082 grains metallic copper, 0·049 grains metallic arsenic. Total, 4·350 grains.

Arsenic, copper, and probably iron, are derived from the lead pipe, manufactured from an inferior quality of lead, and zinc from the lining of the tank. In supplying private houses or institutions with water through a system of pipes, care should be taken to find out whether the water to be supplied be pure or not: in the former case, and when rain water is the source of supply, as it is in many sections of our State, lead pipes should be discarded, and tin-lined lead pipes substituted for them.

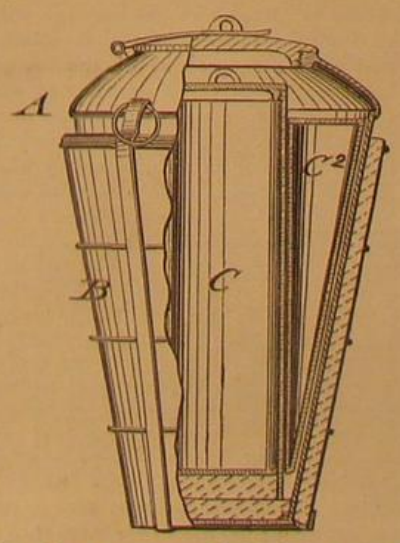
A MARINE SAFE.

Few of the great ocean steamers now leave our ports without carrying large amounts of bullion and specie. In case of the wreck of the vessel, this precious freight is likewise lost, since its weight and that of the heavy safes in which it is inclosed necessarily carry it to the bottom when the ship breaks up. Sometimes, and of course only when the disaster occurs in comparatively shoal water, a buoy is attached to the safe, and the latter, if time permits, is thrown overboard. The location of the buoy then marks that of the sunken safe, and it is not difficult to regain the latter.

A much better plan than this, and one that is well worth the attention of ship owners, insurance companies, and others, has lately been patented through the Scientific Ameri-



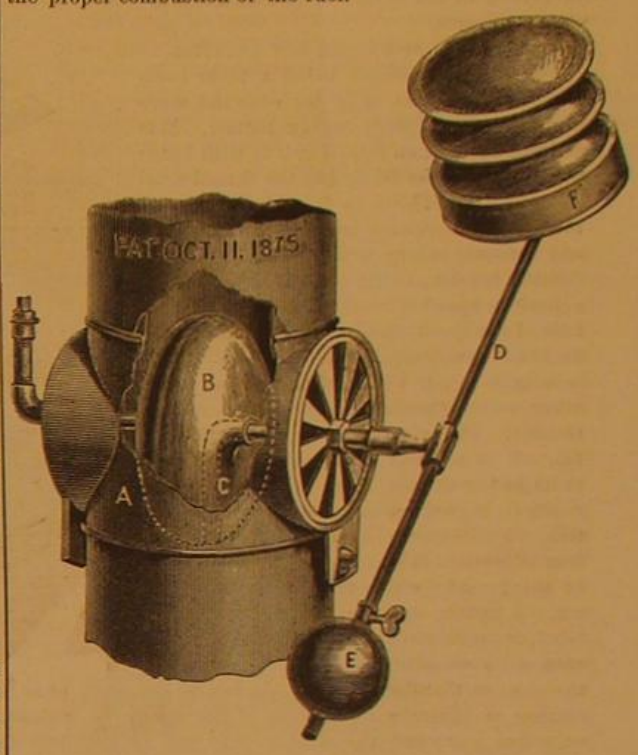
can Patent Agency (August 1, 1876) by Mr. J. L. Gouley, of New Orleans, La. This inventor proposes to make the safe itself a buoy, in the manner exhibited in the annexed engra-



ings. A is a sheet copper vessel, the lower part of which, B, is covered with rubber so as to resist the shock of being tossed on breakers. Inside the vessel, A, are a number of compartments, those marked C^2 being hermetically sealed and containing only air, while the center one, C, is designed for the reception of treasure. There are two covers one for the center compartment, the other for the main vessel, as shown, the latter being provided with suitable locks. It is intended to mark the safe conspicuously with the name of the owners, and then, in case of wreck, throw it over board, so that, if not washed ashore, it is certain to be picked up at some time.

THE ACME AUTOMATIC DRAFT REGULATOR.

We illustrate herewith a novel and ingenious device for regulating the draft of a fire, and which also is claimed to obviate the danger arising from overheated flues. Generally, all smoke pipes are provided with a common close damper for regulating the draft. When this damper is closed, or partially so, the combustion is slow and imperfect, the gases accumulate, and when there is not a free exit they become forced into the rooms. The common damper likewise requires frequent manipulation by hand, to suit circumstances, while the present device does not at any time retard the free exit of smoke and gases, but allows them to pass into the flue as they are generated; it likewise is self-acting in its operation so far as not to require frequent adjusting and so as always to permit the necessary amount of draft for the proper combustion of the fuel.



A is a cast iron collar that fits on the smoke pipe, with double open and shut valves. B is a small cast iron boiler without joints, suspended within the pipe in such a manner and of such shape as not to impede the passage of smoke or gases. C is a siphon pipe, leading from the bottom of the boiler to the exterior lever arm, D. This lever, D, is a continuation of the siphon pipe, weighted at one end with the weight, E; at the other end it carries the metal receivers, F. It is connected as shown with the valves in the collar, A.

The action is as follows: With a moderate amount of heat passing up the chimney, the water in the boiler remains at or near the boiling point, and the valves remain closed; but as soon as the volume of heat is materially increased, steam is generated, which forces a portion of the water through the siphon pipe into the lower metal receiver. The latter then partially overcomes the weighted end and the disk descends, partly opening the air valves in the smoke pipe, admitting a current of cold air which serves to reduce the force of the draft in like proportion. Any further increase in the volume of heat passing into the smoke pipe will likewise increase the steam pressure, forcing a greater weight of water into the receivers and opening the air valves wider and reducing the force of the draft to its lowest point necessary for combustion. As soon as the fire is checked and the smoke pipe cools, the water gradually returns to the boiler, reversing the action; and the draft is gradually increased until the process is again repeated. Thus the fire itself is the agent for regulating its own draft.

There is claimed to be no danger of explosion, for, as state the manufacturers, were the boiler to become red hot, the water would be forced out of it into the receivers, and cannot return again until it has cooled. Though the air valves are self-regulating, and are acted upon by the force of combustion, they can be manipulated by hand if desired, by simply sliding the weight on the arm of the lever, which will open or close the valves, as may be desired.

The device can be readily applied to any stove or furnace, where the smoke pipe is over five inches diameter, either on a vertical or horizontal pipe. Patented October 11, 1875. For further particulars address the S. J. Gold Heater Company, 93 Liberty street, New York city.

Joint Stock Maternity.

A Welsh correspondent sends to *Nature* an interesting instance of a joint stock concern in the poultry yard: "Two hens sat on, or by, one nest, and thus between them hatched one chick. They have since, for some weeks, been parading the yard, each clucking and manifesting all the anxiety and care of a true mother over this one. The hens never quarrel, or show the least appearance of jealousy or rivalry."

Continued from first page.

moving exteriorly to the sheds of the warp, without absolute and positive connection between the shuttle and the motor, is a problem, requiring for solution something more than a mere modification of existing devices, has been apparently unrecognized. The first weaver pushed or threw the shuttle through the warp with his hands. Kay connected pickers or hammers at the end of the shuttle race with a cord along the front of the loom, and attached to the middle of the cord a handle or "picking peg;" and this the weaver jerked in one direction or the other, causing the pickers to strike the shuttle and drive it through from side to side. In the power loom, the pickers are operated by proper mechanism; but the principle on which they work remains precisely the same. The shuttle, in fact, becomes a mere projectile, entirely out of the control of the weaver during its passage across the warp. The disadvantages pertaining to this arrangement are so many and so great that the mere recapitulation of them is sufficient to excite the deepest surprise that, for a hundred and thirty years after the device was invented, during an age of progress more rapid than the world has ever before known, the skill and genius of mankind were baffled in every attempt toward reaching the radical change so obviously and imperatively demanded. And it is necessary to consider these disadvantages for a proper appreciation of the invention to which this article is devoted.

DISADVANTAGES OF THE FLY SHUTTLE.

The ordinary shuttle being a mere boat-shaped implement, it slides over the warp thread on its slightly convex bottom. It is obvious that, when hurled as it is with lightning rapidity, the friction on the thread must be excessive. This is in fact the case, and the result is frequent breakage of the warp and constant injury to the filaments of such delicate fabrics as silk, cambric, etc., so that a limit is speedily reached, in point of fineness of the goods made, beyond which the fly shuttle is practically useless. Similarly there is a limit in the width of the fabric, or, in other words, the distance the shuttle can be thrown. The wider the warp, the more difficult it is to pick, since, while it is harder to impel the shuttle, it is likewise harder to check its high momentum and reverse its motion. A still greater obstacle to the production of perfect fabrics is the variable nature of the force by which the shuttle is projected. A certain speed of the mechanism being just sufficient to make the throw, an increase in velocity may result in causing the shuttle to rebound, thus slackening the weft, or even leaving a bight in it. Again, if the speed be reduced only five per cent, the shuttle may fail to complete its journey. The least evil consequent is that some of the threads are tight, while others lie loose; and when the completed fabric is woven, the former take the strain, giving way first; and the material, as is commonly the case with poor and cheap silk, "cockles," and speedily becomes valueless. The greater evil is a "smash," which must occur where the shuttle either rebounds into the sheds or fails to pass through them. It then is struck by the lay, the delicate dents of the reed are bent or broken, and the threads of the warp in the vicinity are destroyed. Hours may be required to repair the damage; but even then, the loom overseer has no assurance but that, before the machine can make half a dozen strokes, the same accident may re-occur and necessitate the same outlay in time and expense. In making fine goods, the bending of the dents is practically irreparable; and to continue weaving the piece with the reed injured, however slightly, is to produce a fabric with a slackly woven streak in it.

Again, the character of the selvedge of certain goods is one of the criterions by which the quality of the article is determined. To make a perfect selvedge, however, a very delicate adjustment is required to draw the thread of the weft firmly up against the exterior threads of the warp opposite the shuttle, after the latter, having completed its flight, comes to rest just prior to the beat of the lay. This adjustment is exceedingly difficult to attain; and where it fails, the quality of the goods is again injured.

Lastly, the fly shuttle is a source of no inconsiderable danger. Guards have been devised for keeping it in place, and great ingenuity has been expended in the means for checking and reversing its motion. But it is obvious that the picker rarely strikes it so as to propel it in identically the same line, and that slight variations must constantly occur. From these and other causes, determining, perhaps, a failure of the safeguards, the shuttle has often been known to leave the loom and seriously to injure the operatives. It was only recently that we learned of a case where an unfortunate mill girl was struck in the eye and totally blinded, and there have been instances where the sharp pointed projectile has inflicted fatal wounds.

IMPROVEMENTS IN PICKING.

To remedy all these defects, there have been but few efforts. The air pump pick was an attempt to drive the shuttle by compressed air, forced into a cylinder, the two long piston rods of which gave motion to the drivers, which impelled the shuttle. This was a failure. Another and more successful device includes a long needle or arm, which carries the shuttle through the warp, then is withdrawn until the lay is beaten, and finally is returned to catch the shuttle and draw it back. This may be seen at the Centennial Exposition, applied to a carpet loom, for which class of machine it is best adapted. A double weft is thus laid in the warp. This is useful for ingrain carpets, but not available, for obvious reasons, for other fabrics. Another and somewhat similar plan includes two hook arms and no shuttle. One arm carries the bight of the weft into the warp for half the distance and delivers it to the other arm, which extends in similar manner from the opposite side. Still another ingenious inventor unsuccessfully attempted to draw the shuttle through by magnets moved above and below the sheds, but the shuttle persistently attached itself to the nearest lodestone, and refused to proceed further without destroying the warp threads in front of it. A device successful for short throws, not exceeding five inches or thereabouts, is a rack and pinion under the shuttle carrier. This is now employed in weaving ribbons and other narrow goods, and may be seen on the looms engaged in weaving bookmarks at the Centennial. One more invention is also worthy of notice here, though it failed, and is obviously of no practical value. It was positive, however, inasmuch as a cam traveled under movable needles, and these, rising through the warp in rear of the shuttle, surely but very slowly pushed the latter through.

The above will serve to convey to the reader some general idea of the difficulties existing in the loom, as well as of what others have done to remove them, at the period when Mr. James Lyall began the study which led to his remarkable invention

Fig. 2.

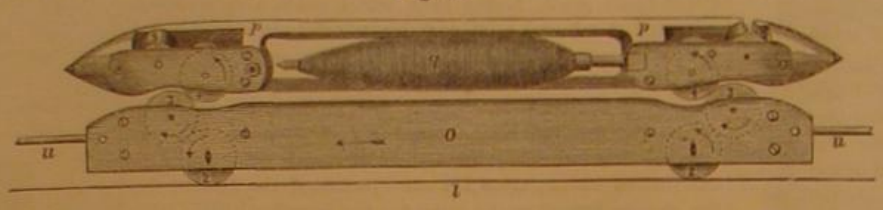


Fig. 3.

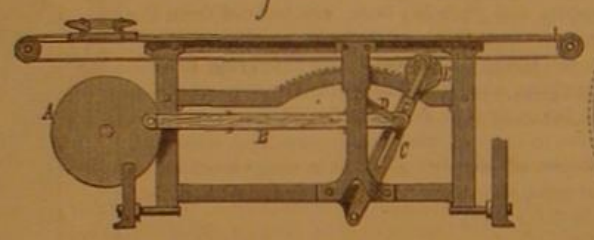


Fig. 4.



THE POSITIVE MOTION SHUTTLE.

THE POSITIVE MOTION SHUTTLE.

We now proceed to the explanation of that device, the essential features of which are represented in Fig. 2, where the shuttle is shown resting on its carriage, *o*. Motion is given to the carriage and through it to the shuttle by means of a stout band, *u*, which passes over grooved pulleys fixed to the ends of the lay and communicating with a single large pulley underneath the loom, to which, by special mechanism hereafter to be described, the proper movement is imparted. The wheels, 2, of the carriage are pivoted to the ends of short horizontal arms; the wheels, 3, are simply journaled in the carriage. The weight of the latter, therefore, rests on the pivots of wheels, 3; and as these rest on the tops of wheels, 2, it follows that they must receive a counter motion in the direction of the arrows marked on them, exactly equal to the motion of wheels, 2, which is likewise equal to the motion of the carriage along the raceway, *l*. Now suppose a sheet of parallel threads to be stretched above this carriage and beneath the shuttle, *p*. The only points where these threads will be in contact with carriage and shuttle are obviously between the wheels, 3, of the former, and wheels, 4, of the latter. If we move the carriage so that the wheels, 2, revolve to the left, wheels, 3, will rotate to the right; and supposing the shuttle removed, it is clear that, while the threads are successively raised as wheels, 3, pass under them, the rotation of said wheels precludes any lateral movement on their part. It is easy to see that the laying of the shuttle in place above the carriage will in no wise affect this result, because the wheels, 3, rotate the wheels, 4, at precisely the same speed; so that the successive threads, for the inappreciable instant of time during which they are between shuttle and carriage, sustain no disarrangement from their normal position beyond the very slight elevation, a small fraction of an inch, caused by wheels, 3. This clearly imposes no strain, while a moment's consideration of the mechanics of the device will show that friction on the threads is practically nothing, being applied at the mere line formed at the place of contact of two rolling bodies, and this never twice at the same points considered in horizontal succession from thread to thread, because the sheds are constantly alternating and constantly being moved bodily away as the weaving progresses. The wheels, 5, do not engage with the wheels, 4, but roll along the under surface of a beveled rail, holding the shuttle down to its work. The shuttle is dovetail in section, and, when in place with its carriage, can only be removed by drawing it out at the end of the lay.

