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HOLBORN VIADUCT SUBWAYS.

In the construction of the Holborn Valley viaduct, and the streets connected with it, the corporation of London determined to introduce subways for gas, water, and telegraph pipes, and thus to prevent the breaking up of the road surface, which is so often necessary with the ordinary system of placing them in the ground beneath the public way. As a means of conveying water, subways have, for some years, been used in Paris, and more recently in London. They were first introduced in London in the construction of Southwark street, from Blackfriars road to the Borough. The conveyance of gas, however, requires special arrangements for ventilation to prevent the risk of explosion, and the subways under the Holborn viaduct are believed to be the first constructed with a view to their safety when used for this purpose. The arrangements must here be explained. In the Holborn viaduct there is a subway, 7 feet wide and 11 feet 6 inches high, on each side of the road, running between the great arches which carry the roadway and the house vaults which support each footway. The subways are immediately above the sewers, and are well drained, floored with large slabs of York stone, and lined with light gault bricks. In each subway a 14 inch main pipe of the New River Company is carried by iron chains near to the wall nearest the frontage of the houses, and above it 10 inch gas mains, belonging to the City of London and Great Central Gas Companies, are supported on iron brackets projecting from the wall; on the opposite side of the subway a pipe, containing the telegraph wires, is carried in a similar way. All the pipes are so fixed that workmen can easily examine and repair the joints; and, in anticipation of the new buildings, junctions with the gas and water pipes have been made for each house; from these junctions the pipes will be conducted through holes formed in the sides of the subways and communicating with the house vaults. Branch pipes are laid on from the subways to the street watering posts, and to the fire hydrants in the streets, and gas is laid on to the street lamps. All the usual valves, meters, and other apparatus are accessible within the subway itself. Rails are laid along the floor of each subway, on which runs a traveling crane, to facilitate the removal and fixing of the gas and water mains. The subways are ventilated by means of small circular gratings fixed in the footways along the center of each subway, and by flues which run up the party walls of the houses and terminate above the roofs. Every street lamp, and every post along the edge of the footways, communicates also with the subways, and is so perforated as to act as an efficient ventilator. Wherever practicable, the doors of entrance are also constructed of open iron work. Hitherto the ventilation has been perfectly efficient, and no danger is apprehended from the use of naked lights or from the gas jets by which the subways are lighted at times of inspection. One portion of the viaduct subways, between Farringdon road and Shoe lane, has been lighted by means of Hyatt's patent vault light, an American invention introduced into England by Mr. Haywood, the engineer of the Commissioners of Sewers, who designed the Holborn viaduct. It consists of a large frame of cast iron glazed with thick bosses of glass, let into the footways, at intervals, over the crown of the arch of each subway, forming a very efficient means of lighting. In Charterhouse street, Snow hill, and in the other subsidiary streets, there is but one subway, of a lower form, 12 feet wide and 7 feet 6 inches high, running under the center of the roadway. In these, the pipes are laid on dwarf walls along each side of the central pathway. In all other respects, the arrangements are as nearly similar to those already detailed as the circumstances would allow.

HOLBORN VALLEY VIADUCT.—SECTION OF SUBWAY ON EACH SIDE.

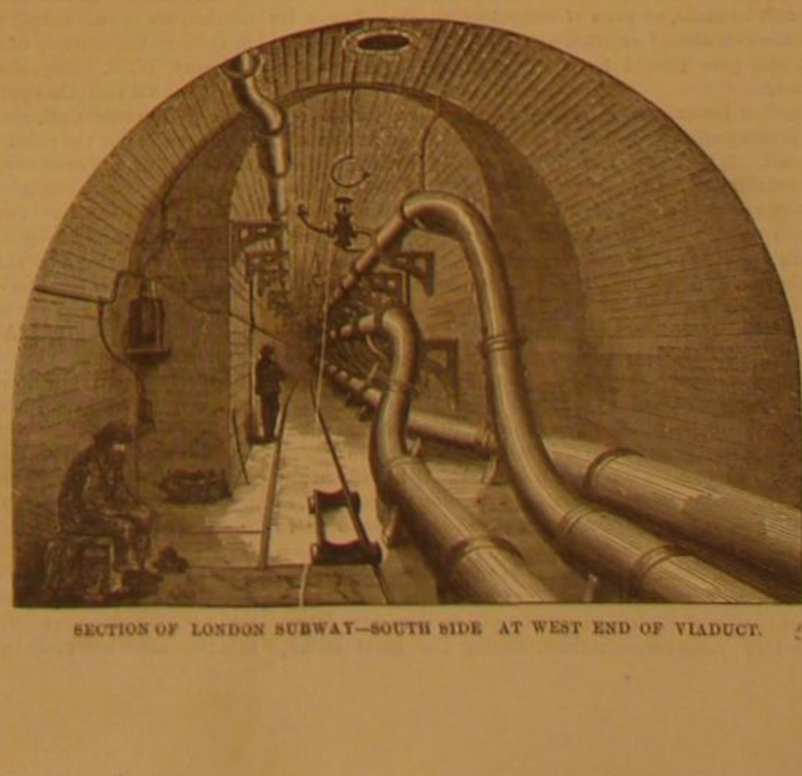
Jasmine Pipe Stems.

In a recent number of the *Revue Horticole*, M. Barillet describes the cultivation of the common jasmine (*jasminum officinale*), near Constantinople, for the purpose of tchibouk (pipe) making. The object sought is a long straight stem, free from leaves and side branches. For this purpose the plants are grown quickly in a rich soil, and drawn up by being grown in a sheltered situation, to which the sun has little access at the sides, but only at the top. Pinching is resorted to, and during the second year's growth one end of a thread is attached to the top of the jasmine stem. This thread passes over a pulley attached to the post to which the jasmine is trained, and from it is suspended a weight, the effect of which is to keep the stem always in a vertical direction. When the jasmine stem is about two centimeters (say $\frac{3}{4}$ inch) in diameter, a cloth is wrapped around it to prevent access of dust and of the sun's rays. Twice or thrice in the year the stem is washed with citron water (*eau de citron*), which is said to give the clear (*claire*) color so much esteemed. When the stem has acquired a length of some 15 feet it is cut down and perforated by the workmen, and fitted with a *terra cotta* bowl and an amber mouth piece. The length of the tchibouk stems varies from one to five meters (3 feet to 16 feet about); in the latter case as much as $100 is demanded for their purchase.

Annealing.

The change produced by annealing is not well understood. Most of the malleable metals assume two distinct forms: one crystalline, which is the result of slow cooling, and the other fiberous, which is brought about by hammering or rolling. If hammered or rolled beyond a certain point, the metals become so hard that they cannot be bent without breaking. If annealed beyond a certain point, the metals become crystalline. The particles of the metal change their arrangement without altering the external form. Hence it is necessary to preserve wire, such as is used in the manufacture of pins, in a dry air, or under the surface of water.

SECTION OF LONDON SUBWAY—NORTH SIDE. JUNCTION OF CHARTERHOUSE STREET.



SECTION OF LONDON SUBWAY—SOUTH SIDE AT WEST END OF VIADUCT.

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NEW YORK, SATURDAY, NOVEMBER 15, 1873.

Contents:

(Illustrated articles are marked with an asterisk.)

THE PANIC AND THE LABORING CLASSES.

The daily journals of the past week have exhibited such crowded columns of reports from all parts of the country, indicating the temporarily depressed condition of the manufacturing and industrial interests, that it is hardly necessary here to particularize individual cases as evidence of the prevailing despondent feeling. By far the majority of establishments are retrenching: some by reduction of working force, others by cutting down hours, and more by removing a percentage from the salaries of employees. While the outlook is far from cheerful, there is a belief that the worst is over. The railroads and many of the iron founderies still take a gloomy view of affairs, and we notice that reductions of expense are yet being largely made.

With all the facts in view, however, we still are inclined to adhere to our belief in the passing nature of the trouble. We find much to applaud in the course adopted by many establishments, which, trusting to the early revival of better times, are working straight on, with no greater alteration in their business routine than such as they are imperatively driven to make. So far as the producers of the necessaries of existence are concerned, we think little apprehension need be felt as to their rising superior to the disaster; but with reference to those who gain their living from the manufacture or sale of articles pertaining to the luxuries of life, there is a probability of less favorable results.

To the workmen, however, the prospect is indeed dark. No pay on Saturday night means, to hundreds, no dinner on Sunday—no rent for the coming week—no fuel to keep off the bitter cold of winter. In ordinary times, these men might seek other employment, or turn to some labor, the return for which would keep body and soul together; but now, when thirty thousand operatives in this city alone have been thrust from employment, the chances of gaining comfortable support for a family are far from promising. Let employers put themselves in the places of their hands, and imagine their own feelings in so dire a strait, and then think of the hardships which, perhaps through a mere sentiment of over cautiousness, they entail, not only upon their immediate workmen, but upon their families and the host of other people dependent upon their small custom for a means of existence. It is for this reason, above all others, that we advocate the keeping open of every industrial establishment while its bare expenses can be met, no matter if not a cent of profit be made, or even if some loss accrue. Better far that the rich should sacrifice a portion of their wealth than that the poor should be left destitute or driven to pauperism.

Another lesson, and a fruitful one, is to be gleaned from the pending crisis, which the workmen would do well to take to heart. It is the utter futility and hollowness of strikes, and notably that of a year ago, when regarded in connection with the present aspect of affairs. It is strange that hardly twelve months should elapse before the very condition to which a number of wrongheaded men strove to reduce the employers, through coercion and an unjust exercise of power over the ignorant, should be brought home to their own doors. The defeat of the great movement of 1872 was complete enough, but it has been reserved for the panic of 1873 to give it double effect and to render its teachings indelibly impressed.