THE LOOM MECHANISM.

The ingenuity and beauty of the device above described alone would be amply sufficient to secure prompt recognition of its surpassing value; but the inventor has grouped about this chief feature of his invention a wealth of novel movements and mechanical combinations, which are also well worthy of notice. Everything is positive; and when we state that cams are abolished and the crank everywhere substituted, we perhaps sum up all in the fewest words.

The two diagrams, Figs. 3 and 4, will serve to convey an idea of two of the most important devices out of several for effecting similar purposes. It is necessary in many cases to produce a dwell or period of rest, either in the shuttle or the lay. In the one case the shuttle stops sufficiently long at the end of its run to allow of the lay being beaten; in the other, the lay delays its beat sufficiently for the shuttle to make its journey. The dwell in the lay is necessary in making heavy goods. In all cases it is a great desideratum to have the motion of the shuttle swiftest midway in its course, and gentle at the ends; and one way in which this is accomplished is shown in Fig. 3, where A is a crank disk, from which motion is imparted by a connecting rod, B, to a sliding block in the slotted vibrating arm, C. D is a link attached to the sliding block and pivoted to the frame. Arm C, carries, as shown, the wheel, actuates the shuttle band, and is itself rotated by a rack and pinion device, clearly represented. When the crank disk starts from the position exhibited (the shuttle being at the end of the race), the sliding block is at the upper end of the slot in arm, C. Hence the arm, and consequently the shuttle, is given very slow motion. But as one end of the connecting rod is carried up the disk, its other end causes the sliding block to descend to the arm, the wheel on the outer extremity of which, therefore, constantly receives an accelerated motion, which is most rapid when the shuttle is midway in its course, and gradually in the same manner decreases until the pick is made. The shuttle is never returned until the lay is got home; so that on matter what the position of the shuttle is to the race when the loom is stopped, on starting again the first thing done is to draw it out of the way of the lay.

Dwell in the lay, an obvious necessity when the shuttle, in weaving wide fabrics, has to travel a very long distance, is obtained by the device shown in Fig. 4. A is a slotted pulley wheel, in the slot of which is a sliding block, to which is attached the crank of the shaft, B, which imparts motion to the lay. The crank wrist is eccentric to the pulley; and as the latter revolves, it moves radially in the slot. Consequently when nearest the center it imparts an extremely slow or no motion to the shaft, B, and a quick movement when it has traveled out toward the circumference.

THE EXHIBIT AT THE CENTENNIAL.

Without dwelling further upon the general features of the invention, we may pass to some of its practical applications as exhibited in the magnificent display made by Messrs J. & W. Lyall at the Centennial. The five great looms (taken from the factory in West 23d street, New York city) are located in a commanding position in Machinery Hall, and are represented in the superb engraving which occupies our initial page. These we shall consider briefly in their order, pointing out their several merits and capabilities. To the left of the enclosed space is seen the largest loom in the world, a physical embodiment of the fact, which the reader has doubtless, ere this, divined, that the width of fabric which can be woven by the Lyall loom is unlimited. Weaving wide fabrics, such as oilcloth foundations, by the hand loom hitherto has been a most arduous undertaking; three men were required, one at each end, to drive the shuttle with heavy hammers, a third to stand between them and aid them in beating the lay. It was labor of the severest sort, and those engaged in it became prematurely old. Contrast this with the colossal machine which scarcely requires the attention of the single young girl in front of it. Imagine a fabric woven 8 yards wide and 40 yards long in ten hours, 320 square yards of cloth in a single day. Ten such looms could make enough material to cover the enormous area of Machinery Hall in less than three weeks. The huge shuttle travels 31 feet at every throw, and its journey is completed 35 times in a minute. No need of a mechanical counter for the machine itself at the Exposition. It is only necessary to watch the involuntary motion of heads and eyes of those who stand in wonderment before the loom, as, like so many Chinese dolls, they gravely wag their craniums from side to side in time with the shuttle. The great loom is made in two yard sections, in other words, the lay is really beaten up in four places at once. This gives all the strength of fabric which would be imparted by four narrow looms placed side by side. The back beams are sections of 1 yard each, so that they can be made on an ordinary warping machine. In the loom they are united in one by male and female clutches. There is a dwell, of course, in the lay to accommodate the shuttle.

No one can witness the operation of this great apparatus, nor indeed of any of the others below described, without being impressed with the ease and grace with which the shuttle operates. There is no breaking of the yarn, no constant stopping for repairs, but perfect smoothness in every motion. We can readily believe the manufacturers' statement that the loom will weave shoddy almost too weak to stand its own weight, or filaments like cobwebs in their delicacy and fineness. Huge looms similar to that at the Centennial are now weaving all the oilcloth foundation that is made in the United States, and have stopped our

importation of that fabric from Scotland, where it was manufactured by the laborious method already described.

The three machines, represented in our engraving on the side of the enclosure opposite to the great loom, are, first, the bag loom, in the foreground; second, a ten-quarter cotton loom; and third, a heavy jute carpet loom—three admirable exemplifications of the wonderful capabilities of the invention.

THE BAG LOOM

weaves four seamless bags with one mechanism. There are four shuttles connected by rods in the single raceway; and they are caused to travel so that each, in passing to one side or the other, fills the place formerly occupied by its neighbor. The bottom of the bag is closed in the loom, so that, as the bags are woven, it is merely necessary to cut them apart. The weaver is, besides, enabled to examine both sides of her work, and thus the holes and defects in the under sides of the bags, which in some other looms cannot be examined, are avoided, and a perfect fabric produced. The machine travels at the rate of about 120 picks per minute, and in construction it is mechanically beautiful. That it must eventually supersede other methods of bag weaving seems to us merely a question of time.

THE CARPET LOOM,

in the distance, has a large cop in its shuttle to make heavy jute striped carpet. Its running is the perfection of ease. It makes 110 picks per minute, or about 100 yards of carpeting per day.

THE TEN QUARTER COTTON LOOM

is exhibited at the Exposition weaving unbleached sheeting for the well known New York Mills, of Utica, N. Y. The fabric produced is pronounced by competent judges to be unexcelled in point of fineness and level. One girl can attend three machines with ease. The speed is about 94 picks per minute. In this loom are embodied some most ingenious new mechanical devices, in the shape of compound let off motion, variable dwell crank, thin place protector, etc. It is a piece of mechanism well worthy of study in its every part, and its value may be estimated from the fact that the type which it represents has been adopted by the leading mills of the country, those above named and the Wamsutta Mills, of New Bedford, Mass., and many others.

We leave for the last the description of a machine which, were all we have already alluded to blotted out of existence, would still be sufficient to ensure for its inventor a world-wide fame. We refer to

THE CORSET LOOM,

represented in the center of the illustration. It is a marvelous combination of the positive motion and power loom with the Jaqcuard apparatus, an embodiment of the three greatest inventions ever made in the weaver's art. Four webs of corset are woven at once, in perfect form, all precisely similar and yet possessing every gore, every gusset, every welt formerly laboriously put in by hand work. Five corsets per day was the extent of the labor of the German weaver; this wonderful invention makes eighty-four in infinitely superior manner in the same period of time. The Jacquard cards govern the quantity of warp to be kept in action, so that, when for instance the parts which fit about the protruding portions of the body are to be made, only a certain portion of the warp is kept in play, and through this only the weft passes. As the shuttle then does not pass through the whole warp, but over a portion of it, it would necessarily seem that a slack loop of weft, corresponding to that portion in length, would be left. This is provided for by a let-off device in the shuttle, so that the thread, passing to and fro (after leaving the bobbin) several times between extended leaf springs, is always held taut, and thus only the exact amount required for the pick is allowed to escape.

This machine lies at the foundation of a great industry which has already achieved a fair footing.

THE POSITIVE ADVANTAGES OF THE POSITIVE LOOM.

Thus far we have indicated the immense value of the Lyall loom principally negatively, by showing wherein older devices have failed; it remains now to sum up, in brief terms the advantages which the invention secures, and these are: First, the abolition of the picking sticks; second, a positive motion to the shuttle from any point in its course; third, the unlimited width of the fabric which may be woven; fourth, the unlimited variety of fabrics which may be produced, from the finest silk to the heaviest carpet, from jute oil cloth foundation to exquisite woven embroideries; fifth, the almost total absence of wear, through the small motion of the reed which thus wears but little on the warps, through the small opening of the heddles which thus offer less strain on the same, through the absence of friction of the shuttle on the yarns, and the non-subjection of the weft to sudden pulls on starting; and sixth, the extremely small amount of power required to operate the looms. We saw the huge 8 yard machine, driven by a 3½ inch belt, and easily worked by hand power exerted on the gearing. We were told that it required but half a horse power for its operation. We saw, furthermore, that, as the great engine at the Exhibition slackened and stopped at noon, the looms continued weaving until their momentum gradually succumbed

We can add no better conclusion than by repeating the opinion we expressed regarding the invention shortly after its first appearance: "It is to the loom what the link motion is to locomotive engineering, or the compass to navigation. It substitutes certainty for uncertainty, and thus lays the foundations for future development in the textile arts hitherto unattainable. Radical in its character, it may be compared to the invention which placed the eye of the sewing machine needle at the point; and like that invention, it will in its proper field be likely to produce results impossible at present to estimate at their true value." Bold predictions, many pronounced these when we uttered them; but that they are fulfilled even in greater measure than we anticipated, the whole weaving industry of the country will bear us witness. That there has been no corresponding advance in weaving since the application of power to the loom may confidently be asserted; that within late years no invention in any field has exceeded this in importance and value to humanity is likewise truth. It will pass to posterity as one of the great triumphs of American inventive genius, as the peer of the grand accomplishments of Watt and of Arkwright, of Whitney and of Jacquard.

Correspondence.

The Weight of a Body in a Hollow Sphere.

To the Editor of the Scientific American:

Your correspondent, whose communication appears on page 84, seems surprised to find that the "body in a hollow sphere doctrine" is endorsed by Professor Young He will probably, upon inquiry, find that not only Professor Young, but every professor of standing in the scientific world endorses it, and none have ever repudiated it. It was first demonstrated by Sir Isaac Newton, and mathematical demonstrations are not easily set aside.

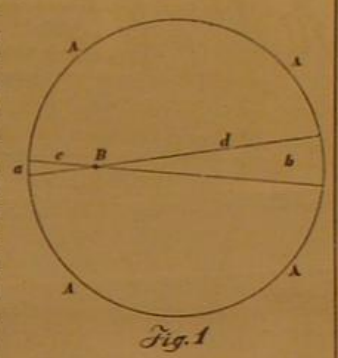


Fig. 1

Let A represent the hollow sphere, and B the body placed within, say half way between the center and one side. Then let a represent a certain portion of the mass of the shell, which of course attracts B in that direction, and let b be the mass which is opposite to a, and attracts it in the other direction. Let c represent the distance of a, and d the distance of b. Now the attraction is inversely as the square of the distance; consequently the relative forces are as $\frac{a}{c^2}$ on the left, and $\frac{b}{d^2}$ on the right. But the force is also directly as the mass; and b, being farther off, is a greater area, and hence a greater mass (included within the angle), than a, and is just as much greater as the square of the distance, d, is greater than the square of the distance, c. That is, the mass, b, is to the mass, a, as d^2 is to c^2. Hence $b = \frac{a \times d^2}{c^2}$. Now in the expression of the force on the right, $\frac{b}{d^2}$, we will substitute for b its value $\frac{a\,d^2}{c^2}$; and we have: $\frac{a \times d^2}{c^2} \div d^2$ or $\frac{\frac{ad^2}{c^2}}{d^2}$. Now, cancelling d^2, which appears both as multiplier and divisor, we have $\frac{a}{c^2}$, just the same as on the left. It ought to be obvious to any one that the body, B, is attracted equally in both directions, and hence will be at rest as far as the portion of the mass, a, and all the mass exactly opposite, b, are concerned: also that the same will apply to every point of the sphere and to every position of the body, B. Hence "a body placed within a homogeneous hollow sphere of uniform thickness will, so far as the attraction of said sphere is concerned, remain at rest in any position."

Between this proposition and theother, given by Olmsted, that "a body lowered toward the center of the earth would lose in weight in proportion to its distance downward," there is no discrepancy whatever. Of course it is understood that he means this upon the supposition that the earth is homogeneous, leaving out of consideration the difference of density at different depths.

Let us take the case presented by your correspondent. A body upon the surface of the earth, at A, weighs, say, 24 lbs. If lowered to P, half way to the center, C, it passes ½ of the "mass," that is, it reaches a new circumference, P E F G, inside of which there remains but ¼ of the whole mass. Thus the whole ¾ outside of this line, farther from the center than the body at P, being neutral according to this theorem, P is still attracted toward C by the mass within, which is ¼ of the whole.

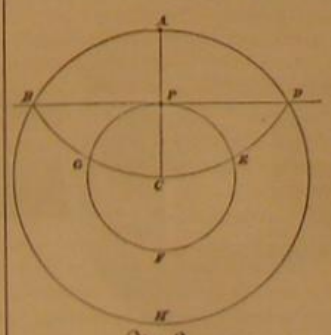


Fig. 2

But it does not follow, according to the "queer theorem," that it would weigh but ¼ as much as at A. Your correspondent has quite overlooked two considerations: 1. Masses attract each other with a force in inverse proportion to the square of the distance. 2. The distance from P to C being but one half from A to C, the attraction of the interior ¼ for the body at P is four times as great as that of the same ¼ when the body was at A twice as far from C.

Hence, the mass being ¼ as much, and the square of the distance four times less: $4 \times \frac{1}{4} = \frac{1}{1}$, and this is the amount of attraction at P.

One half of 24 is 12; so that, according to this "absurd theorem," the body weighing 24 lbs. at A will weigh 12 lbs. at P, half way down, just as your correspondent believes it would, in fact; and the old proposition does not "fall to the ground," but agrees exactly with the other.

Davenport, Iowa. W. H. PRATT.

Weight On and In the Earth.

To the Editor of the Scientific American.

With your permission I will show Mr. Whitman the error into which he falls in attempting to disprove the mathematically demonstrated "body in a hollow sphere doctrine." A careful study of his own diagram will prove that the external shell cannot exert any influence on the inclosed body. I will demonstrate it in the following simple manner: Let E, Fig. 1, be the shell of uniform density, C the center, B the body, and A D a diameter passing through C and B. Suppose the distance, A B = three times B D; it is plain that the body cannot depart from the line, A D, because we have equal masses at equal distances from the body on all sides of the line. It is also plain that it cannot approach A or D, being equally attracted in both directions. This last assertion I must prove: Imagine four lines passing through the center of B, and touching D at the four corners of a surface one inch square. If these lines are produced to A, they will touch A at the four corners of a surface three inches square. Produce these four lines through both sides of the shell; and the parts of the shell within the lines will be two masses, the one at A being nine times as great as the one at D. Now supposing the mass, A, to be divided into nine masses, each as great as the mass, D, each one of these small masses at A exerts ⅛ of the attraction on B that D exerts, because placed at 3 times the distance. The nine small masses at A then exactly counteract the attraction of the mass, D.

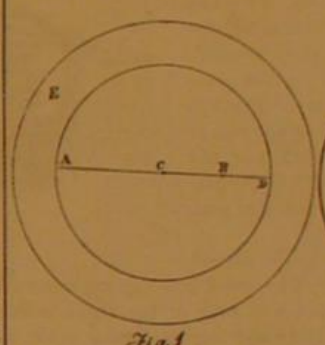


Fig. 1

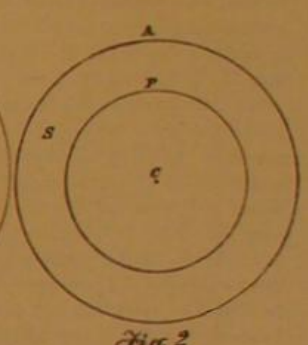


Fig. 2

I will now show why a body which weighs 24 lbs. at the surface of the earth will weigh 12 lbs. when lowered half way to the center: At A, Fig. 2, the body weighs 24 lbs.; remove the shell, S, and still keep the body at A, and it will weigh but 3 lbs., because attracted by a body ⅛ the size of the earth. Now place the body at P on the surface of the small sphere, and it will weigh four times 3 lbs., being at one half the distance from C, as when at A. Attraction does not vary in inverse proportion to the distance from the attracting body, but in inverse proportion to the square of the distance. JAMES M. PALIN.

Savannah, Ga.

Locomotives for Steep Grades.

Messrs. Copeland & Bacon, of this city, have constructed, under the supervision of Mr. Henry C. Walters, and from his designs, a locomotive for use on inclined railroads, and we have had the pleasure of observing its workings on an inclined track. The engine is worked by means of a strong wire rope which runs from one end of the track to the other, making several turns around two large drums on the engine, one above the other, the upper drum being connected with the steam power by means of a huge cog wheel. Six of these locomotives are to be built by Messrs. Copeland & Bacon for use on a couple of mountain roads—one near Salt Lake and the other near San Francisco. They are four miles long and very much curved, and do a freight and passenger business, connecting two other railroads with each other. The locomotive works finely, and can be stopped anywhere on the steep plane.—*Bridgeport Standard.*

A New Odontograph.

Professor S. W. Robinson, of the Illinois Industrial University, has devised a new and very simple odontograph for describing accurately and quickly, all kinds of gear teeth, such as epicycloidal in every form, involute, etc., without the aid of any other instrument. The device is a ready made scribe templet of flat brass, graduated and finished alike on both sides. By means of tables given once for all, it is properly set for the face or flank of a tooth; and by means of countersunk holes, it may be mounted by wood screws on a radius rod and swung round to position for each tooth of the wheel. The device may be examined at the Centennial Exposition in Machinery Hall, at B 10, column 77, and its theory will be found fully explained in No. 24 (just out) of the Science Series, published by D. Van Nostrand, 23 Murray street, N. Y.

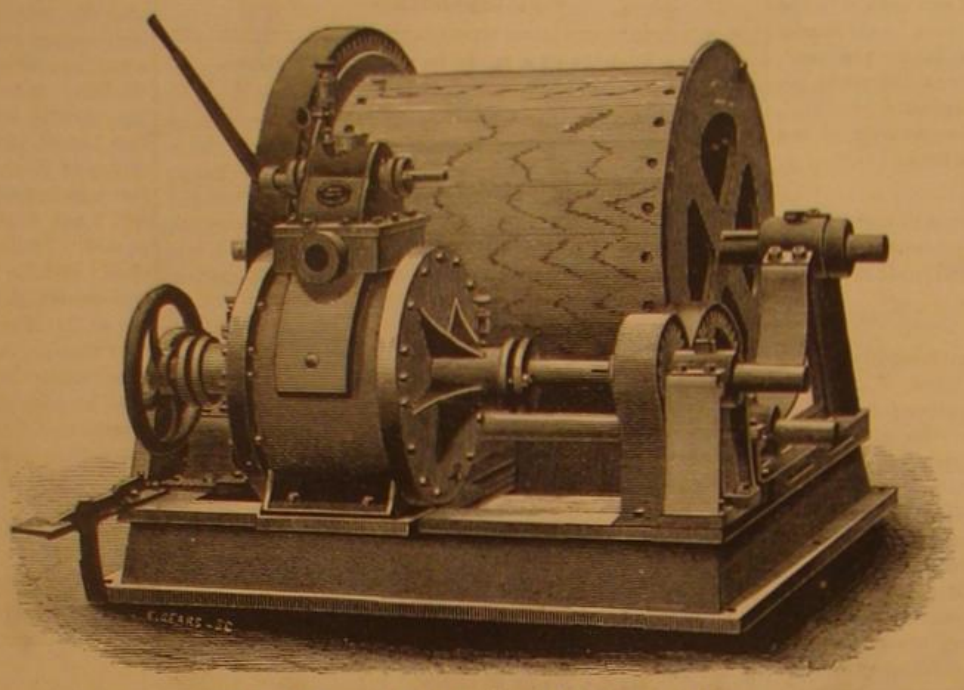
Falling Hair.

A correspondent of the *Medical and Surgical Reporter* asks: "What will prevent the falling of hair? I have used, for the past ten years, in my own case, and prescribed frequently for others, the following with complete satisfaction: Glycerin and tincture capsicum, each 2 ozs., oil of bergamot, 1 drachm; mix and perfume to suit. This is to be the only dressing for the hair. Wash the head occasionally with soft water and fine soap.

THE LIDGERWOOD ROTARY ENGINE AT THE EXHIBITION.

We have already explained the construction of this machine and some of its other forms, in previous issues. It is sufficient here to point out some of the advantages of the type illustrated, which is designed for hoisting in mines and quarries, and represents one of eight similar engines lately completed by the manufacturers for Messrs. L. B. McCable & Bro., of Baltimore, Md., for use in the permanent water supply tunnel of that city. The machines, being reversible, are each connected with two elevator platforms, one of which ascends while the other descends. They lift 6,000 lbs. with a single rope at a speed of 200 feet per minute, and at about 60 lbs. steam pressure. Larger sizes of the engine are capable of hoisting up to 7 tuns, at 250 feet per minute. There are no centers, and by manipulating the single lever the steam is made to hoist, lower, or hold the load.

Small hoisting engines of the Lidgerwood type are now in use on board steamers for raising coal, ashes, etc., and have found a wide utilization in quarries and along docks where cargoes are constantly handled. The portable engine and boiler, which is the third form in which the machine is constructed, is a very completely arranged apparatus, containing everything in the shape of necessary fittings, including a compact heater for the feed water. It is made self-propelling if desired. Still another form is the adaptation of the rotary engine to platform elevators, such as are used in hotels, warehouses, stores, etc. This has compound gearing, which runs noiselessly, and a brake on the flywheel for controlling the load, manipulated by the same lever that governs the engine. There is also a governor for regulating the rate of speed in hoisting or lowering, and the construction throughout renders the machine well adapted for the especial purpose for which it is built.



THE LIDGERWOOD ROTARY ENGINE.

All of the above forms may be seen at the Centennial Exposition. The small hoisting engines will be found at work raising ashes in each of the three boiler houses. Several other Lidgerwood engines are at work at the Centennial.

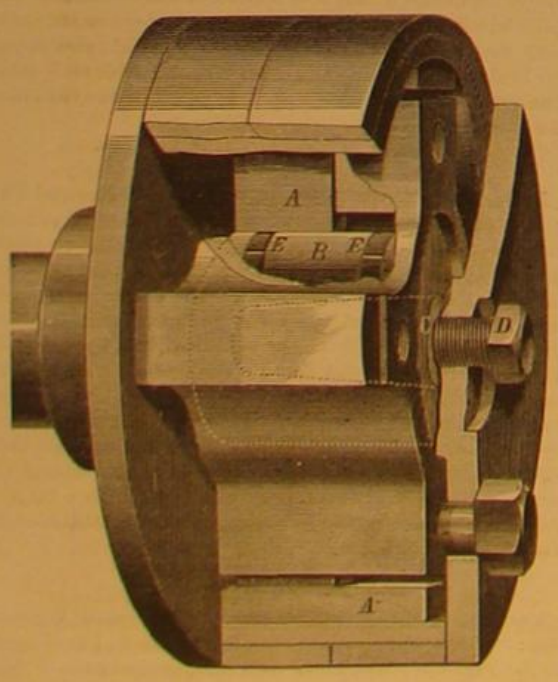
Another adaptation of the rotary engine, and one which has deservedly attracted considerable attention of late, is to the propulsion of small steam yachts or launches. We are informed that in this particular the Lidgerwood machine has attained considerable success. Nine boats, varying in length from 28 to 50 feet, have been fitted with the engine; and one, now in process of building, which is to be 42 feet long, with 6 feet beam, and 3 feet 6 inches depth of hold, is to be propelled at the speed of 12 miles per hour by a Lidgerwood engine equal to a 5x6 inch reciprocating machine.

Among the other advantages of the device, not yet noted, are its simplicity, it having but eight pieces exclusive of bolts, its smoothness and rapidity of action, the fact that its working parts are covered, the absence of brakes, except of course in the elevator engine, and its general utility for all purposes of hoisting or elevating.

Further particulars may be obtained by addressing the Lidgerwood Manufacturing Company (P. O. box 2,132), 165 Pearl street, New York city.

WOOD'S IMPROVED PISTON.

We illustrate herewith a universal expanding device for



the pistons of steam engines, which is capable of expanding the packing rings equally with a positive motion; so that, while the piston can be adjusted as desired, it acts, while working, like a solid piston. While, therefore, it can be regulated so as to take up the usual wear, it will not accommodate itself to the inequalities of the cylinder, nor wear more in one place than in another. A further advantage offered, as will be seen from the following description, is that the necessity of removing the follower in order to adjust the packing, is obviated.

At A are the followers, which slide in suitable ways in the piston head. B is a central core or cylinder, which is bored out conically, as indicated by the dotted lines, and which is provided with a conical plug, C, which is forced in by the screw, D. The core is made in segments held together by circular springs, E, placed in grooves on its exterior. The followers abut upon this core, and also have feet which press against the packing rings, so that, when the plug, C, is forced in by the screwdriver, the core is expanded, and the followers, driven outward, produce a uniform expansion of the rings. The piston rod, instead of passing through the head, is screwed into a boss cast on one side, of the head, and the plug, C, may be easily removed when desired.

Patent pending through the Scientific American Patent Agency. For further particulars address John Wood, Jr., Conshohocken, Pa.

BEDELL'S SEWER GAS TRAP.

We illustrate herewith a recent invention in a very important department of sanitary engineering, that which re

Fig.1

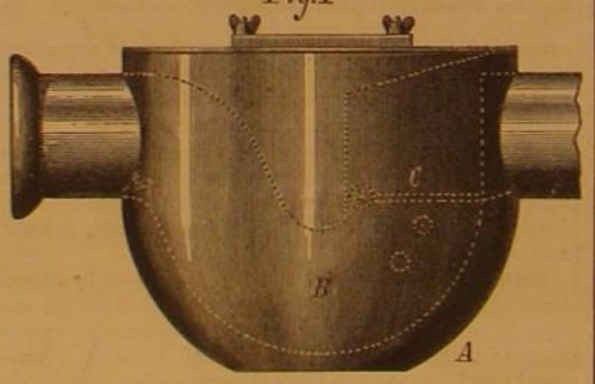
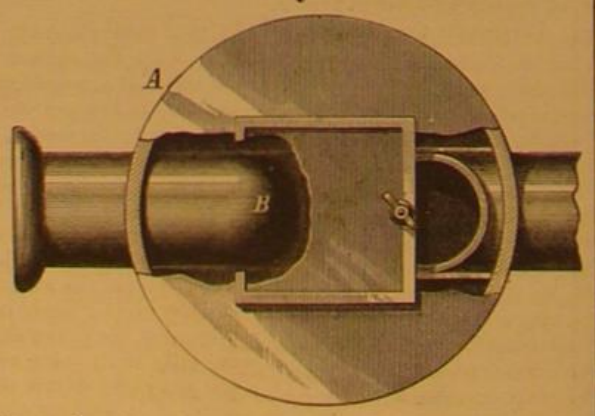


Fig.2



lates to house drainage. It consists of a terra cotta tank, A, 18 inches deep by some 16 inches in diameter by ¾ inch thick, inside of which is a U-shaped pipe, B, 6 inches in diameter, also made of terra cotta, the pipe and the tank being cast or molded in one piece. A little below the bottom of the outlet or discharge pipe, this siphon is closed by a copper valve, C, which, when down, is entirely under the water which fills the whole interior of the tank to a hight of some two inches above the valve. The tank again is sealed perfectly watertight, the cover being molded on the tank before it is baked, and the opening (shown in Fig. 2) closed by a thick plate of glass imbedded in putty and held down by thumbscrews. Around two sides of the valve, as shown in Fig. 1, are sheets of copper or tin, so that, when the valve is up, all connection with the tank is cut off, and the sewage thus prevented from entering the tank and forced to go out by the discharge pipe.

The action of the trap, then, is this: The matter to be discharged enters through the pipe, which is provided with a flange or lip, flows down the siphon, and lifts the copper valve, which, as it rises, cuts off, with the two copper sides placed at right angles to it, all connection with the tank, and forces the sewage to pass out through the discharge pipe. When the matter has passed out, the valve falls, closes the opening in the pipe, and thus the process known as siphoning, by which the water is so often drawn off from similar traps, and the gas from the sewer thus allowed to pass up through the house, is prevented. The gas which comes up the discharge pipe from the sewers can, by this arrangement, get no further than the tank, for the siphon is closed by the metallic valve lying two inches under water, and the tank is filled with water to a few inches of the cover, and hermetically sealed, and the small amount of gas that does find access to the tank cannot escape either by the pipe or the tank cover.

It is well known that a sewer gas trap, to be of any service whatsoever, must accomplish two things: it must render impossible the process known as siphoning, and must offer a mechanical resistance to the pressure of sewer gas, to prevent the gas being forced through the water. These two important features are claimed to be accomplished by the invention described. We are informed that the time required to set one in perfect working order is ten minutes.

For further particulars address the patentee, Mr. William Bedell, 985 Eighth avenue, New York city.

Sensible Assertion.

The Colorado *Farmer*, published at Denver, utters the following truthful sentiment: Now is the time when the intelligent and educated farmer is going to have the advantage over the one who does not keep himself posted. When times are good, any one who knows how to raise good crops makes money. But when the country seems to have too much of everything in it, the man who picks up the improvements first, and who has raised good big crops cheap, is the man for the times; and we have to say that no man of brains, who has taken up farming for a business, should quit it now; for he cannot sell out without loss, and the time is sure to come when he will do well.

HOSE ATTACHMENT FOR FAUCETS.

It has been well said that few great conflagrations have ever occurred which a pail of water would not have extinguished, had it been on hand at the proper time. There are so many causes of little fires which may easily grow into great ones, in every dwelling, that it is a good plan to have the needful pail of water, or its equivalent, always ready; but as filled pails are not handy articles to leave promiscuously about a house, especially where there are children, the ingenuity of inventors has been taxed to supply some other means for a prompt water supply. Such a device is that herewith illustrated, it being nothing more than a length of hose provided with a nozzle, as shown, and coupled to an enlarged portion of the ordinary basin faucet. The hose is long enough to lead to any part of the adjacent room or rooms; so that in case a coal falls out of the grate and sets the floor on fire, or a curtain blows out the gas flame, or a lamp upsets, or any similar accident occurs, it is not the work of a minute to lead out the hose, turn on the water, and at once play on the incipient blaze.