As to the means of alleviating the condition of those who, it now appears, are to be so sadly reduced during the coming winter, some organized plan will undoubtedly become necessary. A contemporary suggests the division of large cities into districts, and the appointment of suitable committees to visit the houses in each, in order to solicit contributions to a general fund. Our opinion is that now is the time for the trades' unions to assert themselves, and to prove that they are unworthy of the odium under which they now labor. Several of these organizations, during the great strike, boasted freely of their reserve capital and of the assistance to be gained from kindred societies in Europe. Now let the International and the British associations, which send such earnest emissaries here, come forward and render that aid which they have so freely promised. If the trade associations will join forces, and labor, not merely in the interest of their own members but of all working men, they will do more towards elevating the condition of the laboring classes than they could accomplish by any number of successful strikes.

THE PROGRESS OF THE HELL GATE EXCAVATIONS.

General Newton, of the United States engineers, the officer in charge of the government works at Hell Gate, has recently submitted his annual report of progress made in that important undertaking. The various tunnels and galleries now aggregate in length 5,884 feet, of which 2,731 feet constitutes the advance of the past year. The total amount of stone removed during this period is 9,554 cubic yards, of which 7,619 yards were extracted by the Burleigh drill, 185 by the Diamond, and the balance by hand work. About ten linear feet of holes have been made in each cubic yard of rock; and to explode this large number of blasts, 11,808 pounds of nitro-glycerin, 1,218 pounds of giant powder, and 3,445 pounds of black powder have been employed. In hammer work, 9.03 feet of hole and 0.9 pounds of nitro glycerin correspond to one cubic yard of rock blasted.

The report speaks very favorably of the operation of the Burleigh drill, each machine, it is stated, having made for the year an average of 25 feet per shift of eight hours. The loss of steel by abrasion and drilling is estimated at 0·5¼ ounces per linear foot, a calculation which of course must be confined to rock of similar nature to that at Hallett's Point. The balance of the report refers more particularly to the operations of the steam drilling scow during the year 1872, reference to which has already been made in these columns. There is the usual complaint of delay and increased cost of operations, owing to the lack of necessary funds. It is strange that Congress is so apathetic in this regard. The importance of securing a free channel from Long Island Sound to the East River has been so frequently and so forcibly urged, and so much money has already been expended in fruitlessly endeavoring to secure the same, that there can be no reason for withholding the means of completing a work regarding the ultimate success of which no doubt can be entertained. Delay, as General Newton has so often pointed out, only increases expenses, and besides indefinitely defers the advantages to be gained by both city and country. We were told during last winter that at that period a sum in the neighborhood of five or six hundred thousand dollars would be sufficient for all purposes. It seems to us that both our city and state authorities should, during the coming session of Congress, especially interest themselves in this matter, and, by the exercise of their powerful influence, ensure the appropriation of the balance now needed to effect the speedy completion of operations.

A RECENT IMPROVEMENT IN GAS MAKING.

On another page of this issue will be found an illustrated description of an improved plan of gas manufacture, which has recently been put in practice at the works of the Citizens' Gas Company in Brooklyn, N. Y. It is a matter of general information that the forcing of jets of superheated steam through anthracite coal, over heated metal, or through a furnace fire, is not a new idea, nor is it our intention in the present instance so to infer. Some sixty patents or more have been granted for " water gas " and kindred processes, dating as far back as 1823. The system in general has found many opponents, notably, among others, the late Dr. Torrey: while Professor Wurtz, in published reports on the subject, has pointed out that it is impossible to convert the steam entirely into hydrogen and carbonic oxide. Some of the steam, he considers, is not decomposed, and, passing into the coal retorts, operates injuriously, probably by oxidizing the olefiant gas. In conclusion, the same author remarks that the greatest of practical objections is "the uncertainty of the quality of the product."

Without entering further into the details of the subject or inviting discussion of the vexed question in the present connection, we submit simply a statement of facts as laid before us through the courtesy of the President of the above named company, W. P. Libby, Esq. Whether gas experts may or may not hold that the operation and apparatus we have described are economical, remunerative, or of any advantage whatever, is not the point upon which we wish to dwell. The books of the company, we are told, indicate no inconsiderable saving, while the aspect of the works, the absence of the usual complement of hands, the diminished requirement of coal, and finally the satisfaction expressed by the officials employing this threefold process, add still further testimony in corroboration of its apparent value and utility.

POSTAL SCIENCE.

It seems to us that the postal regulations now in force are singularly inconvenient, not to say unjust, as regards publishers, who, in the ordinary course of their business, find it necessary to transmit large quantities of printed matter through the mails. We have already called attention to the fact that we are now preparing a special edition of sixty thousand copies of the SCIENTIFIC AMERICAN, numbers of which will be mailed to persons in every city, town and village in the United States. As the recipients of these papers will in all cases be non subscribers, the postage thereon must be paid in stamps previous to mailing; so that, at the rate of two cents per copy, the aggregate expenditure for this item alone will reach the sum of twelve hundred dollars. Now sixty thousand papers would supply 1,154 subscribers with one copy each per week for one year. But each person, paying at his own post office, would be charged only five cents per quarter postage, or twenty cents for the entire period. Consequently, the 1,154 people would together aggregate the sum of about $231, or a very little over one sixth of the amount which we pay in advance in order to send all the numbers at once. If, as it is urged, the low rate of postage to subscribers has for its only end the facilitating of the dissemination of news and useful knowledge, then why is it not equally fair to further the same object by giving those who produce the means of imparting such information similar advantages? Why should we, in the present instance, be required to hand out one dollar and four cents for sending fifty-two copies of our special edition at once, when if we forward the same number of issues of our regular publication, weekly for a year, our subscriber would be taxed only twenty cents?

Again, is it not possible to simplify the mode of sending such masses of matter, to the interest of both government and publishers? We are now obliged to purchase sixty thousand stamps—three hundred sheets—and go to the labor of pasting them on the wrappers, after which each stamp of course has to be cancelled in its passage through the mails. It seems that it would be a much easier proceeding for the Post Office to detail one employee to weigh the entire issue, note the result, and thence calculate the charge at regular rates. This sum determined, we could pay it at once, the papers would be despatched, and the proof of prepayment might simply be a hand print of "New York—paid," or something of similar kind, applied by the same people and in the same manner as they would obliterate the ordinary postage stamp. The government would thus gain the cost of manufacturing the sixty thousand two cent stamps, while we should be spared the trouble of affixing them.

In England, the sender is not obliged to stamp his matter if the postage thereon equals or exceeds one pound sterling. If, for example, he has two hundred and forty letters to forward, at the rate of a penny each, the office weighs them and receives the cash, stamping them paid in the manner above noted. Or, in other cases, if it be so desired, the post office will emboss stamps upon wrappers or envelopes of any size, upon any variety of white paper, without any charge other than the face value of the imprint. These plans might well be put in practice here, and it seems might prove of no small convenience. For the English newspapers even a better arrangement is in existence. Formerly there was a revenue tax on every journal, which covered its transmission, free through the mail, for any number of times up to a certain date from that of its publication. London papers were sent from the publishing offices to those of the Internal Revenue, at Somerset House, where the proper stamps were affixed; after which no further payments were required. Now, however, the income goes directly to the post office; but instead of obliging journals, like the London *Times*, for instance, the circulation of which outside of the capital is very large, to buy and attach innumerable penny stamps, an electrotype of the government imprint is locked up and struck off in the regular forms of the paper. An official is stationed in the press room to count the sheets printed, and the proprietors pay the tax called for by his report.

The efforts toward postal reform, which have been for so long advocated by both press and people, were well inaugurated by our last Congress in the abolition of the franking abuse, the establishment of charges upon exchange newspapers, and the authorization of the postal cards. It remains for the coming legislature to continue the work by reducing the postage on all letters, sent within the United States, to the uniform rate of one cent; while, at the same time, we trust that the discrepancies which we have pointed out in relation to newspaper charges may be fairly adjusted. The question of increasing the facilities for transmission, by means similar to those referred to above, is within the authority of the Post Office Department, and merits its careful consideration.

ON THE MOLECULAR CHANGES PRODUCED BY VARIATIONS OF TEMPERATURE.

Professor R. H Thurston, of the Stevens Institute, has prepared a very interesting paper on this subject, in which is presented, in brief form, a history of the various practical experiments and the conclusions reached by different observers on the above subject. He states that the most complete investigation ever made, particularly to determine the effect of changes of temperature in modifying the physical properties of iron and steel, was that of Knut Styffe, the director of the Royal Technological Institute at Stockholm, Sweden, and supplemented by the experiments of Christer P. Sandberg, who translated the report of Styffe into English.

The work of the first named engineer was done at the instance of a committee appointed by the King of Sweden. It was commenced by Professor Angstrom, continued by Herr R. Thalen, of the University of Upsala, and by Engineer K. Cronstrand, and it was finally concluded, with the assistance of Cronstrand and Lindell, by Styffe, who wrote out the results of the whole investigation and made the report public.

These labors were begun in 1863, and extended over several years.

The conclusions of Styffe were:

"(1). That the absolute strength of iron and steel is not diminished by cold, but that, even at the lowest temperature which ever occurs in Sweden, it is at least as great as at ordinary temperature (about 60° Fah.)."

"(2). That, at temperatures between 212° and 392° Fah., the absolute strength of steel is nearly the same as at ordinary temperature; but in soft iron, is always greater."