The device can be used wherever there is a water pressure whether derived from a tank on the roof or from the town mains. It will also be found useful for shampooing purposes. It is one of those simple yet handy little inventions which may often be the means of saving valuable property.

Patented July 18, 1876. For further particulars relative to sale of rights, etc., address the inventor, Mr. D. G. Trembley, 103 South Fourth street, Brooklyn, E. D., N. Y

A Master Piece of Mechanism.

There has been on exhibition for some days in the store of Bates & Sons, a Little Monitor sewing machine, made from gold and silver. It is the handiwork of James W. Du Laney, a son of the inventor, and speaks highly for his mechanical ability, taste, and good judgment. The machine was shipped to Philadelphia on Tuesday last. The plate, needle bar, lifters, foot bar, tensions, spool case, and some of the screws are of gold, while the other parts of the machine are of silver and white metal. Upon the bed plate is a neat model of the Little Monitor resting upon the water and surrounded by a wreath of laurels. The Monitor has two flag staffs with flags, and the design gives the entire machine an appearance of elegance and taste that will command much attention from the sight seers at the great show. The machine is in complete working order, well wrought, and proportioned as only a master hand at mechanics could do it.

The firm has now on exhibition at Philadelphia over a dozen machines of different patterns, some inlaid with ivory, others gold mounted, and all bearing testimony to the ability of their manufacturers. In a future issue we shall speak more fully of the machine, its inventor, and the manufactory.—*Rhinebeck Gazette of July* 20.

THE PEARLY ALOE.

One of the most ornamental of the large tribe aloes, numbering some 200 distinct species, is the *Haworthia subulata*, generally called *aloe margaritifera*, or pearly aloe, of which the annexed engraving is a representation. It has a very short stem, and leaves which are flat above and convex below; in short, triangular in shape and rounded towards the tip. The leaves are covered with a number of white, horny tubercles, which resemble pearls, and give the name to the species. The flowers are greenish, with whitish lobes marked with a green line, and are grouped together in a terminal spike. The beauty of this aloe, however, resides in the leaves, the flowers being, comparatively speaking, insignificant. It is by no means difficult to grow, nor any of the genus to which it belongs; the best soil for it, says J. C., in the English *Garden*, is a mixture of three parts loam and equal parts of leaf mold and sand, and it likes good drainage and partial shade in a cool greenhouse.



THE PEARLY ALOE.

Singular Property of Tomato Leaves.

"I planted a peach orchard," writes M. Siroy, of the Society of Horticulture, Valparaiso, "and the trees grew well and strongly. They had but just commenced to bud when they were invaded by the curculio (*pulgon*), which insects were followed, as frequently happens, by ants. Having cut some tomatoes, the idea occurred to me that, by placing some of the leaves around the trunks and branches of the peach trees, I might preserve them from the rays of the sun, which were very powerful.

"My surprise was great, upon the following day, to find the trees entirely free from their enemies, not one remaining, except here and there where a curled leaf prevented the tomato from exercising its influence. These leaves I carefully unrolled, placing upon them fresh ones from the tomato vine, with the result of banishing the last insect and enabling the trees to grow with luxuriance. Wishing to carry still further my experiment, I steeped in water some fresh leaves of the tomato, and sprinkled with this infusion other plants, roses, and oranges. In two days these were also free from the innumerable insects which covered them, and I felt sure that, had I used the same means with my melon patch, I should have met with the same result. I therefore deem it a duty I owe to the Society of Horticulture to make known this singular and useful property of the tomato leaves, which I discovered by the merest accident."

The Battle of the Gages.

A comparison of the weight and cost of a passenger train on the Eastern, standard gage, and on the Boston, Revere Beach, and Lynn Railroad, narrow gage, respectively, has been made. These two roads run nearly side by side and the carrying capacity of the two trains is practically the same. The heavy Pullman car is a disadvantage to the Eastern road in the comparison, as are also the baggage car, which is not required on the short line. A locomotive, baggage car, Pullman car, and four passenger cars on the Eastern road give capacity for 230 passengers, weigh 138 tuns, and cost $63,000; one locomotive and six passenger cars on the Revere Beach and Lynn road give capacity for 272 passengers, weigh 58 tuns, and cost $18,000.—*Engineering News.*

Railway Economy.

The long engine runs adopted last winter on the New York Central and Hudson River Railroad (engines go through between Buffalo and Albany, 300 miles) have resulted in a notable economy in locomotives, the company having been able to lay up 42 of its stock of engines, notwithstanding a large increase in traffic. There are other considerable economies effected by it, as in fuel (saving heating up, cleaning, switching, etc.); and the company is altogether satisfied of the wisdom of the change. It is not pleasant for the men, who are compelled to be away from their homes a much longer part of the time; but the economy is such that there is no prospect that the practice will be abandoned for the old one.—*Railroad Gazette.*

Construction and Maintenance of Public Highways.

The Association of Sanitary Surveyors, of London, the other day, at their late conference, discussed the question of road making, but the several bearings of the question were left unsolved. Mr. E. B. Ellice Clark, C.E., the Borough Surveyor of Derby, read an exhaustive paper on the subject, in which he advocated, for macadamised roads, a rough paved foundation, with center channels, instead of side water tables. He also suggested a paving of all streets now macadamised; and stated that granite, wood, and asphalt were severally adapted for varying kinds of roadways—namely, granite for roads where heavy traffic has to be considered, and where noise is not a material objection; wood where quietness is an essential condition; and asphalt in cases where these necessaries have to be combined, and where flat gradients and facility of cleansing can be secured.

We may learn of the old Romans the art of forming a good foundation. Large stones were first laid—in fact, a pavement was formed over the surface by by hand, the largest faces being placed downwards, the deepest stones occupying the central part of the road, to bear the heaviest traffic. This pavement of flat stones distributed the pressure; and the principle should never, it appears to us, be lost sight of in road making. The great secret in a good foundation is to distribute the weight over a large area of ground. Speaking on this subject, Mr. Ellice Clark says: "I think it might be laid down as a rule that the harder the bottom of a road is the better, whether for wood, asphalt, granite, or broken stone; and if you do not start with this initial, you will never have a sound roadway." We agree with Mr. Clark in thinking a solid hard substratum a requisite, instead of, as generally, dry core or cinder, devoid of the essential qualities of compactness and stiffness. This may be concrete—in fact, a concrete bottom seems to be the *beau ideal* foundation, though we are not necessarily compelled to resort to a metalling of the most adamantine rigidity. The truth is there is an essential difference between the hardness necessary for roads and the metallic inelasticity some road constructors advocate. Leaving the subject of foundation, we next come to the formation and the materials of the road itself. Here greater diversity of opinion exists. The battle of paving materials has been long waged, and stone, granite, asphalt, and wood have by turns enlisted the public favor. There are a great many strenuous supporters of paving, and we are told that the Manchester streets are examples of the endurance of granite sets. Of course the kind of traffic, whether heavy or light must be considered in coming to a conclusion. It is shown that Moorgate street, with a daily traffic of 7,400 vehicles, costs 33 cents per square yard per year to pave and maintain. Mr. Clarke estimates a saving of $250 a year for cleansing a street of about 3,000 square yards in area if paved instead of macadamized. Allowing $65 per yard, including concrete, as the original cost, the total cost per annum for maintenance is a little over 20 cents per yard, if we allow 8 cents per yard annually for this item. In the annual saving of cleansing, a paved road has by far the greater advantage, and we may therefore at once admit the merits of paving over macadam. The same authority says, *ceteris paribus*, "it is cheaper to pave a roadway having a traffic of 1,000 vehicles per diem over its surface than to macadamize it, and this would be the minimum number to commence paving with."

SUCCESS OF WOOD PAVEMENTS IN LONDON.

As regards paving materials, Mr. William Heywood, the City of London engineer, whose experience may entitle him to be considered an authority, says, speaking of the relative merits of asphalt and wood, asphalt is "the smoothest, driest, and cleanest paving, but wood the most quiet." As regards cleansing, wood is more difficult and expensive to cleanse than asphalt; and as both require occasional strewing with sand or gravel, there is not much difference in this respect. As regards repair both asphalt and wood can be laid and repaired with equal facility; but wood is superior to asphalt as regards safety, whether considered in reference to the distance a horse can travel before it meets with an accident, the nature of the accident, the facility with which a horse can recover its footing, the speed at which travel is safe, or the gradient at which it can be laid. As to durability and cost, it is shown that in the city wood pavements have a life varying from 6 to 19 years, 10 being an average life with repairs, that the durability of asphalts is not known, but that wood is dearest if we contrast the tenders received for laying and maintaining for a term of years. Again, referring to the safety of the materials, Mr. Heywood reports that a horse can travel 132 miles before a fall takes place on granite, 191 miles on asphalt, and 446 miles on wood. These approximate figures are deduced from observations in the London streets. From the above conclusions there is an overwhelming balance in favor of wood, though granite has its admirers. Mr. Clark thinks that, where there are few shops, and noise is not objectionable, granite is the cheapest and best material; but that in streets of business where absence of noise is a desideratum, preserved wood paving is the best, though expensive. Asphalt, with iron studs on the surface, as used by the Val de Travers Company, is, as Mr. Clark says, objectionable: though we should like to see a combination of wood and asphalt. The Derby surveyor consequently recommends for some of the streets of that town granite pitchers 5 inches by 3 inches, and for others creosoted wood. The experience of London has certainly gone to show us that wood paving is not only less dangerous and less injurious to health than granite, but also more durable than some of the asphalts. The noise of granite paving is unbearable. The objections raised against wood are the absorption of putrescent matter in the fibers, the permeability and splitting of the blocks, and the consequent undermining of the foundation. These are hardly supported by experience. Mr Deacon, the Liverpool engineer, observes that the wear is very small. Among the different kinds of wood pavement, the "Ligno-Mineral Wood Pavement," laid in Gracechurch street—Mowlem & Co.'s method—the "Asphaltic Wood Pavement," and the "Improved Wood Pavement," may be considered among the most desirable. In most of these the blocks, about 9 inches long by 3 inches wide, and 6 inches deep, are filled between with a quantity of lime and gravel, or liquid tar, or asphalt, and the grain of the wood is disposed crosswise to the surface of wear. In all cases it is desirable to saturate the blocks with oils, as in the ligno-mineral process, or to creosote them. Mr. Clark refers to some pavement at Sunderland, where creosoted Baltic red wood was tried, and which required no repairs for five years. Perhaps we may cite the "Improved Wood Pavement," now being laid in various parts of London. Two layers of inch boards, creosoted, laid transversely and longitudinally, are placed on the foundation. Upon this the blocks are placed, kept apart by strips nailed to the flooring.

NICHOLSON SYSTEM.

These joints are then filled in or rammed in with fine ballast, run with liquid tar, the surface of the road being strewn with fine gravel. An elastic foundation is given by this plan of boarded flooring, tending to distribute the pressure, and reducing the wear of the blocks. The ligno-mineral and Carey's wood pavement are laid on a concrete foundation and on a bed of ballast or sand. In the first case the blocks are sawn at an angle of about 60°, the object being to expose the fiber obliquely to the wear. The angles of each course are reversed. Henson's pavement has been tried in America with some success. The great merit of all these pavements is their elasticity.—*The Building News.*

NEW AND CURIOUS ELECTRICAL EXPERIMENTS.

A new treatise on statical electricity has recently been published in France by M. Mascart, in which the author has collected a large number of the most curious, striking, and novel electrical experiments. Many of these have but recently been devised, and hence among the engravings, given herewith and taken from the above named work, our readers will doubtless find much that is new and interesting. The name of

ROUSSEAU'S DIAGOMETER

has been given to the apparatus represented in Fig. 1. The difference in the conductibility of two different liquids, or, in other terms, the time necessary for electric propagation across two identical masses of two such liquids, may serve



Fig. 1.—Rousseau's diagometer.

as a distinguishing characteristic. Supposing, for example, it were required to determine the degree of purity of olive oil, which, for commercial purposes, is frequently adulterated with peanut and other cheap oils The electric conductibility of the suspected material would be compared with that of oil known to be pure. The least portion of foreign oil alters this conductibility in marked degree, so that here is a novel application of physics to the detection of adulterations, a work ordinarily within the domain of analytical chemistry.

The liquid to be tested is placed in a metallic capsule, C, which rests on a disk connected with the needle, *a b*, mova ble on a central pivot. One of the extremities, *b*, of the needle traverses a dial; the other carries a small disk which, when in neutral state, rests very near the rod, A, connected to the wire, E D. A battery, P N, transmits, by the pole, P, through the isolated rod, T, and the capsule, an electric discharge into the two balls, A *a*. The time is then noted, necessary to obtain a maximum deviation under, for example, the following conditions: 1. The capsule being filled with pure olive oil, a deviation of 40′ is observed. 2. Filled with peanut oil, 25′′ is noted. 3. Filled with a mixture of the two oils, the deviation is 20′. Now a simple calculation, based on the fact, previously determined, that the conductibility of the mixture is the mean of that of its constituents, shows the measure of the fraud to be in the sample $\frac{1}{10}$. The battery used is a dry pile, that is to say, a voltaic pile formed by bodies containing little humidity, and between which the chemical action is quite weak, in order that the apparatus may retain an invariable electrical status for as long as possible. M. Rousseau suggests a battery formed of double disks of zinc and Dutch metal, between which is a mixture of peanut oil and turpentine in equal parts.

GAUGAIN'S ELECTRIC VALVE.

In Fig. 2 is represented a singular phenomenon yet ur explained. If within an egg-shaped glass globe, of form as shown, the air be rarefied by an air pump, and if between the two balls placed within a spark be caused by means of an induction coil, the following will be observed: When the positive pole is attached to the lower ball, and the negative pole to the upper one, or inversely, a galvanometer interposed in the circuit shows a constantly increasing deviation in proportion as the air in the globe is rarefied. This fact is explained by admitting that, of the two inverse currents simultaneously produced by the coil, one has always a greater tension than the other, and natu rally it is the stronger which constantly produces an effect. Thus far there is nothing remarkable; but if now the lower ball be varnished, so that of its surface only a small conducting space be left, it will be observed that, for a determinate pressure of the surrounding air, the current transmitted between the two balls has always the same direction, wherever may be the points of attachment of the poles of the coil. The varnished ball seems to fulfil a part similar to that of a valve in a water or air pipe, when



Fig. 2.—Electric valve.

so arranged as to allow the flow to pass but in a single direction.

VARIOUS FIGURES OF THE ELECTRIC DISCHARGE.

Faraday distinguished four forms of the figures or conditions assumed by the electric discharge: 1. The spark. 2. The feather. 3. The lambent illumination. 4. The obscure discharge. The spark is the fiery offshoot which leaps between two unequally charged conductors. It becomes thinner as the explosive distance augments, while keeping its brilliancy at the extremities. Fig. 3 represents the spark obtained between the conductor of an electric machine and the edge of a metal plate in communication with the soil. Beyond a certain distance from the point of emission, the spark no longer traverses a right line, but is formed of a succession of zigzags. Fig. 4 represents such a discharge at the distance of from 5·8 to 9·7 inches. If the distance is increased, the form becomes complicated, and lateral ramifying offshoots from the angles of the zigzag are thrown out, as shown in Fig. 5.

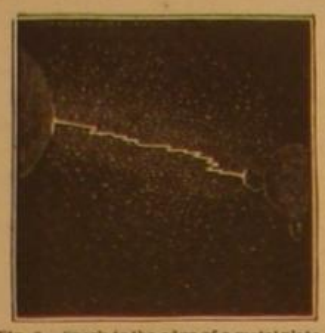


Fig. 3.—Spark to the edge of a metal plate.