"(3). That neither in steel nor in iron is the extensibility less in severe cold than at ordinary temperature, but that, from 266° to 320° Fah., it is generally diminished, not to any great extent in steel, but considerably in iron."

"(4). That the limit of elasticity, in both steel and iron, lies higher in severe cold; but that at about 284° Fah., it is lower, at least in iron, than at ordinary temperatures."

"(5). That the modulus of elasticity in both steel and iron is increased on reduction of temperature, and diminished on elevation of temperature; but that these variations never exceed 0·05 per cent for a change of temperature of 1·8° Fah and, therefore, that such variations, at least for ordinary purposes, are of no special importance."

The experimenter gives it as his opinion that the cause of the frequent breakage of rails in cold weather, and of articles made of iron and steel, is unequal expansion and contraction and the rigidity of supports, where, as is the case with rails, frost may very greatly affect them.

Sandberg's conclusions, from 20 experiments, are thus given:

"(1). That, for such iron as is usually employed for rails in the three principal rail-making countries (Wales, France, and Belgium), the breaking strain, as tested by sudden blows or shocks, is considerably influenced by cold; such iron exhibiting, at 10° Fah., only from one third to one fourth of the strength which it possesses at 84° Fah."

"(2). That the ductility and flexibility of such iron is also much affected by cold: rails broken at 10° Fah., showing, on an average, a permanent deflection of less than one inch, while the other halves of the same rails, broken at 84° Fah., showed a set of more than four inches before fracture."

"(3). That, at summer heat, the strength of the Aberdare rails was 20 per cent greater than that of the Creusot rails; but that, in winter, the latter were 20 per cent stronger than the former."

Sandberg suggests that this considerable decrease of toughness at low temperatures may be due to the "cold-shortness" produced by the presence of phosphorus. Our knowledge on this point must remain imperfect until similar experiments have been made with iron free from phosphorus.

The practical result of the whole investigation is that iron and copper, and probably other metals, do not lose their power of sustaining "dead" loads at low temperatures, but that they do lose, to a very serious extent, their power of sustaining shocks or resisting sharp blows; and that the factor of safety in structures need not be increased in the former case, where exposure to severe cold is apprehended; but that machinery, rails, and other constructions which are to resist shocks, should have large factors of safety and should be most carefully protected, if possible, from extremes of temperature.

MEDICAL SCIENCE IN COURT.

Nearly two years ago James Fisk, a managing director of the Erie railway and a prominent man in various steamboat and other enterprises, well known, doubtless, by fame to many of our readers, was shot by the hand of an assassin. The scene of the tragedy was at the Grand Central Hotel, on Broadway, in this city. Fisk had just entered the premises, and was in the act of ascending the stairway of the ladies' entrance, when he was shot by a person standing on the landing above. The ball entered his abdomen just above the navel and passed obliquely downward through the intestines, lodging in the muscles of the thigh. Another ball made flesh wounds in the arm. The assassin was Edward S. Stokes, who was almost immediately arrested and lodged in jail, while the wounded man at once received medical attendance in the hotel, where, after lingering until the following day, he died.

Stokes has had three trials. On the first, the jury failed to agree. On the second, he was found guilty and sentenced to death. But the Court of Appeals, in consequence of certain informalities in the proceedings, ordered a new trial. This third trial has just been finished, resulting in the finding of the prisoner guilty of manslaughter in the third degree. The highest punishment of the law, four years in the State prison, was immediately pronounced, and thus has terminated one of the most remarkable cases in criminal jurisprudence.

To the superficial observer, the result of the trial seems strange enough. Here was a man ruthlessly shot down in broad daylight, and the shooting clearly brought home to the accused; yet he escapes with a comparatively slight punishment. It is even stated, on good authority, that nine of the jurors were in favor of an absolute acquittal, and consented, with great reluctance, to the verdict given. The questions naturally arise: What basis had these jurors for such a verdict, and why, if Stokes shot Fisk, was he not found guilty of murder?

The defences were: 1. That Fisk had threatened to shoot Stokes, that on this meeting he drew his pistol, when Stokes discharged his revolver in self defence. 2. That the previous threats of Fisk had affected the mind of Stokes, and that at the moment of the shooting he was insane. 3. That Stokes did not shoot with intent to kill. 4. That the death of Fisk did not result from the shooting, but from poisoning by malpractice of the doctors after the shooting. It is to the evidence pertaining to this last theory of the defence that we wish to direct attention, for it involves the testimony of some of our most distinguished physicians, acting in the capacity of scientific experts.

From this evidence, it appears that Fisk was attended by seven doctors and surgeons, all prominent men in this community, namely, Drs. Carnochan, Tripler, Steele, White, Sayre, Fisher and Wood. In the multitude of counsel, there is generally supposed to be wisdom; but it seems to have proved otherwise in this case. Dr. Tripler began operations by deeply probing the distressing wound, an injudicious proceeding, according to some of the medical experts. Subsequently Dr. Fisher, Dr. Wood and Dr. White each used the probe. Several glasses of brandy and water were administered, also chloroform and morphine. The latter was administered by the mouth, and by subcutaneous injection, six times within four hours.

Dr. Wood testified that he told Drs. Fisher and Tripler, who were the choice of Mr. Fisk as attendants, that they had two lives on their hands, Fisk's and Stokes', and must administer the opium with their fingers on the pulse and watch carefully the condition of Fisk's pupil and of his intelligence. He ascribed Fisk's death to shock, but admitted that the latter symptoms, such as stertorous breathing, were symptoms of opium poisoning. He had heard of many cases of recovery from serious wounds in the intestines; he had seen, in cases of hernia, a portion of the intestines slough away and the patient recover; he did not, in the light of authenticated cases, consider Fisk's wound necessarily fatal.

Dr. John M. Carnochan, the distinguished surgeon, reached Fisk's bedside some seven or eight hours after the shooting. He did not think, when he saw Mr. Fisk, that he exhibited the symptoms of shock; he had reacted; he thought the giving of two and a half grains of morphia—thirty drops—hypodermically was a most dangerous way of using opium; it was, he believed, at least the cause of his premature death, that is, that it hastened his death. He thought Fisk could not intelligently have made his will, if he was laboring under shock. He related cases, that he had known, of penetration of the bowels which had not proved fatal. On cross examination, Dr. Carnochan said that he found Fisk, when he reached him, in an unnaturally somnolent condition; the wound did not kill him, the morphia did: there was a possibility that the wound had something to do with it, but he had none of the usual symptoms immediately following injury from a gunshot wound; there was nothing to indicate that he was suffering in any manner from the wound; it was a very dangerous wound, but not necessarily a fatal one. Q. You would expect him to get well? A. Of course I would.

Dr. Gurdon Buck testified that the wound was alone sufficient to account for death, and that the use of opium he regarded as a proper treatment; but some of the symptoms agreed with those of opium poisoning.

Dr. A. B. Crosby testified that he would consider such a wound fatal.

Dr. Thompson, professor at the university, explained that death from shock arose from enfeeblement of the heart, while death from narcotism arose from coma or from the head. Probing, in abdominal wounds, while the shock lasted, he thought should rarely be resorted to. Chloroform was contra-indicated by shock. It should not be used while shock lasted. He thought he had seen death result from the administering of twenty drops of chloroform. He described at length the symptoms of opium poisoning, which ends in coma, and declared that, in death by shock, though there might be insensibility, that was different from coma. Snoring was utterly inconsistent with shock. Deep breathing was the clear mark of recovery from shock. He declared that the symptoms described indicated that Mr. Fisk had recovered from shock. He thought the length of time excluded entirely the idea of death from peritonitis, and the only conclusion was that he died from an overdose of morphia.

Dr. Macready was examined as an expert on the effect of the wound, and the effect of the morphia administered. He was inclined to think, from their describing the doses by drops, that one half more had been given than was supposed, as ten drops would be fifteen minims. The administering of morphia hypodermically nearly doubled its power. He was strongly of opinion, from the description of the case, that Fisk did not die from shock or peritonitis. There was not enough peritonitis to produce death, and the development of the symptoms were not those of shock. The symptoms were those of inflammation of the brain or uræmic or narcotic poisoning. There being no disease of the brain or kidneys, he ascribed the death to an excess of narcotics.

Dr. Marsh, deputy coroner, testified that he made the *post mortem* examination. In his opinion the death of Fisk was due to shock and peritonitis. But the latter was not sufficient of itself to have caused death. As to narcotism, he did not make any examination. Subcutaneously administered, one twenty-third part of a grain of morphia had been fatal. Taken in the stomach, two grains had been fatal. As to wounds in the abdomen, in the Crimean war ten per cent of those wounded had recovered; in the recent rebellion war, twenty-five per cent had recovered.

Judge Davis, in submitting the case to the jury, made an elaborate and excellent charge. He solemnly warned them against allowing themselves to be influenced by any feelings of prejudice either for or against the prisoner. They must be wholly governed by the evidence before them. In reference to that branch of the defence here under consideration, the Judge was very clear and explicit. "If morphine, improperly administered, either as to the manner or as to the quantity, caused the death of James Fisk, Jr., on the 7th of January, 1872, not as an accelerating cause, but an independent cause, being in itself the sole agent producing death at that time, then the prisoner is not chargeable with the death, because another and an independent agent produced that result, in which his act—the wound he caused—did not occur. * * I charge you, as the law on this subject, that if you come to the conclusion that the medicines administered were the sole cause of death, and at the same time that the prisoner intended to kill, that he fired the fatal shot with intent to kill, and inflicted a wound with that design, then it is your duty to convict him of an attempt to commit murder in the first degree." In view of this charge, and the medical evidence, it would seem as if the jury had reason for giving the verdict they did, independent of the other points of the defence, which were well sustained.