When an electric machine acts in a dark chamber, luminous feathers or *aigrettes* escape from the salient parts of the conductors with a dull sound analogous to that of a puff of steam or air. These *aigrettes* are generally formed of a quite brilliant stem which suddenly splits into a large number, of less vivid violet hue. The branches in turn ramify and finally melt into darkness. Beautiful *aigrettes* may be produced by holding a metallic plate at a distance from the conductor a little exceeding that required



Fig. 4.—A seven inch spark.

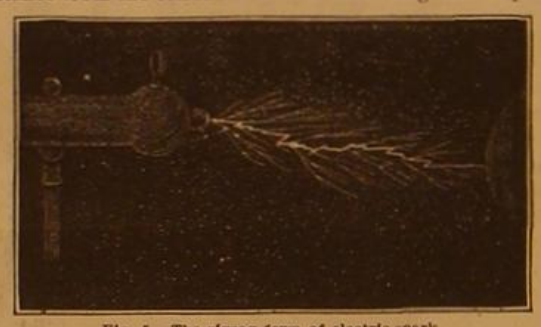


Fig. 5.—The zigzag form of electric spark.

to make the zigzag spark, and by terminating the conductor with a small ball. Fig. 6 represents an *aigrette* obtained at

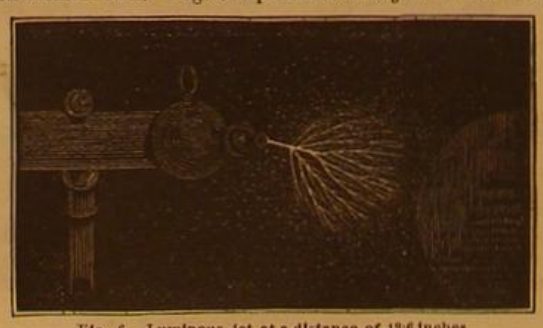


Fig. 6.—Luminous jet at a distance of 13·6 inches.

a distance of 13·6 inches. Under these conditions the edge of the disk becomes slightly luminous, although it is separated from the *aigrette* by a comparatively dark interval. *Aigrettes* may be still more clearly shown when the non isolated exterior conductor presents a large surface, as shown in Fig. 7.



Fig. 7.—Luminous jet toward a large surface.

It happens sometimes that an electric machine in activity presents, at the extremities of its conductors, especially when they terminate in small balls, a lambent illumination of variable brilliancy and extent, tranquil, continuous, and noiseless. Faraday has shown that in order to transform an *aigrette* into this species of discharge in ordinary air, it is necessary to diminish the dimensions of the conductor at the point of emission, to force the action of the

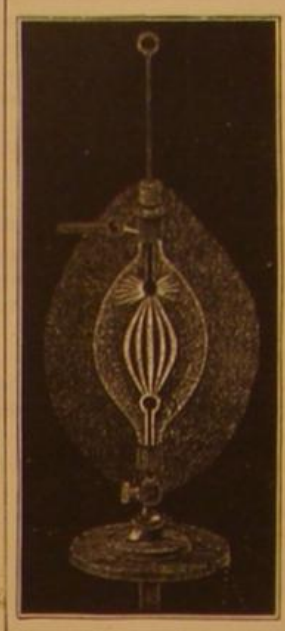


Fig. 8.—Electric egg in rarefied gas.

machine, and to remove all foreign bodies. The lambent discharges then appear to be the location of a continuous communication from the electricity to the surrounding air. In rarefied gases, the phenomenon is most striking. Under a vacuum of 2 to 3 inches in the apparatus known as the electric egg Fig. 8, there escapes from the upper ball, supposed to be positive, a multitude of purple bands, of which some are directed toward the sides of the globe, while others form a bundle of ribbons ending at the negative ball. At the same time the last mentioned ball and the rod which supports it are enveloped in a thick atmosphere of violet light.

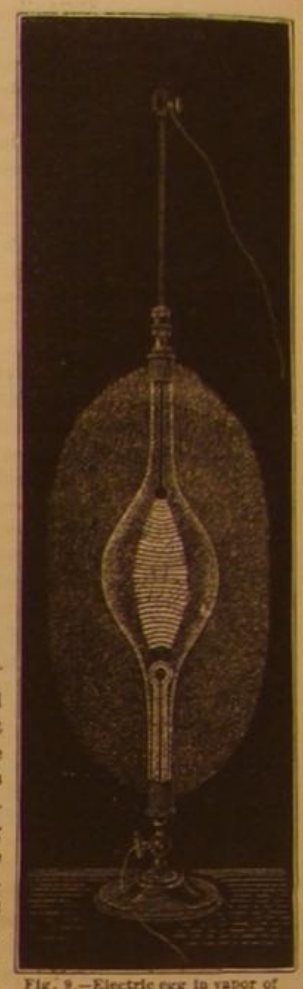


Fig. 9.—Electric egg in vapor of turpentine.

If the upper portion of the egg is connected with the conductor of a machine or terminated by a point which gives a continuous flow, the discharge is not propagated over any great distance. At the positive ball appears a faint purple light, and the negative ball is surrounded by a violet halo; but the illuminations are separated by a completely obscure interval. In this interval, however, a movement of the electric fluids occurs, and hence the phenomenon has been termed an obscure discharge.

STRATIFICATION OF THE ELECTRIC LIGHT

When vapors of alcohol, turpentine, etc., are introduced into the electric egg, previous to rarefying the air therein, and when through these the discharge is passed, the luminous emission becomes divided into strata separated by obscure bands, as shown in Fig. 9. This is produced in all tubes containing rarefied gas. The distance and brilliancy of the strata depends on the nature and pressure of the gas, the dimensions of the tubes, and the energy of the discharges. They are more marked with a bright light and narrow tubes. The explanation of the phenomenon is not yet definitely known

COMPOSITION OF THE ELECTRIC LIGHT.

We terminate the present series of illustrations with Fig. 10, representing the spectrum of an electric spark passing

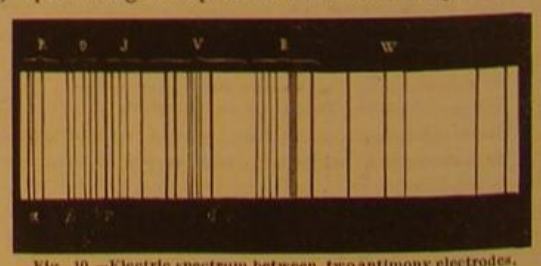


Fig. 10.—Electric spectrum between two antimony electrodes.

between two electrodes of antimony. It is the characteristic spectrum of that metal, showing the rays α, β, γ, δ, in the situations indicated between the red and the green. After a number of experiments upon spectra electric sparks, similar to others, M. Masson has reached the conclusion that the constitution of electric spectra is, for a like substance employed as poles, independent of the electric source and of the medium to which the spark passes.

To Clean Plate.—Take an ounce each of cream of tartar, muriate of soda, and alum, and boil in a gallon or more of water. After the plate is taken out and rubbed dry, it puts on a beautiful and silvery whiteness. Powdered magnesia may be used dry for articles slightly tarnished, but if very dirty it must be used wet and then dry.

PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

We give, below, brief abstracts of the papers read at the meeting of the above named society, recently held at Buffalo, N. Y.

Professor Burt G. Wilder, in a paper entitled

NOTES ON NORTH AMERICAN GANOIDS,

called attention to two pairs of serrated cartilaginous appendages of skin on each side of the hyoid arch of the mud fish. These are too flexible to serve as offensive weapons; and as their function is not known, it was suggested that they be studied in the young fish. Dr. Newberry, in the discussion following the reading of the paper, considered that the parts were remnants of an armor fully developed in the progenitors of the species.

Professor Thomas Meehan took positive ground in an essay on the

FERTILIZATION OF FLOWERS,

against the theory that plants, as a general thing, abhor close breeding, and that all flowers with color, fragrance, and sweet odors can only be fertilized by insect agency. He stated that the flowers of the black cap and other raspberries, which have neither color nor fragrance, are remarkably attractive to insects: and yet the flowers produce raspberries just as well under gauze bags, when the insects are excluded. He summed up his conclusions in the following propositions: First. Cross fertilization by insect agency exists, but not nearly to the extent claimed for it. Second. Where it does exist, there is no evidence that it is of any material benefit to the race. Third. Difficulties in self-fertilization result from physiological disturbances that have no relation to the general welfare of plants as species.

Some interesting observations on the effects of temperature in changing the

INDEX OF REFRACTION IN SPECTROSCOPE PRISMS

were made by Professor T. C. Mendenhall. From experiments made with glass heated as high as 392° Fah., it was found that the change of the index of refraction in glass for 9° Fah. is 0·00003. This affords a new scale of comparison in cases where there are differences of temperature to be considered.

Professor C. A. Young described

A NEW ARRANGEMENT OF THE SPECTROSCOPE

for obtaining lines more conveniently separated, and thus facilitating observations of the velocity of the movements of heavenly bodies through the displacement of said lines. Having calculated the scale which this new arrangement required, he applied it to observations of the comparative speed of the sides of the sun, one of which is of course approaching us, while the other recedes, because of its revolution on its axis. These observations give an average for the motion of 123 miles per second. Calculation would give by mere theory this motion as 103; but the difference by spectroscopy is within the limits of error of observation.

Professor A. W. Wright added a note, giving the results of further investigation into the nature of the

ZODIACAL LIGHT.

Careful researches on his part had shown that the zodiacal spectrum varied but little, if at all, from the solar spectrum except in length, that difference being due to the fact that the former was a faint light. The line 577, which a previous observer had found in the zodiacal light, Professor Wright thought was due to an aurora present at the time of observation. The conclusion was that the zodiacal light must be that of the sun, probably reflected from numerous small meteoric bodies, revolving around that luminary.

THE FLYING LIZARDS OF AMERICA

was a brief essay by Professor O. C. Marsh, giving a description of the principal characteristics of American pterodactyls. The animal is only known through the labors of geologists.

It was found from the American specimens that there has been a misunderstanding about the pelvis of the animal. The ischia are found firmly coössified on the medial line, and the pelvis differs in other particulars from what had been supposed. The American specimens give a clear idea, such as was not previously attained, of the hind feet of the animal. The lower end of the tibia has a pulley-like articulation, similar to the bones of a bird. There are also at least two separate tarsal bones. There is also this remarkable circumstance. In the geological horizon where the pterodactyls are found in this country, all the birds discovered have teeth, and hence are unlike all other birds: while pterodactyls are found having no teeth, and hence unlike all other pterodactyls.

Professor S. W. Garman, of the Museum of Comparative Anatomy, at Cambridge, Mass., read a paper on the

COLORS OF ANIMALS.

Despite the popular notion that the chameleon and other animals can change their color at will, he says there is a want of scientific evidence in favor of the belief. Drawing up for consideration a schedule of animals in two groups of comparative brilliance and paleness, we find that light or darkness of habitat determine the colors as a whole. The amount of light in their surroundings is in inverse relation to the brilliance of color The dark colors are found in forests and on dark soils; the light colors on plains and snow. The bleaching process applies to the lower surface, to the ventral portions of animals by reflection. In the water the same is true, the rivers with muddy bottoms being peopled by dark forms; the brilliant colors are found in hot and sunny waters or transparent lakes. This was shown in a great variety of instances

Naval Items.

It is the intention of the navy department to put the steamers Alliance and Ranger in commission. The Alliance is of the same class as the Adams, which made such successful runs over the measured mile at League Island on August 14, the average speed for four runs being 11·3 knots, with 63·04 revolutions of the screw, developing 882 horse power. Better results would have been obtained had there been a greater depth of water on the course. On returning to her anchorage after completing the trial, she passed through 7½ fathoms of water, when the revolutions, with the same pressure of steam and same cut-off, increased to 68½, which would have given 11·6 knots.

NAVAL ENGINEER CORPS GAZETTE.

Passed Assistant Engineer L. R. Harvey detached from the United States steamer Pensacola, and to wait orders at San Francisco, Cal.

Passed Assistant Engineer J. F. Bingham detached from the Mare Island navy yard and ordered to the Pensacola.

Assistant Engineer W. H. Platt ordered to report for examination, preliminary to promotion.

Better Times at Hand.

On every side, evidences of a better state of business feeling prevails. Our merchants are confident of a good fall trade, and the fear that the coming winter will be an exceptionally severe one on our working people is being dispelled by many stable signs of brisk trade this autumn. Even in New England, where the business depression has been most disastrously felt, quite a number of large mills, silent for many months past, are starting into action and on full time, for the fall and winter. In our State, says the Philadelphia *Inquirer*, some of the furnaces, mills, and factories, shut up for over a year, have been reopened, and work has been or will be resumed very shortly. The reason of this is that prices have touched their lowest point and show signs of improvement. Stocks of goods have been reduced to the bare boards, or very near them; the products of the country have been unprecedented; and there is at last some encouragement to resume traffic with a prospect of profit, for that is the great business magnet. If our merchants and manufacturers can now resurrect the old-time commercial confidence, we may look for the dawn of better times very soon.

Tasteful Steel Plate Engraving.

We rarely seen more tasteful and novel designs for business cards, checks, letter headings, and similar work on steel than those produced by Messrs. John A. Lowell & Co., of Boston, Mass. By means of finely ruled lines, enclosed in simple yet handsome shields and like figures, effects of great beauty are produced at moderate cost. To manufacturers, bankers, merchants, and indeed all who take pride in handsome bill heads, checks, bonds, and stock and society certificates, we can recommend the artistic productions of the above firm.

NEW BOOKS AND PUBLICATIONS.

THE COMPLETE PRACTICAL MACHINIST, embracing Lathe Work, Vise Work, Drills and Drilling, Taps and Dies, Hardening and Tempering, the Making and Use of Tools, etc. Illustrated by 130 Engravings. By Joshua Rose. Sent free by mail on receipt of price, $2.50. Philadelphia, Pa.: Henry Carey Baird & Co., 810 Walnut street.

We have given to our readers so much practical information, on all branches of the art of producing the finest mechanical work in the most economical manner, from the pen of the author of this book, that any commendation here bestowed by us on the work would seem like egotism. The tens of thousands of skilled operatives who read these pages look regularly for some fresh instruction in manipulating tools, some new method of working out a mechanical idea, in our chapters on "Practical Mechanism;" and they are, we know well, seldom disappointed in their search. Mr. Rose justly says in his preface that the education of the machinist has not received its proper share of attention at the hands of authors who have written on mechanical subjects; and he has labored faithfully and skillfully to remedy this defect, and has produced a volume of condensed instruction, extracted from long experience in many countries, which could only be written by an engineer and mechanic of the highest skill, endowed with unusual facility in explaining and illustrating his meaning.

FILTH DISEASES AND THEIR PREVENTION. By John Simon, M. D., F. R. C. S., Chief Medical Officer of the Privy Council and of the Local Government Board of Great Britain. Price $1. Boston, Mass.: James Campbell, Publisher.

Mr. Simon's labors in the etiology of disease have been for many years regarded as the master work in sanitary science; and his reports are matters of worldwide importance, illustrating the causes and development of all the preventible diseases, which do not vary in different localities. His skill in investigation is worthily supplemented by a clear, concise, and methodical mode of explaining his views; and the thoroughness with which all his work is done gives it the highest value. The State Board of Health of Massachusetts have ordered this reprint of Mr. Simon's last essay to be published, and they state truly enough that, "if the practical suggestions made therein were acted on by all citizens, hundreds of lives now annually doomed to destruction would be saved, and the health and comfort of the people greatly increased." We shall shortly publish some extracts from this valuable document, which is one of the greatest importance to every government and people.

WOOD CONVERSION BY MACHINERY. By John Richards, M. E. London, England: J. & W. Rider, 14 Bartholomew Close.

The author of this book is a member of the firm of Richards, London, & Kelley, of Philadelphia, but has been for some time a resident of London. The essays which make up this volume have been published in the *Timber Trades Journal*; and they contain some valuable practical information on all branches of the subject. In the chapter on "patent monopoly in wood conversion," there is a boldly outspoken criticism on the action of the Patent Office in the notorious Woodbury planer case, which we commend to the attention of the woodworkers of this country. We shall probably recur to this volume again.

THE INTERCOLONIAL: an Historical Sketch of the Inception, Location, Construction, and Completion of the Line of Railway Uniting the Inland and Atlantic Provinces of the Dominion of Canada. By Sandford Fleming, C. E., Engineer in Chief of the Newfoundland, Intercolonial, and Canadian Pacific Railways. Montreal, P. Q.: Dawson Brothers, 159 St. James street.

This volume affords an excellent idea of the formidable difficulties encountered in the construction of the railway through the "wilderness," which, as the author truly says, "separated the Maritime from the Inland Provinces." The natural obstacles in the way were enormous, and they were conquered only by great courage and untiring patience; and the result is a railway which, "in all the essentials, has no superior."

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From August 1 to August 9, 1876, inclusive.

BOILER.—A. D. Brock, Washington, D. C.
BUFFING LEATHER, ETC.—J. E. Fisk, Salem, Mass.
CHILD'S CARRIAGE, ETC.—C. F. Tenney *et al.*, Baldwinville, Mass.
COOKING UTENSIL.—J. H. Weare *et al.*, Cincinnati, Ohio.
ELEVATOR.—H. K. Terry, Jersey City, N. J.
FISH JOINT, ETC.—R. Long, Pittsburgh, Pa.
GAS GENERATOR.—W. Maynard, New York city.
HYDRAULIC PROPELLER.—G. G. Caldwell, Baltimore, Md.
INDICATOR.—J. W. Thompson, Salem, Ohio.
MICROSCOPE.—J. Zentmayer, Philadelphia, Pa.
PAPER BOX, ETC.—S. Wheeler *et al.*, Albany, N. Y.
PAVEMENT.—J. Shillinger, New York city.
PIPE COUPLING.—H. Pennie, Brooklyn, N. Y.
POSTAGE STAMP, ETC.—L. H. G. Ehrhardt, Philadelphia, Pa.
PROPELLING POWER, ETC.—F. J. Bell (of Phila., Pa.). London, England
SASH PULLEY CASE, ETC.—W. T. Doremus, New York city.
SEPARATING LIQUIDS.—J. J. Thomas, Philadelphia, Pa.
SMOKELESS FURNACE.—J. W. Bonta, New Brighton, Pa.
TELEGRAPH CABLE, ETC.—W. Strickler, Lebanon, Pa.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED LOCOMOTIVE DRAFT PIPE.

Thomas Diffenbaugh, Danville, Ill.—This is an improvement in the draft or lifting pipe of locomotive and other high pressure engines that exhaust into the chimney, which draft pipe is commonly known to locomotive engineers as a petticoat pipe; and it consists in making the draft pipe in sections, and adjustable by lever connection with the cabin of the locomotive. The common practice at present is to close up the exhaust nozzles, which, when the engine is working at full stroke, are not large enough to allow the exhaust steam to escape freely into the smoke stack, thereby cramping the engine, as the steam cannot be exhausted quick enough. By making the draft pipe variable in size, the nozzles may be made larger than at present, and the pipe then be adjusted to the volume of the exhaust steam—larger when the engine is working at full stroke and exhausting a whole cylinder of steam, and smaller when cutting off and exhausting only part of the quantity, thereby allowing the engine to work with more freedom, and maintaining a sharp draft when required.

IMPROVED PISTON.

John Wood, Jr., Conshohocken, Pa.—This invention is a universal expanding device for the pistons of steam engines, capable of expanding the packing rings equally with a positive motion, so that, while the piston can be adjusted when desirable, it acts, while working, like a solid piston; and it consists in the combination of followers sliding in suitable radial ways in the piston head, with a central sectional core or cylinder, which is bored out conically, and is provided with a conical plug, which, when forced into the sectional core, by means of a screw placed in the piston head for that purpose, expands, forcing the followers against the packing rings. The advantages claimed are that, while the piston can be adjusted to take up the usual wear, it will accommodate itself to the inequalities in the cylinder, and will not wear more in one place than in another, as is the case with packing which adjusts itself. Another important advantage is that it obviates the necessity of removing the follower to adjust the packing.

IMPROVED PUMP VALVE.

Mrs. Charlotte Thomas, executrix of William H. Thomas, deceased, Sacramento, Cal.—The object of this invention is to provide an improved substitute for frappet valves whose hinged flap, or movable piece, is composed of leather. To this end, the invention relates particularly to the valved seat composed of hard metal and having a beveled rim, the improved valve having an annulus of soft metal secured in a suitable cavity, and the vertical guides for causing the valve to seat itself accurately, these elements being conjoined under a particular arrangement whereby the valve seats itself in the soft metal at each stroke, and always in the same place.

IMPROVED COMBINATION LOCK.

George Winter, Jacksonville, Va.—In this invention, the bolt is locked by a series of sliding dogs or tumblers provided with semicircular grooves to receive rotating pins, having semicylindrical posts adapted to fit in said grooves. When the pins are adjusted in one position, the dogs may be raised simultaneously out of the notches in the bolt, thus allowing the latter to be withdrawn into the case; but when adjusted in another position, the dogs are held locked, the semicylindrical portion of the pins in such case entering the grooves in the dogs. The position of the pins is indicated by a series of fingers inserted in the dogs, and pointing to numerals inscribed on the face of the lock.

IMPROVED HORSESHOE MACHINE.

John W. Chewning, Jr., Shadwell Depot, Va.—This invention relates to a novel construction of horseshoe machine; and it consists in the construction and arrangement of the devices for operating the swaging die and bending jaws, in the combination with the pivoted jaws of bending and guide rollers, in the construction and arrangement of the ejector for the swaged horseshoe, in the construction and arrangement of the knife for cutting off the section of the bar forming the horseshoe, and in the means for adjusting the length of said section.

IMPROVED SELF-DUMPING SCOW.

Philetus L. Murphy, New York city, assignor to himself and John A. Squires, same place.—This consists in a scow made in two parts, having the plane of division passing longitudinally through its center, the deck being inclined from the outer sides to the line of division. The parts connect with each other at one end by hinges, and at the other end by a rope, so that when said rope is released the weight of the load may force the parts apart, and thus dump the load automatically.

IMPROVED STONE-SAWING MACHINE.

James Pepler, Green Point, N. Y.—This invention consists in the arrangement of roller guides for the saws, which make it possible to make diagonal or straight cuts through a block, or to make both diagonal or straight cuts at one time in a block of stone. The operation may be described as follows: The block of marble or other stone to be sawn is placed on the support; and if it is to be worked up into monument shafts, the saws are arranged so that the rollers will guide and deflect them so that they will saw diagonally through the block. On turning the blocks over, the saws are arranged two in one socket or holder at one end, to bring them as near together as possible, to cut out the wedge between the shafts. The saws may be arranged so that part only will saw diagonally, or all may be adjusted to saw in that way.

IMPROVED NAIL PLATE FEEDER.

William H. Rittenhouse, Norristown, Pa.—In this invention, two spring nose pieces are employed instead of the one rigid one heretofore used, in order that, when the barrel is turning over on one of them, its weight and the pressure of the bearings will spring it, and so nip the plate that it will not feed while turning. The blank from which the nail is cut obliquely across has one edge longer than the other, necessarily; and as the reciprocal feed turns the long and the short edge up alternately, in ordinary nail plate feeders, high speed is not possible, because the moving knife lifts the plate from the bed knife when, in turning, the long edge is up. But in this device, when the short edge is up, and the nose piece made to spring and bind the plate, the moving knife will clear it every time, and there is no limit to the speed, so far as the feed is concerned.

IMPROVED RAILROAD RAIL JOINT.

Duncan C. Waddell and John F. Finger, Marion, S. C.—This invention consists of a chair that embraces the bottom and inner side of the rail, and is provided with a central standard or bearing piece, which comes between the ends of the rails when they are placed in the chair, and extends beyond the outside of the rail, where it is mortised to receive a split key, that rears against the web, the said key being retained by a wedge driven in the split. The device forms a rigid support for the ends of the rails. It may either be placed on the cross ties or between them. The bearing piece between the ends of the rails permits the wheels to pass over the joint without jarring or injuring the end of the rail.

IMPROVED SEWING MACHINE FOR EMBROIDERY.

Charles Marin, Newark, N. J., assignor to himself and Isidore Rosenthal, New York city.—This invention produces embroidery stitches of varying lengths at one side of the fabric only, and retains the embroidery stitches at the ends by fastening stitches that pass through the fabric at a considerable saving of thread. The machine is made in the nature of the sewing machine, and produces, by the parallel and angular disposition of the thread, flat or raised designs of any configuration, in a rapid, even, and perfect manner. It consists, essentially, of a reciprocating needle bar, with two adjustable needles, a slotted presser foot, a swinging and parallel feeder, and a shuttle that places the embroidery stitch n position for the fastening end stitches of the adjustable needles.

IMPROVED WHEEL TIRE.

George Cornwall, Garden City, N. Y.—This consists of a tire the essential part of which is rawhide. The hide is fitted on a metal hoop while in a soft state for fixing it in the required shape, and an elastic cushion of rubber is interposed between the hide and the metal band.

IMPROVED LUBRICATOR.

Joseph W. Reed, Kalamazoo, Mich.—This invention is a double automatic lubricator for steam cylinders of locomotives and other engines, by which one of the lubricators may be dispensed with; and it consists of a cup cast in one piece with fixed internal feed pipes, having regulating top nozzles and outer cocks for shutting off the steam. The casting of feed pipes and cup in one piece makes the cup cheaper, and without joints. The steam passes up the pipes from the steam cylinder, and condenses gradually in the cup, which, by the double condensation pipes, forces the oil up the nozzles and down the pipes as long as the engine is running. When the steam is shut off, the supply of oil is interrupted, being regularly continued when the steam is let on again.

IMPROVED WIND WHEEL.

Alfred M. Vanpelt, Capioma, Kan.—By suitable construction, as the wind blows against the forward sides of the fans, it presses them against the weights, and the weights support them against the wind, unless it be strong enough to raise the said weights, and thus take the fans out of the wind. By suitable adjustment, the wheel may be arranged to work with any desired power.

IMPROVED WATER WHEEL.

Samuel G. Marlin, Clarion, Pa.—This consists of a wheel composed of two disks placed side by side, each having buckets and issues, which are so adjusted that the buckets of one fit in the issues of the other, in such manner that, by adjusting one of the disks toward or from the other, the capacity of the issues may be raised to any extent, and may also be closed altogether, if required to serve for the gate.

IMPROVED WINCH.

Elias Sorrinson, West De Pere, Wis.—This consists of a common winch, whose crank shaft is placed by sliding pinions in connection with a second hoisting drum, and with rubber rollers for taking up the slack. It serves to hoist two or more sails at once.

IMPROVED TOOL FOR CAPPING AND UNCAPPING CARTRIDGES.

Isidoro Zamboni and Carlo Zamboni, Owatonna, Minn.—This is an improved device for removing the exploded cap from a cartridge shell for breech-loading shot guns, and recapping and reloading the shells.

IMPROVED LIFTING JACK.

Thomas J. Corn, Sni Mills, Mo., assignor to himself and James M. Faulk, same place.—This consists in making the parts of a lifting jack so that they may be folded compactly together for storage or transportation. When this is desired, the lever is removed and the standards are folded.

IMPROVED MIDDLINGS SEPARATOR

Jefferson Graham, Alden, Minn.—There is a vertically reciprocating shoe having screens, each clothed with finer and coarser numbers of bolting cloth; also a series of chutes, one set for delivering the purified middlings out of the machine, and the other for delivering the imperfectly separated matters upon the screen below. With the above, a blast fan is combined.

IMPROVED GLOVE-SEWING MACHINE.

Peter E. Gullrandsen and Johan C. Rettinger, Copenhagen, Denmark.—The object of this invention is to construct a glove-sewing machine on the revolving hook system, which produces with two threads a stepping and cross stich, that resembles and equals the best sewing done by hand, and makes the seams strong and durable. The device includes glove-feeding cups, reciprocating needle bar with tension devices, a rotating hook with bobbin and tension, and a compound mechanism for operating the cross stitching device. The horizontal actuating mechanism of the parts is inclosed below the table, and operated by a treadle, the glove-feeding cups being run close to each other, or at some distance from each other, to take hold or relinquish the work by means of a pressure spring and releasing treadle connection.

IMPROVED SLAUGHTERING APPARATUS.

Kennard Knott, London, Ontario, Canada.—This invention relates to an improved slaughtering apparatus in which the bullock is thrown down, and (after being killed) drawn out and deposited upon a car, which transports the body to the mechanism by which it is hoisted for being dressed. After the dressing operation it is lowered, divided in halves by a swinging saw, and the two parts, which are suspended from hanging tramways by wheel hooks, are quickly conveyed by said hooks into the freezing house, where they are packed, or from which they may be removed to cars or ships for transportation.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED POCKET CALENDAR.

Benjamin F. Norris, Chicago, Ill.—The improvement consists in the particular construction and arrangement of the two sheet metal disks to each other, one of which is provided with a series of indentations corresponding to the divisions of the calendar face, and the other of which is provided with a stud, one end of which affords a knob for turning the disk, and the other end of which forms a stop which enters into the indentation of the other disk, and by locking the two disks determines the proper registration of the divisions of the two disks and prevents accidental displacement of the same while in the pocket.

IMPROVED LANTERN.

Henry C. Kelly, Chicago, Ill.—This invention relates to a novel construction of the lantern; and it consists in the construction and arrangement of the burner and deflectors, the construction of the base provided with tubes for supplying air to the burner, the construction of the outlet for the hot air above, and the means for attaching the guards to the base piece, and thus connecting and holding the several parts together.

IMPROVED PUZZLE BLOCKS.

Ripley R. Calkins, St. Joseph, Mo.—The object of this invention is to provide a mechanical or material verification of the geometrical problem "that the square described upon the hypothenuse of a right-angled triangle is equal to the sum of the squares upon the other two sides." To this end the invention consists in the combination of five blocks, three of which are in the shape of similar right angle triangles, one in the shape of a trapezium, and the other in the shape of a trapezoid, which blocks are adapted to be put together to form a single square upon the hypothenuse of a right-angled triangle, or to be transferred or arranged in two squares upon the other two sides; the same to be used in schools for purposes of illustration, or to be used as a puzzle for general amusement.

IMPROVED STREET LAMP.

Lewis O. Cameron, Pittsburgh, Pa.—The improvements constituting the invention are embodied in three features, namely: 1st. Constructing the glass body of the lamp with a large opening at the bottom, and providing adjustable perforated plates for closing the same, the said plates being attached exteriorly. 2d. Making the metallic cap or top portion of the globe adjustable and removable. 3d. Providing the lamp with a detachable holder or reservoir for gasoline or other light hydrocarbon.

IMPROVED BROMINE STILL.