THE GOVERNMENT BOILER TESTS.

We have already announced the appropriation by the Government of $100,000 to be expended in an extensive and exhaustive series of boiler trials at Sandy Hook and at Pittsburgh. Although it was intended to conduct these tests during the past months of September and October, it has been found that the extent of the necessary preparation has caused an unavoidable delay, existing up to the present time. Now, however, it seems that the experiments will be begun at once, and some 20 workmen are engaged at Sandy Hook setting up the ten boilers to be employed. The latter are of the best material and construction, and will be placed in the position in which they are usually located upon steamers. The bomb proof shelter is to be built at a distance of 260 feet from the boilers. Suitable pyrometers, thermometers, and other necessary instruments will be supplied, and self-regulating gages are to be buried in the earth near the boilers.

The Government Commission consists of the following gentlemen: Supervising Inspector Addison Low and C. W. Copeland, of New York, J. H. Robinson, of Boston, Supervising Inspector John Menshaw, of Baltimore, J. V. Holmes, of Ohio, Benjamin Crawford and Supervising Inspector John S. Devinney, of Pittsburgh. The experiments will be mainly to determine the truth or fallacy of the various theories as to the causes and conditions of boiler explosions, which theories are briefly:

First: Explosions caused by the gradual increase of steam pressure.

Second: Those caused by low water and overheating of the plates of the boiler.

Third: Those caused by deposit of sediment, or incrustation on the inner surface exposed to the fire.

Fourth: Those caused by the generation of explosive gases within the boiler.

Fifth: Those caused by electrical action.

Sixth: Those caused by the percussive action of the water in case of rupture of boiler in the steam chamber—Clark & Colburn theory.

Seventh: Those caused by the water being deprived of its air.

Eighth: Those caused by the spheroidal condition of the water.

Ninth: Those caused by the repulsion of the water from the fire surface or plates.

The Sandy Hook trials will extend over several days, and the results will be duly noted on these columns. The Pittsburgh tests will begin on November 12; and on their completion the Commission will return to Sandy Hook, with a view of experimenting upon various safety valves.

SCIENTIFIC AND PRACTICAL INFORMATION.

SPIRITUALISM NOT PATENTABLE.

Spiritualism fails to meet with official recognition in the Patent Office of the United States. "Psychic stand" was the name of the device on which a Massachusetts inventor wanted a patent, because, as he stated, it would spell out words and sentences known as spiritual communications "through an alphabet not only invisible to the operator, but the very location of which he cannot know." "Moreover," he added, "the mode of its operation precludes all possibility of trick or imposture." The obdurate examiner, however, not only refused to perceive the peculiar merits of this useful invention, but gave, as an opinion, that spiritual manifestations are "largely mixed with ignorance, deception, and fraud." The Office, it is stated, offered to issue letters patent on the contrivance as a game table, thereby adding insult to injury on the exasperated inventor, who, shaking the dust of the capital from his feet, departed in a state of indignation bordering on absolute ferocity. The alleged offer of the Patent Office to issue the patent for a game table seems to us quite improbable.

THAT EASTERLY CURRENT.

An attempt was recently made at San Francisco to find the easterly current, and by its aid to reach New York by balloon in a few hours' time. The machine took a fine start, having on board three passengers, who, instead of finding the breeze they wanted, struck a westerly current and came down in the Pacific ocean, happily near the shore. The balloonists were received by boats and had a narrow escape.

Donaldson made another ascension a few days ago from Newark, N. J. He found the easterly current, which took him over the cities of New York and Brooklyn, landing him near Roslyn, L. I. In attempting to reach the earth, the car was swept violently against a stone wall, and the aeronaut was considerably bruised.

PETROLEUM IN BURMAH.

According to the report of Captain Storer, agent for the British Government, there are at present about 150 wells worked at Yegnangyoung, which yield 62,500 barrels of oil a year. At Pagan there are about 50 wells. The oil from these wells is obtained in a more liquid state, and more resembles naphtha. It is of a brackish nature, and is better suited for lighting purposes than the Yegnangyoung oil.

AMERICAN LIGHTHOUSES.

Last year the Lighthouse Board of the United States had under charge 179 sea and lake coast lights, 394 river and harbor lights, 22 lightships, and 33 fog signals operated by steam or hot air engines, besides large numbers of unlighted beacons and buoys. Naturally the great diversity of the conditions under which the American lighthouses have to be erected, and the fact that the great extent of coast has necessitated the division of the work of superintendence into thirteen districts, each with its own engineer, have led to considerable variety of design, and we illustrate herewith two of the lighthouses lately erected by the Board, the first engraving showing the Race Rock lighthouse, and the second engraving that at Thimble Shoal, at Hampton Roads, Va.

The Race Rock lighthouse, at the eastern entrance to Long Island Sound, is one belonging to the third district, of which Colonel I. C. Woodruff is engineer. The general design of the structure is shown by the engraving, and we need merely add here that the foundation consists of about ten thousand tuns of riprap stones, weighing from three to five tuns each. The foundation was completed in November, 1871.

LIGHTHOUSE AT RACE ROCK—EASTERN ENTRANCE TO LONG ISLAND SOUND.

The Thimble Shoal lighthouse is in the fifth district, of which the engineer is Major Peter C. Hains. This light has been erected to take the place of the Willoughby Spit light ship, and it is situated on the shoalest point at the entrance to Hampton Roads. A start was made with this lighthouse in May, 1872, and on the 10th of June of that year the platform, which the screwing of the piles into the shoal was carried on, was completed. The shoal proved to be very hard, consisting of fine compact sand, but by the 1st of August, 1872, the last pile was planted. The light is of the fourth order, and the general design of the structure is very neat.

We may add, says *Engineering*, to which journal we are indebted for the illustrations, that the chairman of the Engineering Committee of the United States Lighthouse Board is General Barnard, and the engineer secretary, Major George H. Elliot.

LIGHTHOUSE AT THE THIMBLE SHOAL, HAMPTON ROADS, VA.

The Cocuyo.

M. de Dos Hermanos has recently succeeded, after considerable trouble, in transporting from Cuba to France some fifteen hundred living cocuyos. These insects he has submitted to the French Academy of Sciences, for dissection and general examination.

The cocuyo appears in Cuba generally toward the end of April, after the first rains, and abounds in wooded places and cane fields. It emerges at twilight, but its nocturnal promenade lasts barely over two or three hours. In hollows of trees, under masses of shrubs, among the young portions of cane plantations, it finds favorite places of concealment, feeding upon tender leaves, the soft substances found in old trunks of trees, and analogous materials. It appears that dampness is a condition essential to the insect's existence.

At about the end of July, the cocuyo disappears; but insects may be kept imprisoned in baskets or cages, if carefully guarded and nourished, until September or October. The cocuyo should not be confounded with the aquacero, a name given to an insect exactly resembling the former but hardly one third its size. The aquacero remains out and shows its phosphorescent light during the entire night. The brightest radiance of the cocuyo is found in the ventral region; and it appears at its greatest splendor when the insect flies or is dipped in water. Although completely inoffensive to man, the cocuyo is of quarrelsome disposition, since it attacks its fellows in a terrible manner, especially when a number are confined together. The claws form its offensive arm, with which it often penetrates the neck of its adversary so completely as to separate the thorax from the body. It frequently loses its weapons by the operation, M. de Dos Hermanos mentions instances where the insect has nevertheless continued to exist for some months afterward. The mutilation of the members doubtless hastens death, the approach of which can be foretold by the darkening of the eyes which, when the cucayo is in a state of health, are of a yellowish white. MM. Robin and Laboulbène have taken up these interesting insects as subjects of investigation, and we find their report in full in a recent issue of *Les Mondes*. Several cacuyos have been dissected, and it is stated that, independently of the two phosphorescent organs (which are very apparent in the form of oval shaped dusky yellow colored spots, situated one on each side of the dorsal face, behind the corselet), there exists a third, different from the others. The latter appears to be a large plate, of a yellowish white tinge, placed on the ventral face of the body, between the thorax and abdomen. The insect exposes and render it luminous at will, especially when the elytræ and wings are spread and the abdomen a little turned toward the dorsal portion. Whenever one of these dorsal or ventral organs is uncovered, its moist and brilliant surface darkens in color, and slow irregular movements, due to the contraction of the striated muscular bunches which are inserted in the lower face, supervene. Sections of the different organs show that they are lenticular in form, about one third as thick as broad, and are contained in a deep adipose envelope. The latter is entirely formed of very large cellules, containing numerous fatty globules, as in the adipose tissues of insects; and it has very many healthy vessels in comparison to the rest of its structure. The tissue proper (semi-transparent and damp, forming the central portion) is the most voluminous. It is composed of cellules which do not differ sensibly from those which constitute the luminous organs of the *lampyræ*. These cellules are closely contiguous to each other; and between their adjacent faces, are found only wind pipes and nerve tubes, with the exception of which the mass of the tissue thus constituted may be subdivided into lobes and lobules.

Brown and Linnæus have already pointed out that the luminous production of the *pyrophorus* is governed by its will. The light appears first at the center of the organ and then extends over its whole surface, becoming more brilliant and greenish as its area enlarges. It is well known that, during repose and outside of all nervous influence, the electrogeneous apparatus of fishes passes to a state of electric tension more and more pronounced, from which the fishes free themselves suddenly when they so desire or when under the experimental influence of such and such physico-chemical action. Now in the present case, consider the investigators, the probabilities are that the phosphorescent tissue produces little by little a substance which accumulates slowly in the producing cells themselves independently of all nervous influence, by operations of the same order as those of various secretions, and that the only act by which the discharge takes place is voluntary. The principle which renders luminous during several minutes the substance of broken cellules acts like noctilucine, a nitrous coagulable phosphorescent principle obtained by Phipson from the luminous mucus of certain scolopendræ, fishes, etc. It is a natural principle of little stability, of which the chemical and molecular segregations take place as soon as it becomes free, and which manifests itself by a production of light alone, without heat and in a manner similar to that caused by the accidental decomposition, putrid or not, of different kinds of tissue, mucus, sugars, etc.

The abundance of urates in the substance of the cellules where the disengagement of light takes place, it is believed, indicates that uric acid is one of the crystalizable components resulting from the photogenic decomposition of the above mentioned coagulable substance, since it is gradually eliminated, like the crystaline principles of similar dis-assimilations.

In St. Andrew's church, Dublin, an excessive reverberation of sound has been checked by stretching wires across the building.

A NEW IMPROVEMENT IN GAS MANUFACTURE.

There are few subjects of public importance which are just at present engaging a greater share of the attention of scientific men than the economical production of illuminating gas. The English technical journals—owing in no small measure to the recent coal famine, coupled with the knowledge of the fact that, of the hundred millions of tuns yearly drawn from the mines of the kingdom, fourteen per cent of the aggregate amount is used for lighting purposes, and hence rendered unavailable for industrial or domestic employment—have, of late, been filled with references to the manufacture of gas from petroleum products, resinous substances, and from coal by improved and less expensive systems.

In our own columns we have already presented our views, as well as those of many valued correspondents, regarding the advantages to be derived from the general adoption, in this country, of processes for the utilization of other materials than coal for the purpose noted. Several valuable systems have been patented; and notably some for the use of petroleum and other hydrocarbon oils are in actual employment. Of the relative merits of the different plans, or as to the estimation in which they are held by those using them, it is not our intention here to speak. Suffice it that, considering any or all in comparison with the employment of coal solely, the question of cost of transportation of the latter forms an important argument in their favor; and hence, so far as we can learn, gas companies and engineers generally manifest no lack of willingness to entertain or experiment upon suggestions or inventions having for their first object the reduction of this very material item of expenditure.

As an instance in proof of this latter assertion, the Citizens' Gas Light Company, of Brooklyn, N. Y., have recently introduced, in their works, apparatus for the manufacture of hydrogen, by the decomposition of steam under the Gwynne-Harris or American hydrocarbon process, and also for the preparation of naphtha gas, both of which products are mingled with that obtained in the ordinary way from coal. As a result, we are told that, as against 28 benches or 140 retorts in use in October, 1872, at present but 14 benches are employed, two of which generate hydrogen, two naphtha gas, and the rest coal gas, supplying the full amount required, and yet working only from 14 to 15 hours per day. The process, briefly stated, is threefold: first, coal which produces the ordinary quantity of gas, but of inferior quality, is carbonized in separate retorts; second, hydrogen, generated in the manner about to be described, is mingled with the coal gas, giving it high incandescent power, and, besides, taking up hydrocarbon vapors which otherwise would be lost; third and last, naphtha gas, or any of the petroleum products, which may be made of almost any richness that it is possible to burn, is led into this mixture, insufficient proportion to produce the requisite degree of illuminating power. In other words, coal gives coke for fuel to run the works, and common gas; hydrogen takes up the carbon vapors, and adds heat to the flame; thus creating more perfect combustion; and naphtha increases the lighting power to any desired standard.

FIG. 1.

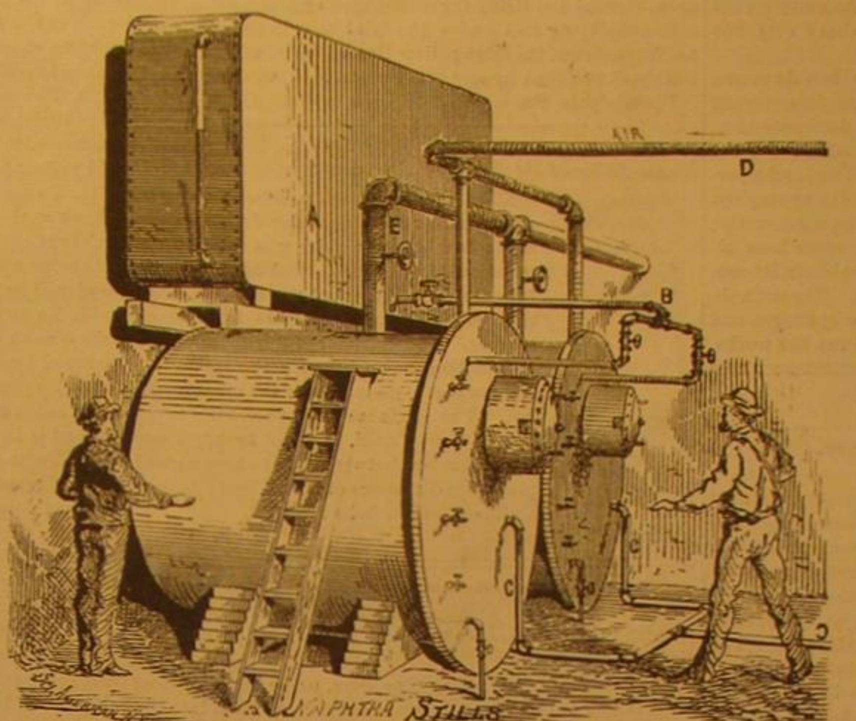
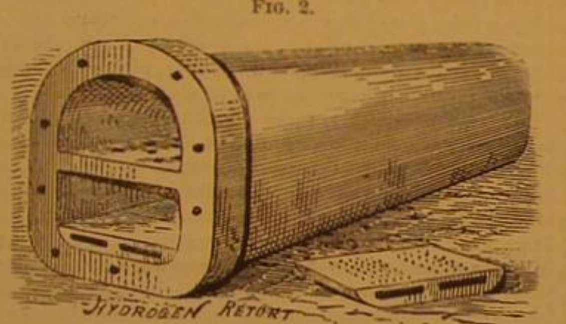


FIG. 2.



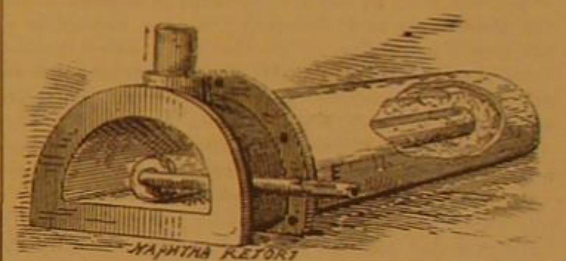
Using coal alone, we are told that 9,026 feet of gas per tun was about the yield with the full complement of benches. Now, 13,000 feet of coal gas and hydrogen mixed is produced, or an average of about 6 feet per pound of coal, which may be increased by increasing the hydrogen.

As the hydrogen and naphtha processes are quite distinct, we shall refer to each in detail, separately. In our large engraving (Fig. 4) the artist has shown the exterior of the hydrogen bench, and in the smaller engraving (Fig. 2) is represented one of the retorts here used. The latter, though of the general shape and of the same material as the ordinary gas clay retort, differs from it in that it has a diaphragm extending horizontally across the center, forming a double retort, and is, besides, covered at the bottom with tiles, one of which is represented separately. The diaphragm is perforated with medium sized openings. The tiles have smaller holes in their upper surfaces, communicating with other apertures which, when several tiles are laid side by side, form two longitudinal passages through them. Thus arranged, three retorts are placed in each bench, in the usual manner, and, when in use, are filled with anthracite coal. Once in a day, the coal is raked back, and about a bushel of anthracite is thrown in; and once in each week the retorts are refilled.

From an ordinary cylindrical boiler, steam is led to a superheater, and thence to the vertical pipe, marked A in our large engraving (Fig. 4). Following its course for the retort on the right, the steam escapes from tube, A, into two pipes which lead to the dryers, the ends of which are represented at B. Near the junction of the pipes with tube, A, are placed suitable valves to regulate the supply. The dryers, B, are made double; that is, the steam enters an inside metal tube, by which it is carried back five feet into the bench, and then passes to and through an inclosing metal tube, back to its starting point. This is intended to prevent any wet steam from reaching the clay superheaters or retorts in the bench; and, finally, the steam passes out by two upwardly leading pipes, which terminate each just above a retort, at C. At the latter point, each pipe connects with a short tube which joins it with clay superheaters placed just above the retorts, so that the steam, entering at C, travels to the rear of the superheater, which is five feet in length, and then returns, highly heated, in an opening parallel to the front, making its exit by the tubes, D. In the latter it is conducted down under the lower portion of the retort into the longitudinal passages formed through the tiles. Hence, it escapes up through the perforations and through the incandescent coal, and is decomposed, forming hydrogen and carbonic oxide gas.