Freeling W. Arvine, Mason City, W. Va.—The points of novelty in this invention consist in making the still with a funnel-shaped bottom, introducing the steam pipe at the lowest point of the same, and providing an annular orifice for the escape of the liquid product. It also consists in providing a return pipe for the escaped bromine at the mouth of the receiver, and conducting the gas to an absorber where it is dissolved in bittern and returned to the still for utilization by decomposition.

IMPROVED HORSE DETACHER.

Amos M. Barker, Macon, Neb.—In using the device the cock eye of the tug is put over the outer arm of a double hook, and the head of a rod is placed in the space between the points of the said double hook, holding the hook securely in place. Should it become necessary to detach the horse, the driver pulls upon the cord attached to the arm of the rod. This turns the rod and raises its head out of the space between the points of the double hook, when the draft strain turns the hook forward, draws the tug from the said hook, and the horse is detached.

IMPROVED POCKETBOOK FASTENING.

Ernst Schnopp, East New York, N. Y.—This lock consists of a face plate, with swinging handle, applied to the closing flap of the pocketbook. It has a center knob at the under side of the same, that enters a centrally perforated radial spring plate for closing the lock, the button being released by pulling at the face handle.

IMPROVED TEMPORARY BINDER.

Ferdinand Guicheteau, Brooklyn, N. Y.—This invention consists in the combination of a spring clip of novel construction with the back of a book-shaped box or receptacle, in such a way that letters, invoices, and other similar papers, may be placed on a pair of needles fixed to the said back and retained by a spring. The latter is slotted, and so placed as to be capable of following the papers down on the needles.

IMPROVED UMBRELLA SUPPORTER.

August H. Adams, Piqua, Ohio.—This consists of an attachment for vehicles, having a socket for the umbrella handle at one end and double sockets at a suitable angle at the opposite end, to be secured by clamp screws to a grooved supporting post attached to the wagon seat.

IMPROVED EAR RINGS.

Leon P. Jeanne, New York city.—This invention consists of a spring lever hook, attached to a knob of the ear ring or drop, and bent upward, so as to bear on the ear, and retain the button securely in position.

IMPROVED BILLIARD BALL.

Gustav Magnus, Berlin, Prussia.—These balls are made uniformly solid throughout, without any pores or cavities. They are perfectly elastic. They rebound to a hight of eighty feet if thrown on an iron plate. Their center of gravity is exactly in the center of the ball, so that they lie still in any position on a surface of quicksilver. They do not crack or peel off, and they do not lose their color. The ingredients are rubber, sulphur, a suitable coloring matter, and heavy spar, or sulphate of baryta, the latter in a quantity at least fifty per cent of the rubber. The mixing is done in the usual way. After having made a ball, as nearly true as possible, and about one half inch smaller than the finished ball, it is enveloped in a sheet of the same mixture, having the required color, of three eighths of an inch thickness, and put in a very strong metallic mold of adequate form. The whole is then submitted to the curing process during at least ten hours, commencing with a low temperature, and increasing it slowly but steadily. The mixture is exposed only for one hour or less to the highest degree of heat, which will vary according to the quality of the india rubber used. The cured balls are then turned and finished.

NEW HOUSEHOLD INVENTIONS.

IMPROVED WATER FENDER FOR DOORS.

Elliot L. Valentine, Oakaila, Ill.—This consists of a water conduit, made from sheet metal, to be attached to doors, windows, and other similar places, to catch the water that drifts against them, and conduct it outside the sill.

IMPROVED WASH BENCH.

Peter E. Rudel, Grand Rapids, Mich.—This is a folding wash bench, hinged to a vertical standard carrying wringer rolls. The bench is formed of two sections, which consist each of a platform supported upon a hinged frame or leg, and adapted to fold and lie close against the upper portion of the standard.

IMPROVED INVALID BEDSTEAD.

Franklin E. Sawyer, Hyde Park, Vt.—This bedstead may be easily and conveniently adjusted by the occupant or attendant to any position, to be used as a common bed, or as a sofa or settee, or at any inclination. It is also easily movable from one room to the other, and has accommodations for the storing away of soiled clothes.

IMPROVED BOTTLE WASHER.

William Scherenberg, New York city.—In using the machine, the bottles are placed in a frame and secured. A trough is then lowered, bringing funnels into the mouths of the bottles, into which water and shot, tacks, or other suitable substance, are poured. A wheel is then turned which shakes the frame and bottles, washing the said bottles clean in a short time. When the bottles are sufficiently washed the frame is turned through a half revolution, which allows the water and shot or tacks to flow from the bottles into a basin.

IMPROVED WASHING MACHINE.

Allen D. Ferris and Albert N. Ferris, Blakeley, Minn.—The suds box is made in the form of a half cylinder, and to it is attached a series of parallel cross bars, which form the rubbing board, and at the same time strengthen the zinc bottom. The top opening is surrounded with a curve which prevents any water that may be spilled from running off upon the floor, and serves as a rest for the attachment of a wringer. Devices are provided to hold the suds box stationary while the wringer is being used.

IMPROVED SPRING PILLOW.

Jacob Beamer, Manor Station, Pa.—The object of this invention is to furnish, in place of the feather pillow, an improved wire spring pillow, that is conducive to sound and healthy sleep by keeping the head cool, and admitting pure air to the back of the same. Wire cloth is stretched on curved band springs, which are attached to the lower ends to a suitable supporting frame, and at the upper ends, by a cross strip, to upright rack bars. The supporting springs are laterally braced by a curved stiffening rod.

IMPROVED EVAPORATOR FOR REGISTERS.

W. R. Fowle, Baltimore, Md.—The invention consists in moistening hot air as it passes into an apartment from a furnace or stove, by causing it to pass through strips of absorbent material, more or less saturated with water. The absorbents are endless pieces of fabric held by opposite rolls, and dipping into the water, being spaced by ring grooves in the top roll. The invention is equally adapted to any form or location of register by means of an attachment open at the bottom so as to enclose with a lid the ordinary floor register, and provided with a rear opening to correspond with that of the evaporator.

NEW AGRICULTURAL INVENTIONS.

IMPROVED FARM GATE.

Dennis C. Bacon, Litchfield, Ill.—This consists in hitching the rear post of the frame to the main gate post, on which it turns by eyes and long staples.

IMPROVED CHURN.

David J. Rogers, Bardstown, Ky.—This invention relates to certain improvements in churns, designed to simplify and extend the use of the same, and expedite the operation of churning. It consists principally in the combination with a tube or case, provided with slits and perforations, of a projecting handle for holding the tube stationary against the bottom of the outer case while the dasher is being worked up and down in the said tube, by means of which arrangement any vessel without a special cover may be employed for the outer containing case, and the churning devices adapted for use in the one as well as in the other.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WAGON SPRING ATTACHMENT.

Reuben Doty and Joseph Doty, Wellsville, N. Y.—This is a device for attaching springs to a wagon body, composed of a top plate, a cross bar, encircling clip or band, and downward extending lugs, to form shackles for springs, the whole made in one piece.

IMPROVED ROCKER AND TRACK FOR CRADLES AND CHAIRS.

Daniel Rupp, Four Corners, Iowa.—This device is so constructed that the rocker shall always have a smooth surface to rock upon, however rough the floor may be, or however soft the carpet. The invention consists of a track having a right-angled bracket with a V-shaped slot, in combination with a cradle rocker, having a pin which enters the slot in the bracket.

IMPROVED PORTABLE HOUSE.

Francis M. West, Des Moines, and Addison R. Smalley, Snyder, Iowa.—This is a portable house that may be readily shipped and set up, and taken to pieces in case of fire, or for moving, the construction being strong and durable, while at the same time neat in appearance. The walls are made of grooved and tongue-locked logs, with detachable door and window casings applied in similar manner. The floor is connected to the joints by pins and recessed locking strips, while the roof sections are supported on dovetailed rafters by lateral bearing strips and top battens, the parts being interlocked rigidly.

NEW TEXTILE MACHINERY.

APPARATUS FOR BOILING AND DYEING SILKS, ETC.

Lewis Leigh, Pittsfield, Mass.—This consists in the combination of the series of fingers, their connecting rods, and an operating mechanism, with the two vats for moving the rods that support the material being boiled or dyed, and in the combination, with the end of the outer vat, of a box, connected with the space between the two vats by an opening. The box receives the wash from the ebullition of the liquid in the first vat, and, being higher than the said vat, allows the liquid to flow back into the same, thus avoiding any risk from boiling a liquid in an airtight space.

IMPROVED SPINNING AND DOUBLING MACHINERY.

John L. Taylor and Robert Ramsden, Bolton, England.—This invention relates to the machines known as throstle spinning and double frames, and consists in imparting a positive motion to the bobbin on which the yarn or thread is wound, and a variable motion to the inverted flier, which is fixed to a bush, bearing upon a flannel or other washer placed on the lifting rail. The advantages claimed for the improvements are: First, no oil is required for the spindle to lubricate the bobbin after doffing, as heretofore; secondly, no snarling of the yarn on the top of the spindle can take place; thirdly, no friction of thread against the flier leg; fourthly, no removal of fliers when doffing; fifthly, a great saving of waste is effected, and of time in doffing, and the bobbins can be doffed while the frame is going; and, lastly, as the bobbins bear upon metal plates, they are not liable to be saturated with oil, and consequently no oil can penetrate to the yarn on the bobbin, as heretofore.

Business and Personal,

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

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More than Ten Thousand Crank Shafts made by Chester Steel Castings Co., now running; 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 189.

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Jethro Wood.—If any of our readers can send or refer us to any publication containing a portrait of Jethro Wood, the plow inventor, we should be obliged. Munn & Co.

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See Boult's Paneling, Moulding, and Dovetailing Machine at Centennial, B. 8-55. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

John McDonald (formerly of Kingston, Jamaica) will please address Geo. B. Lundy, Balmoral, Ontario, Ca.

Hydrant Hose, Pipes, and Couplings. Send for prices to Bailey, Farrell & Co., Pittsburgh, Pa.

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Notes & Queries

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Enquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical enquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to enclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to enclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

T. B. G. can remove tattoo marks from the hands by the process described on p. 331, vol. 30.—G. B. should read our remarks on p. 202, vol. 34, on dissolving shellac.—B. can ebonize white wood by the process described on p. 50, vol. 33.—I. F. D. H. will find directions for making printing ink on p. 107, vol. 35.—Mrs. R. can chemically preserve natural flowers by dipping them in hot melted paraffin.—G. S. can best clarify varnish by filtration.—B. C. is informed that a recipe for erasive soap was published on p. 181, vol. 31.—B. L. F. will find directions for cutting glass with hydrofluoric acid on p. 379, vol. 33.—F. S. can polish white metallic alloys by the process described on p. 57, vol. 34.—R. W., T. D., W. S. H., W. B., W. A. R., A. A. C., G. M., J. B., J. M. P., J. E. S., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) M. M. C. asks: Does a point on a connecting rod between the centers of the crank pin and crosshead journal describe a perfect ellipse, or is the figure which it describes slightly larger at one end than at the other? A. Slightly larger at one end.

(2) A. W. H. asks: I have a side stroke slide valve portable engine. Cylinder is 7½ inches in diameter, with 14 inches stroke. It is rated at 12 horse power. I run a gin stand with it at speed of 250 to 300 revolutions per minute. I think it ought to run at 125 or 130 revolutions of the driving wheel per minute when the gin saws are at their maximum, 300 revolutions per minute. A friend contends that the engine would do the work more easily running at 75 revolutions per minute. Which is right? A. You are.

(3) J. P. says: Of what benefit is lagging between the jacket and the boiler of a locomotive? A. It prevents the heat passing off, by conduction, to the air.

(4) A. B. says: We have two engines, each 7x12 inches, attached to one shaft; they are reversible by link motions, and are provided with ordinary slide valves. One of the engines has too much opening on either center. How can we shorten the stroke so there will not be more than ⅛ inch opening on either center? A. Place the eccentric more nearly at a right angle to the crank.

(5) G. M. F. asks: Will plaster of Paris, made in the form of a cup, answer for the porous cup in the Bunsen battery? A. No, for the reason that it is not porous.

(6) C. W. M. asks: 1. What should be the inside and outside diameter of a helix, whose length is 3 inches? A. Inside 1 inch, outside 2 inches. 2. Of what size should the wire be, to give the greatest lifting force? A. Use No. 14 copper wire. 3. Would any kind of wood do for a spool for winding it on? A. No spool is necessary. Wind the wire on the iron core.

(7) W. B. asks: If two magnets be placed parallel, with their opposite poles together, the poles will attract each other. If the magnets be placed end to end, with the positive pole of one to the negative pole of the other, they will repel, according to Ampere's theory, whereas in practice they attract. How is this explained? A. According to Ampere, they should attract under the conditions mentioned.

(8) A. S. says: I am making an electro-magnet, which I wish to insulate by winding on silk, and then dipping in paraffin. The only paraffin I can get here is made up into candles, which I fear may be adulterated with something that would spoil my wire after I have taken the pains to wind it. Would you advise me to use it? A. The silk is sufficient. The dipping in paraffin will do harm.

(9) M. A. G. asks: 1. Is a hollow lightning rod as good a conductor of electricity as a solid one of the same diameter and same metal? A. No. 2. Is the conductive property of a rod in proportion to its surface, or to its solid contents? A. To its solid contents.

(10) C. M. says: 1. I have an electrical conductor on my dwelling house, composed of three twisted iron wires and a small copper wire between each of the three strands, about ⅛ an inch diameter altogether. Is such a rod a suitable protector against electric shocks? A. Yes, if properly connected with the earth. 2. Would a galvanized iron rope of ¾ inch diameter be as good as a conductor? The rope would be probably twice the weight per foot of the lightning rod. A. Yes, better than the other.

(11) W. N. G. asks: What is the average distance which a printer's hand travels for each type set? A. About 30 inches.

(12) L. C. K. says: I wish to bring water into my house from a spring 30 rods from the house and 100 feet higher. I wish to use ½ inch iron pipe. I am told that it will fill in a short time with rust so as to stop the flow of water entirely. Would it be advisable for me to lay iron or lead pipe? A. A tin-lined iron pipe is now being introduced into the market, which we think will best answer your purpose, and probably not cost more than a lead pipe of sufficient thickness to bear the pressure.

(13) T. E. K. asks: Is there a preparation for rusting steam joints together? A. Use a mixture of cast iron borings 100 lbs. and sal ammoniac 8 ozs., well wetted with water.

(14) G. D. M. asks: Can you tell me what substance plasterers mix with their white glue in making molds for ornamental plaster work, to give a gray color and make it tough like rubber? A. No; glycerin is said to be a good coating for the interior, but lard and oil is most commonly used. Plaster casts, immersed in a hot solution of glue long enough to be well saturated, will bear a nail driven in without cracking.

(15) F. R. asks: Is solder as good after it has been in use on iron and brass as when new? A. No.

(16) L. S. C. asks: 1. What good material or paint can you recommend to cover a shingle roof, to make it approximately fireproof against sparks and heat in case of the burning of an adjoining building? A. Quicklime boiled in linseed oil and applied hot is said to be fireproof. 2. Can a durable wall 9 inches thick be made of sun-dried unburnt brick for a building one story high, the foundation being of burnt brick? A. We should consider the wall too thin: it is not likely to sustain the roof; 16 inches thick would do better. It could be laid up in clay. 3. Would hydraulic cement adhere to such a wall, if plastered on the outside? A. No; it would be better to fur off the inside, and lath and plaster it in the usual way.

(17) J. R. K. asks: Has the temperature any effect on a steel spring blade? A. The effect will not be noticeable by ordinary measurements.

(18) T. M. M. asks: Is there not such a thing as getting lumber too dry? We kiln our lumber in a very hot dry house. Sometimes we leave it in a week longer than we should if we were in a great hurry for it. Our foreman claims that there is no such a thing as getting lumber too dry; but we find sometimes, after we have used lumber that has been in the kiln so long, that the end wood swells. A. We think your foreman is right; but kiln-dried lumber is no doubt more subject to swell by the absorption of moisture than that which is seasoned by long exposure to the action of the weather. If you stack your lumber two or three years before using it, you will no doubt have the best seasoned stuff.

(19) J. S. asks: How much powder will a small mortar, with a bore of 4 inches diameter and length 4½ inches, take to throw a shell ¼ of a mile? A. From ⅛ to ¾ lb.

(20) B. F. M. says: I have canned some blackberries and raspberries, but I have lost about 25 cans by the cans pulling in two; sometimes they will burst all to pieces. Can you give us some reason for it? A. In canning fruit it is necessary, in order to expel as much of the air as possible, as well as to destroy any incipient germs of fermentation, (1) that the vessels should be as full as possible and (2) that before being sealed they should be placed for a short time in boiling water until their contents become of the same temperature as the surrounding water, in which condition they should be sealed, and immediately thereafter removed and allowed to cool.

(21) L. A. asks: Is there anything except muriatic acid that I can use for soldering copper or tin to galvanized iron, or for soldering the iron itself, and make a smooth job? A. Use borax, acid chloride of zinc, or sal ammoniac.

(22) B. W. says: We have some steelyards that have no poise. Can you tell me how to make or adjust one? A. The principle on which the steelyard acts is that of the simple lever. If you can get two or three correct weights, you can make a poise by experiment. To calculate the proper weight of the poise, measure the lever arm of the weight, and that of the poise to one or more of the notches, and use the proportion that any given weight is to the required poise as the distance from the fulcrum to the poise is to the distance from the fulcrum to the weight.

(23) C. E. C. asks: How can I best succeed in getting a journal to make itself a seat in a bearing that is slightly too narrow for it? A. File out the sides of the bearing.

Is it likely that any other substance than oil or mud is the cause of the water foaming or surging in the upright tubular boiler? A. There are other causes, such as want of sufficient steam power.

(24) F. H. S. says: My friend claims that in a chronometer watch the escapement will commence to move at the same moment that the detent liberates the said escape wheel. I claim that the inertia of the train of wheels is sufficient to retard the time for commencement of motion of the escape wheel sufficiently to allow the balance to move through a space of at least three degrees from the time the detent has just liberated the escape wheel to the time that said escape wheel commences its movement with every beat of the balance, pendulum, or whatever it may be. Who is correct? A. Your view of the matter is the more correct of the two, though the amount of motion of the balance wheel before the other commences to move could only be settled by experiment. It should be noted, also, that the teeth of the escape wheel could have such a shape that it would be in motion while disengaging from the escapement. Possibly this is the case in some watches.

(25) J. E. W. says: I am running my engine at the rate of 175 revolutions per minute. What would be the difference in the amount of steam that I should use if I ran it at 200 revolutions per minute, provided that I increase the size of pulley on machinery so that the engine will be doing the same amount of work? A. There will be no great difference, but there will probably be a little gain by using the increased speed.

(26) A. L. asks: What would be the safe pressure for ½ inch external diameter steel pipe 0·3 inch in thickness, and also of 1 inch external diameter steel pipe, ¼ inch thick? A. About 5,000 and 2,000 lbs. per square inch respectively.

(27) W. R. H. says: In a recent issue you describe a new electric battery. I have had this battery in use since January last. The jar is a common glass tumbler. The zinc cylinder is sheet zinc, twice the hight of the tumbler. The porous cup is made of blotting paper around the zinc turned in at the bottom. The copper wire is coiled over the paper, which keeps the zinc and paper in place. Sulphate of copper solution is used as in a Daniell battery. This battery can be constructed for twenty cents, and will work from 5 to 8 weeks, producing a current suitable for experimental purposes. By making the zinc cylinder twice the hight of the tumbler, the battery remains in working order longer. The zinc, being very thin, is soon destroyed on the lower edge; but by pushing the cylinder down, the same amount of surface is exposed to the action of the acid. A. The Daniell battery is capable of many modifications, and this is as good as many others which have been used.

(28) E. S. asks: What will remove a linseed oil stain from common white cloth? A. Try benzine or naphtha, and press with a little warm pipe clay.

(29) R. T. S. asks: How can I dye white kid slippers black? A. First steep the material in a strong, hot solution of logwood, and then in one of sulphate of iron (copperas). Repeat if necessary.

(30) W. B. asks: How can I pulverize mica? A. Heat it as hot as possible, and while in this condition plunge it suddenly into cold water. It thus becomes very brittle and may be reduced without difficulty.

(31) W. G. S. asks: What is the hydraulic pressure of a column of water 30 feet high? A. About 12½ lbs. on the square inch.

Can I get a full large blaze from glycerin by putting the fluid above the light? I can get it to burn, but it gives a small blaze which, it seems, will not get any larger. A. A higher temperature in contact with the air will produce a rapid decomposition of the glycerin, giving a much stronger flame, but at the same time liberating irritating and offensive fumes of acrolene. 2. What is the cost of it compared with alcohol? A. Glycerin, in comparison with alcohol, is very cheap.

(32) D. F. E. asks: How much sand and lime does it take to mix one bushel of Rosendale cement in mortar for laying brick? A. One of cement, one of lime, and six of sand will make a good mortar for brickwork.

(33) W. G. W. says: I am bringing water 250 feet from a well through a 1¼ inches plain wrought iron pipe. The water is clear and good, to all appearance; but when it has stood in a pail or vessel of any kind an hour or more, a greasy reddish scum arises to the surface in sufficient quantity to color the inside, so that it requires considerable scrubbing to clean it off. Is there any chemical property in the water that causes the difficulty? A. The sediment you mention is very probably due to some corrosive action of the water on the iron conduits. This may be due in part to the presence of free carbonic acid. Draw a quantity of the water, add to it a small quantity of lime water, and allow to stand over night; then draw off the clear water. The addition of the lime water will neutralize the free acid, with which it forms an insoluble salt, and at the same time precipitate any iron that may be in solution. Experience will soon teach you the proper quantity of lime water necessary.

(34) J. A. V. asks: What is the most efficient means of stopping and preventing leaks in gutters? I have one of copper that leaks terribly, thereby ruining the cornice of wood beneath. A. If your roof is a steep-pitched one, the copper lining of the gutter may not extend up far enough under the covering to prevent the water from flowing over the back edge of it, into the

woodwork of the cornice; or the contraction and expansion may have worked the joints loose. The latter should be closely examined, and, if loose, repaired before painting. We find no difficulty here in keeping gutters, that are simply lined with tin, tight.

(35) C. F. S. asks: 1. Is the radiation of the method of heating private dwellings with furnace in basement and tin pipe leading to different rooms at the floor called direct or indirect? A. Indirect. 2. When this method is used, where should fresh air be admitted to the room thus heated, at the floor or near ceiling? A. Fresh air should be taken from the exterior of the house at the basement, and supplied to the air chamber of the furnace by a special pipe or shaft, which may be of wood; it is this air, when warmed, that becomes the fresh air of the rooms. The fireplace flue will carry off the vitiated air, having its opening near the floor.

Can cast iron be case hardened with prussiate of potassa? A. Yes.

(36) L. W. asks: Will any injurious effects arise from working over and inhaling the vapor or steam arising from boiling or hot aniline dye? A, Yes, it is extremely unhealthy, if from no other cause than induced predisposition of the system to take cold and contract pulmonary complications.

(37) A. H. S. asks: Is it injurious to a person's health to sleep in a printing office after working in it all day? It is said that the antimony in type metal is poisonous. A. If the office is well ventilated, and free from the odor of benzine and other exhalations, it will not be unhealthy. The antimony does not evaporate.

(38) G. G. says: I need a flexible tube to use in kerosene oil. What is the best material to make it of? A. Try one of leather. Rubber will not answer. 2. In a lamp burning kerosene oil, what is the best distance to have base of flame from surface of oil? A. About 2¼ inches.

(39) E.T. M. says: I am about to construct a flume for carrying off the smoke from a quicksilver furnace, the smoke being strongly impregnated with sulphurous acid. What effect will it have on a four feet flue constructed of Portland cement, gravel, and sand? A. The effect will be to speedily convert the exposed surfaces of the lime into an oxysulphide, and finally into sulphate of lime, which will resist any further change.

(40) J. W. says: My cellar is always wet. If I dig a drain or two in it, and dig a well down to the gravel, the drains going into it, will the water soak in the gravel? A. It depends upon the nature of the several strata over which your house stands. Better consult some of the older residents of your neighborhood. See query 20, p. 107, vol. 35.

(41) M. E. A. asks: 1. I wish to build an icehouse on my farm, to hold about 8 tuns of ice, in which to keep meat, etc. A. You will find a description of one of this size on p. 251, vol. 31 (in which read "7 feet square" for interior chamber instead of 6.) 2. Is it best to build it into a bank and cover the top with earth, or build it all above ground? If the former, how shall I construct it? A. It is not necessary to build it in a bank; let the building be isolated, but the floor about 2½ feet below ground. 3. How should the door be made? A. Provide a canvas on the inside that will allow it to be packed with about 6 inches thick of sawdust. 4. Should the provisions be kept in the same room with the ice? A. No; but in the surrounding passage, as in the description above referred to.

(42) W. D. asks: Can vinegar be made directly from corn or corn meal without first converting the corn into starch, then to dextrin, and then to grape sugar, and then to vinegar? A. No.

(43) J. H. P. says, in reply to B. D., who says: "I have a piece of gold which has been polished with mercury. What will remove the mercury?" A. Cover the gold in a glass vessel with nitric acid. The acid will eat the mercury all off, and will leave the gold less brittle than if heat had been applied to it.

(44) E. P. says, in answer to C. B., who asks how to plow with three horses abreast, and regulate the running of the plow: We often do this by shifting the outer end of the clevis off the beam towards the land, and fastening it at the right distance with a guide pin.

(45) J. M. L. says, in reply to H. P. B., who asks if eggshells can be utilized: Eggshells form one of the best clarifiers for cider and wine. One pint of pulverized eggshells will clarify one barrel of cider or wine in from 24 to 48 hours, according to the clearness of the weather. As eggshells cannot always be had in sufficient quantities, can you tell me of a substitute for eggshells? What is the lime composition of the same? A. It is the small quantity of residual adhering albumen, and not the lime salts composing the shell, that exerts the clarifying action upon the the liquor. A good substitute for the expensive egg albumen may be obtained from water that has been used to wash the starch from wheat flour or scraped potatoes, by allowing it to stand until it becomes clear, and then boiling it. By this means it is rendered turbid, and, after a short time, a flaky white substance deposits, which has the same properties as white of egg, and is known as vegetable albumen. The shells are chiefly composed of the carbonate and phosphate of lime, together with a little organic matter. In some parts of Europe and elsewhere, it is common to clarify wines, etc., by heating for a short time with ordinary clean *papier maché*, and then filtering through bags of fine linen.

(46) N. A. B. asks: 1. Can I arrange the motive power of an electric clock so that a regulator will not be necessary, and so that slight variations in the force of the current will make no difference in the time kept? A. No. 2. I have an instrument for producing shocks by the extra current; it has no secondary coil. If I should attach a condenser to it, could I obtain any of the effects of frictional electricity, or is the secondary coil necessary? A. A secondary coil is necessary to obtain static effects of any considerable tension.

(47) J. V. A. says: Is there any metal or other substance that is perfectly or almost perfectly impenetrable to magnetism? If I take a magnet and place a plate of some substance above it, could the magnetism be prevented from going through it, so that it would have no influence on a piece of iron placed above it? A. No. There is nothing which will cut off magnetism except iron, which does so by itself absorbing the magnetism produced.

(48) W. H. asks: 1. How can hard cistern water be made soft and good for table use? The hardness arises from the cistern being built of cement. A. Boiling the water usually causes precipitation of some of the foreign matter. 2. Is a partition of common brick laid in cement, dividing the receiving conductor from discharge pump pipe, a good filter for a cistern? A. We think not.

COMMUNICATIONS RECEIVED.

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

On Water Supply for Seaboard Towns. By H. B. M.
On Shrunk-On Parts of Machinery. By T. I. B.
On the Radiometer and its Uses. By S. H. T.
On the Pyramid and the Sphynx. By C. R.
On the Sinking of a Large Pond. By J. N.
On Working Men's Demonstrations. By J.E.E.
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On Building Prisons. By H. G. K.
On the Hidden Key. By J. E. W.
On Preparing Ornamental Leaves. By M.A. K.

Also inquiries and answers from the following:
T. P. P.—J. B. H.—W. G. W.—W. W. K.—M. W. W

M. G. P. asks: Are not meerschaum pipes sometimes boiled in wax etc., to bring out the color? If so, what is the process?—F. S. K. asks: Please give me a recipe for keeping the weavil from corn after it is cribbed in the shuck.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells bicycles? Who bores for water by driving well tubes, and what is the cost of the operation? Who sells wooden clocks? Who makes envelope machinery? Who makes machinery for preparing moss for upholsterers' use?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

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

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9,437.—UMBRELLAS.—G. Bockstaller *et al.*, St. Louis, Mo.
9,438.—SKIRT BORDERS.—G. Bowman, New York city.
9,439.—EMBROIDERY.—E. Crisand, New Haven, Conn.
9,440 to 9,443.—CENTER PIECES.—S. Kellet, San Francisco Cal.
9,444.—FLOWER BOXES.—J. Rogers, New York city.
9,445.—STOVE.—E. Smith, Albany, N. Y.
9,446.—MIRROR FRAME.—R. W. Myers, New York city.
9,447.—FORK HANDLES, ETC.—C. Osborne, New York city.
9,448.—FAN.—J. T. Rowand, Jr., Camden, N. J.

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20 " " " " " " 2.
20 " " " " " " 3.
20 Army Wrought Iron Wood Heater, No. 4.
20 " " " " " " 5.
20 Army Cast Iron Coal Heater, No. 6.
20 " " " " " " 7.
20 Army Parlor Coal Heaters.
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20 " " " " 2.
Specifications of the kind of Stoves required can be had upon application at this office.
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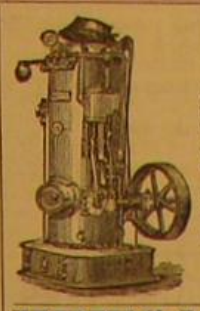
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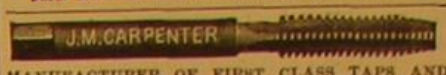
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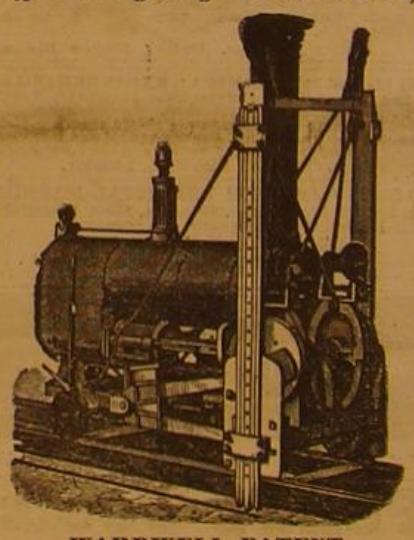
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