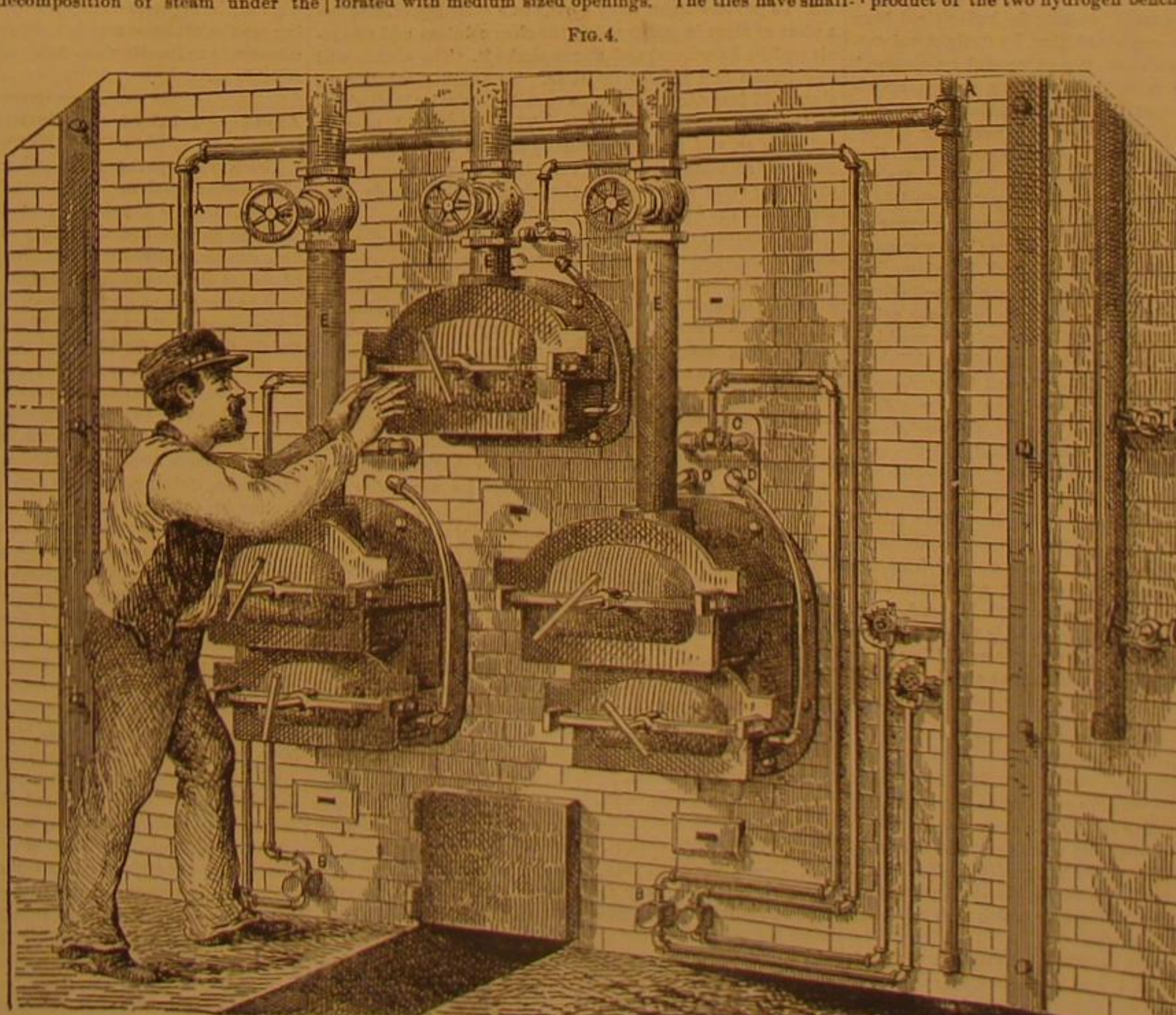
The gas thus generated by this American process passes into the hydraulic main, and thence is conducted to mingle with the gas generated by the bituminous coal retorts. The product of the two hydrogen benches is in the neighborhood of 100,000 feet per day, and its estimated cost is, at outside figures, 20 cents per 1,000 feet.

FIG. 3.



The naphtha employed is deposited in a suitable reservoir at some distance from the works, whence it is pumped as desired into a tank, marked A in Fig. 1. This receptacle receives its supply in order to deliver it by the pipes, B, into the two huge cylindrical stills. Within the latter is a worm pipe which is filled with steam from the boiler by the pipes, C. By means of a fan blower in the engine room, a current of air is driven into the stills by the pipes, D, which mingles with the vapor of the naphtha given off through its heating by the interior steam coil. The gas then passes from the stills by tubes, E, into the works, where it enters peculiarly arranged retorts, one of which is shown in Fig. 3. It will be noticed that the vapor is conducted

FIG. 4.



IMPROVEMENT IN GAS MANUFACTURE—THE HYDROGEN RETORTS to the back of the receptacle by a pipe, whence it escapes.

After heating, the gas is conducted to a condenser, where it passes through a series of pipes surrounded by cold water, and from which it is drawn by an exhauster and carried to the station meter, whence it goes to the main to mix with the coal and hydrogen gases. About 300 feet of gas per minute are thus made, a gallon of naphtha giving some 135 feet. This is of a uniform quality of 22 candle power.

The mixture of the three gases, as supplied to consumers, averages about 18 candles; and by carefully observing proper proportions in combining them, we learn that a very fine silver white light is obtained.

The process is unquestionably one of considerable economy to the gas company, as is evident from the large saving in the number of hands employed, due to the decreased number of benches used. Moreover, the raw material for the hydrogen, or anthracite gas, costs almost nothing, and a portion of the anthracite coal used is available for re-employment as fuel under the steam boiler. Naphtha is not costly; no cannel coal is required, and the gas coal, as we have already observed, is of the type only serviceable in its production of the usual quantity of inferior gas. The main object of the bituminous coal benches, where hydrogen and naphtha are used, is to make coke for fuel to run the works.

Correspondence.

The Perpetual Motion Seeker.

To the Editor of the Scientific American:

Perhaps no enthusiasts are more contemptuously regarded by society in general than those who waste their energies in searching for a perpetual motion. Even persons who have little or no knowledge of the principles of mechanics never fail, upon a mere mention of the subject, to testify unmeasured disapprobation of the fruitless scheme, and, as a term of reproach to any whose visions appear to be Utopian, speak of their efforts as "savoring too much of perpetual motion." Orthodoxy regards the victim of this hallucination as an object of horror, his pursuit showing that he believes he can create; men of science avoid him altogether, or, at best, regret the ignorance that prevents him from appreciating the fact that motion is an equivalent term for expenditure; and the whole world expands into a broad smile when the victim of this very prevalent mental disorder reveals the weakness that possesses him. It is lamentable and extraordinary that at this day, when no end of opportunity is afforded to even the poorest person to thoroughly educate himself in all branches of knowledge, no less than one hundred thousand individuals in the United States alone are wasting time and substance in this seductive and barren pursuit. So infatuated do they become by long application that defeat but stimulates desire, until, disappointed, impoverished, disheartened and despised, the poor victim often seeks the suicide's grave.

An opportunity was afforded me some months since to interview a veritable perpetual motionist, who was said to have expended fourteen thousand dollars in constructing models, and who now believed himself upon the verge of reaping the reward of his exertions. A ride upon a street railway car to the end of the route, and a walk across open lots brought us to his cottage, whither he had retired from the crowded city, as he explained, that he "might uninterruptedly pursue his invention to a successful conclusion." We were permitted to enter the workroom containing his last model. It consisted of the usual combination of gear wheels, balance weights, springs and compensating levers; it was of very large dimensions, and so elegantly made that we at once recognized him as a superior mechanic. He experienced much satisfaction in explaining the principle of its operation; he talked learnedly of "the surplus power retained by relative levers of unequal fulcrum;" he was querulous on the subject of a criticism which his views had evoked from some previous visitor; he spoke feelingly of the "untimely death of Thomas Babbage, who was called away on the very eve of completing his calculating machine,—thereby giving a victory to those who doubted his ability to accomplish the object of his ambition"; and he expressed a hope that he himself might live to rebuke a cold world, by giving it what it scorned to believe possible, a powerful self-motor. His wife, a pale anxious woman, had left the sewing machine at which she had been at work (and which was doubtless the chief support of the family) and, accompanied by her little son, listened to the conversation. Our failure to acquiesce in her husband's views gave her a moment's apparent concern; but the cloud passed quickly from her mind, and she manifested the touching confidence of a woman's loving nature. George Howard is dead. His model was purchased by a speculator who is now applying a secret actuating attachment, preparatory to exhibiting it, in our large cities during the coming winter, as a real perpetual motion.

FORFEX.

The Lamp and the Spectroscope.

To the Editor of the Scientific American:

For the benefit of those who have met with difficulties in examining a spectrum, caused by extraneous light emitted by the Bunsen flame used to render the substance under examination incandescent (especially when the flame is colored by the salts of strontia, lithia, etc.), and also the light emitted by the flame used for illuminating the scale, permit me to describe a simple piece of apparatus which very effectually shuts off the extraneous light.

While recently engaged in examining the spectra of the alkalies and alkaline earths, I was exceedingly annoyed by difficulties from the above named sources; and I cut a circular piece of cardboard about nine inches in diameter, with a hole in the center large enough to slip on the extremity of the collimator tube, carrying the slit and the prism of comparison. This entirely conceals the light of the Bunsen flame. If you cut a second piece, of a similar size and shape, and slip this on the eye piece of the telescope, or on the tube carrying the scale, by inclining it at a proper angle (which may readily be determined by the experimenter) a point will be reached which shades the eye from the second light. One of the chief merits of the plan is that, instead of keeping one eye shut, as was formerly the case, both eyes can be open, thereby not tiring the disengaged eye.

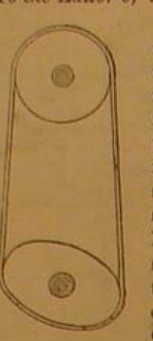
By employing this device the faint lines in the spectrum, as, for instance, the faint yellow line of lithia, are more distinctly shown than by any other means.

C. A. DAVIS.

Philadelphia, Pa.

Elliptic Pulleys.

To the Editor of the Scientific American:



Elliptic pulleys, such as here shown and now used at this place for driving automatic machines requiring a differential movement, are found efficient substitutes for elliptic gearing; and where applicable, they will be found preferable for obvious reasons. The diameter of the upper pulley should be a mean between the transverse and conjugate diameters of the elliptic pulley. The distance between centers of shafts, as now used, is about twenty times the difference between the transverse and conjugate diameters of the elliptic pulley. Ordinary leather belts are used.

New Britain, Conn. F. H. R.

Simple Experiments for Young Chemists.

1. An easy way to prepare an invisible gas, that will burn with an intense heat, is to put some nails or strips of sheet zinc in an old bottle with a good, tight cork. The cork has a hole bored in it, and a clay pipe stem, or better, a piece of glass tubing with a fine opening at one end, is fitted into the cork. The zinc is covered with water and a little sulphuric or other acid added. The effervescence is violent; and if the cork is put in, the gas will escape through the tube. After waiting several minutes, wrap the bottle in a cloth and apply a match to the end of the tube, when the gas will take fire and burn with a colorless flame. If any air still remains in the bottle, an explosion will take place. Hold a cold white saucer in the flame, and it will soon be moistened but not blackened. This gas is called hydrogen, because, when it burns, it forms water.

2. To imitate the delightful odor of rotten eggs, it is only necessary to place some pieces of the sulphuret of iron in an old bottle and pour on water and oil of vitriol. The sulphuret of iron is made when iron filings and sulphur are heated together. If the bottle in which this vilely smelling gas is prepared has fitted to it a tight cork and a glass tube bent so as to conduct the gas under the water in a second bottle, much of it will be dissolved and can be bottled up and preserved for several days. This gas is called sulphydric acid, and must always be prepared out of doors.

3. To produce light, flaky clouds in a clear liquid, dissolve a piece of alum in water and to the clear solution add ammonia (spirits hartshorn) and stir or shake it. The clouds will be colorless and almost invisible. To another solution of alum, add just enough carmine or indigo to color it distinctly, then pour in some ammonia. The clouds will now be red, or blue, and as they gradually sink to the bottom will leave the solution colorless. This illustrates the method of preparing what are known as "lakes." The clouds thus formed are the hydrated oxide of alumina.

4. To convert a colorless liquid to an orange red, dissolve some tartar emetic in water and drop in some of the solution of the vilely smelling sulphydric acid. (See No. 2.) Next put some tartar emetic into a bottle with zinc and sulphuric acid, as described above (No. 1) for making hydrogen. After waiting long enough for all the air to be expelled, ignite the gas and place a cold saucer in the flame, when it will be blackened; and the spot thus formed, which is metallic antimony, will not dissolve in a solution of bleaching powder.

5. Analogous experiments could be performed with acid solutions of arsenic, but, owing to its poisonous nature, we would advise our young friends to avoid its use. The sulphydric acid would form a yellow precipitate instead of a red one, and the black stain on the saucer would be readily dissolved by chloride of lime, or bleaching powder.

6. To produce a strong smell by mixing two dry powders, each without smell, take pulverized sal ammoniac and stir in a little dry whitewash lime. A pungent ammoniacal odor is evolved.

7. In one tumbler or wine glass of water, place a single drop of oil of vitriol, in a second place some carbonate of ammonia, in a third some hydro-fluo-silicic acid and alcohol, in a fourth some bichromate of potash. Drop into each of these glasses some barium chloride. In three of them a white precipitate is formed, in the fourth a yellow one. Dip a clean platinum wire in the barium chloride; then hold it in a colorless gas or alcohol flame, and a green color is produced. The green fires in theaters are made with this substance.

8. To convert a fair complexion into one of African hue, persuade some fair lady to improve her complexion with bismuth pearl powder (many do it voluntarily); then let her enjoy the perfume of the sulphydric acid, and she will gradually blacken. A curious instance of the action of water on an acid solution is noticed by dissolving subnitrate of bismuth in muriatic acid, and then pouring it into a glass of water, when it gives the latter the appearance of milk.

9. To prepare a gas heavier than air, place some pieces of chalk or marble in a deep jar, or in a bottle like that used for hydrogen, and pour some muriatic acid on them. Effervescence takes place, and a taper lowered into the jar is extinguished; or if the gas, which is called carbonic acid, be collected in another vessel, it may be poured from one vessel to another like water. The substance formed when marble is dissolved in muriatic acid is called calcium chloride, and may be used for some interesting experiments: Fill three glasses with water, and to the first add a little sulphuric acid, to the second some carbonate of ammonia, to the third some oxalic acid and ammonia. On pouring the solution of calcium chloride into these glasses it will in every case form, unless too dilute, a milky liquid.

10. To produce an intensely blue liquid, make a solution of blue vitriol, so dilute as to have but a faint color, then add ammonia, and it becomes intensely blue. To another portion, add yellow prussiate of potash and it turns a reddish brown.

11. To make blue glass, bend a piece of platinum wire to a hook at the end and heat red, then touch it on a bit of borax and heat until the latter melts to a little bead. Now dip it into some nitrate of cobalt and heat, when a fine blue glass bead will be formed.

12. To form a yellow precipitate, in a yellow solution, take a weak solution of bichromate of potassium and add sugar of lead; the effect is very pretty.

13. To produce a beautiful purple, take a dilute solution of chloride of gold and add a little chloride of tin; the color formed is known as purple of Cassius.

14. To pour red, blue, and black ink from one bottle, fill three glasses with water, and into one put a little sulphocyanide of potassium, in another some yellow prussiate of potash, in a third a solution of gallic acid, or nut galls. Dissolve a small nail in muriatic acid and dilute the solution. On putting a drop of this chloride of iron into each of the glasses, the three colors will be produced.

15. Yellow and white can be formed similarly by pouring acetate of lead into glasses containing bichromate of potash, and sulphuric or hydrochloric acid, respectively. The white chloride of lead dissolves in boiling water and crystalizes on cooling. Sulphydric acid blackens lead.

16. Red, yellow and black are produced as follows: put some potassium iodide in one glass, bichromate of potash in a second, and sulphydric acid in a third. Pour corrosive sublimate slowly into each, and the three colors will appear. Into a clean glass put a little corrosive sublimate and add potassium iodide, carefully; the color becomes intensely red, but on adding more it disappears entirely, and can be restored by the addition of more of the sublimate.

17. One other way to make a milk-like liquid is to pour phosphate of soda into a solution of magnesium sulphate.

18. When a piece of silver is dissolved in nitric acid and some muriatic acid added, all the silver is precipitated, and the precipitate may be dissolved in ammonia, or a piece of zinc may be placed in it and acidified, when the silver will all be restored to the metallic state as a fine black powder.

We hope the above experiments will prove an amusement for many of our young readers; and when they become experts in exhibiting these "tricks of magic," as we might have called them, they will have also gained some knowledge of the methods employed by analytical chemists in testing for the common metals. Even practical men, who need sometimes to handle chemicals, will find that the above are reliable tests.

Another Trial of the Gatling Gun--One Hundred Thousand Rounds Fired.

The Navy Department, in order to determine the quality of the solid head metallic cartridges made by the United States Cartridge Company, Lowell, Mass., and to test the working powers and durability of the Gatling gun of $\frac{50}{100}$ inch caliber, ordered that one hundred thousand cartridges of $\frac{50}{100}$ caliber (containing United States service charge) be fired in the gun at Fort Madison, near Annapolis, Md. The trials commenced on October 23, and lasted parts of two days. On the first day (the 23d) over 30,000 rounds were fired; and on the 24th, 64,000 cartridges were fired, without stopping to clean the barrels; and after this unprecedented test, the gun (without the barrels being cleaned) was fired for accuracy at a target 12 × 12 feet, placed 300 yards from the gun; and out of 30 shots fired, 29 of the balls hit the central part of the target, striking point on and giving good penetration. It may be safely said that this number of discharges was never before made from any arm in the world.

Singular as it may appear, the fouling of the barrels did not increase after 4,000 or 5,000 rounds had been fired. The trials were made under the supervision of Lieutenant Commander J. D. Marvin, United States Navy, commandant of Fort Madison. Many distinguished navy and army officers were present at the trials. During a part of the trials, the gun was fired at the rate of over 400 shots per minute. A drum which supplied the cartridges to the gun, and which contained 400 cartridges, was frequently exhausted in from 50 to 55 seconds.

Of the cartridges used, none of the heads burst, none of the shells failed to extract, and there was only one missfire in about five thousand cartridges discharged. The cartridges are headed by a new process, which prevents injury to the fiber of the metal from compression.

AT THE recent meeting of the British Association, one of the ruled speculum plates of Professor Rutherford, of this city, 2,300 lines to the inch, was exhibited by Mr. Norman Lockyer, who stated that in the spectroscope it gave the same amount of dispersion as a train of twenty or thirty glass prisms. By its aid, movements of the sun's atmosphere as slow as five miles per second could be measured.

AMERICAN ACADEMY OF SCIENCES.

This select body met at Columbia College, New York city on October 28, when Professor Joseph Henry read an interesting paper upon sound, with especial reference to its employment for

FOG SIGNALS.

The principal part of the paper related to abnormal phenomena of sound, of which a number of instances were given. In many instances the sound from a fog signal is heard at a great distance, while it is inaudible at a much smaller distance. This was attributed to the effect of the wind on the sound. As a general rule the sound is heard at a less distance in opposition to the wind, but in one case the sound is always heard at a distance of nine miles against the wind during a northeast snow storm. This anomalous case is accounted for by an upper stratum of wind in an opposite direction to the one at the surface. Another principle which is applicable to the explanation of several of the abnormal phenomena of sound is that it diverges much more rapidly than light, so that a beam of sound produced by a powerful instrument swells out into a cone of sound, and it is on this account that reflectors have not been found to be of much use in enforcing the sound of fog signals.

Our sea coast is the largest in the world, extending over more than 10,000 miles, and a considerable portion of this distance is beset with dense fogs. On the northwestern portion of the Atlantic coast, whenever the wind blows from a southerly direction, it wafts the warm, moist air from over the Gulf Stream to the cold current coming from the arctic region, and passing along our coast between the Gulf Stream and the land; and thus, in the intermingling of the warm and cold air, the vapor of the former is condensed into fog. On the western coast, when the wind blows directly from the Pacific across the colder current from the north a fog is similarly produced. Fog signals, therefore, are almost as important as lighthouses. Accordingly the Lighthouse Board has devoted much attention to this subject; and however our lights may compare with those of other nations, our fog signals are superior to any elsewhere adopted. They consist principally of three instruments, all founded on the principle of resounding cavities, in which the air itself is the sounding body as well as the conductor of sound. The instruments are: (1). The fog trumpet, furnished with a reed and blown by air condensed by an Ericsson caloric engine. (2). The siren trumpet, blown by steam from a high pressure tubular boiler. (3). The ordinary locomotive whistle of large size, blown also by a high pressure engine. These instruments can be heard in perfectly still air at a distance of from fifteen to twenty-five miles.

ON THE CONSTITUTION OF THE SUN'S SURFACE—BY PROFESSOR C. A. YOUNG.

Professor Young, in a brief extemporaneous address, placed before the Academy his latest views on that subject. Every one is aware, he thought, of the fact that, in the present state of science, it is impossible to regard the sun as anything but a gaseous body: the law of density, it seemed to him, could not be reconciled with the solid constitution of that body; and it is difficult to see how it could be liquid, as the liquids of which we know it must be composed are largely metallic liquids. It is safe to say we know that it is mainly gaseous. Another thing might be said. The luminous surface from its appearance has something of the nature of cloud. We find rapid changes in the appearance and constitution of the surface. It is impossible to consider it anything but flocculi floating in gas. But when we come to examine the overlying chromosphere with the telescope, we find evidence of violent outbursts from beneath, of extreme intensity. At first sight, it was thought that it might be only an apparent motion, or the same kind of motion that we see when a flame jumps up from a coal fire, and simply is communicated among particles already in position. But that would not account for the disturbance of the spectrum lines. It is not uncommon to find displacements of the spectrum lines indicating motion (in a line that joins the mass with the observer) of one hundred, and sometimes two or three hundred, miles per second. There is every reason to suppose that these masses, which we see—masses thrown vertically from the sun,—have really velocities of a corresponding magnitude. The question that pressed upon his mind was to reconcile that with the cloudy character of the photosphere. If anywhere, the explanation, he thought, was to be found in the condensation that goes on the photosphere. If the heat of sun is anything very great (it would melt about 40 feet of ice a minute over the whole surface), the amount that is turned from vapor into liquid, that is, the amount of condensation over the surface of the sun, is something very enormous. On the surface of the earth a shower that gives us two inches in an hour is something tremendous. The rain descends in buckets. But the rate is exceedingly small compared with the rate of condensation on the surface of the sun.

Now these droplets so produced would at first descend in fillets, with an accelerated velocity, and therefore growing slenderer as they fall. But soon they would come down to a place where the atmosphere and gases are denser. The materials they would encounter in the first 300 or 400, and still more in the first 3,000 or 4,000, miles would become denser, and the motion would be retarded. They would thicken in it. Besides whatever weight of liquid drops down from the clouds in a minute, that amount of gas must travel upward in order to maintain an equilibrium. That would cause the currents passing upward to be extreme in their rapidity, and the retarding effect would be still greater. It is probable that a good deal of the descending liquid would be evaporated at that point. But it seemed to him likely that the fillets would thicken and begin to coalesce, in which case they would form sheets. In that case we might get a surface something like a sheet of water at Niagara. The mass of the whole sheet would be vertical, and descend until a portion of the sun would be reached where the rapidity of the evaporation would equal the rapidity of the descent. Then it would be something like a series of descending ponds without any bottom to them. If their velocity were retarded entirely, their whole weight would be supported by the underlying atmosphere. The pressure would be something enormous. The gases would be forced up through them, the whole being in the condition of a liquid breaking up, the gas probably taking portions of the liquid and throwing them up. This theory is compatible with that of the gaseous constitution of the sun. But we do not know what to do with the sun spots on this theory any better than on any other theory. Possibly they may be partly solid matter, as has been asserted. In that case, you might get a mass floating on the top of a more liquid portion. One element, which we are much at a loss about at present, is to determine what amount of the sun's mass is to be referred to condensation, and what to dissociation.

Among other papers presented and discussed was one upon

RECENT FISH COMMISSION EXPLORATIONS,

by Professor A. S. Packard Jr., in which some results of the late cruise of the United States Coast Survey steamer Bache, in the shape of rare marine animals, were described. Near Portsmouth the dredge brought up a sea cucumber, *molpodia borealis*, new to the American coast, and tubes of a worm which occurs at the greatest depths off Norway. The latter came from the coldest abyss found during the expedition. The same author also read a paper on the "spiracles of insects," in which the conclusion he has arrived at is that, no known hymenopterous larvæ—that is, the bees and wasps—have more than two pairs of spiracles on the thorax. Certainly at least, on evolution principles, it is considered, we are perhaps warranted, from the indications in existing caterpillars, in concluding that the ancestral type of lepidopterous larvæ was provided with two pairs of thoracic spiracles.

Professsor Hilgard, on the subject of

MEASUREMENT OF VOLUME,

said that the kilogramme which was originally determined to be the weight of a cubic decimeter (61 027 cubic inches) of water, was not an accurate standard, and that there was an uncertainty of 10·1 milligrammes in its theoretic value. It is proposed to use a cylinder having a hight of a quarter meter and a circumference of one meter. The weight of water displaced by it will be nearly 20 kilogrammes, which can be weighed to 10 milligrammes—equivalent to half a milligramme in a kilogramme or to a fraction of one two-millionth. The circumference is to be measured by developing it upon a railway and comparing with a meter. The two rails are a little further apart than half the length of the cylinder

A communication was also received from Rear Admiral Sands, stating that the preparation of instruments, etc., for the observation of the approaching transit of Venus was in satisfactory progress, and that everything will be in readiness at an early day.

Cyrus Wakefield.

Probably few men have ever contributed more largely to the material prosperity of those around them than Mr. Cyrus Wakefield, the announcement of whose sudden death we notice in recent New England journals. As is well known, he was an extensive dealer in rattan furniture, with headquarters in New York and Boston, and a large manufactory in Wakefield, Mass., a town named after him and to which he presented a fine public hall. He was preëminently a self-made man, clear headed, active and tireless in business, and apparently capable of performing labors far in advance of the capabilities of ordinary individuals. Always charitable toward others, his relations with the large number of his employees was constantly friendly and cordial, while, throughout his life, his efforts in the cause of education were untiring. About two years ago he gave $100,000 to Harvard College, to erect the building which now bears his name. He was also one of the projectors of the Boston *Globe*, and a large operator in real estate in the last mentioned city.

Mr. Wakefield was born in Roxbury, N. H., in 1811, and was consequently sixty-two years of age at the time of his decease. He was also an inventor, and had taken a number of patents of no mean value in relation to his own business.

Inter-Planetary Communication.

Mr. Charles Cros, in a communication to the French Academy of Sciences, thinks that the approaching transit of Venus will afford an excellent opportunity for establishing communication with the inhabitants of that planet—if any exist. He says: "It is possible that among the dwellers on the surface of Venus there may be some who are astronomers, to whom it may occur that the passage of their world across the sun's disk will attract our curiosity. Hence it is reasonable to suppose that these savants will perfect means to transmit signals to us precisely at the instant when they determine that multitudes of earthly telescopes are turned in their direction."

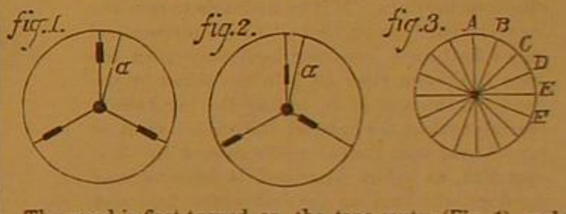
A writer in *La Nature*, commenting on this novel idea, suggests that it would be better to reverse relative positions, and for Venus substitute Mars. That is to say, when to the Martial inhabitants our globe appears to be crossing the sun's face, we should do something to attract their notice. As Mars is an older planet than the earth, it is supposed that its inhabitants are wiser than we, and hence better able to comprehend our signals than those existing on more youthful Venus.

It would be more satisfying to the inquisitive mind if M. Charles Cros or the correspondent of our contemporary would kindly ventilate their plans somewhat more in detail. We have heard somewhere of a scheme for signaling to the moon by means of long black platforms, arranged on wheels and placed on the extended snowfields of Siberia; and, if we remember rightly, it was proposed to roll these about to make the letters of the Morse telegraphic alphabet. How the assumed lunar inhabitants were to interpret the symbols was not explained. Somebody has also suggested huge mirrors arranged to send flashes of light to our satellite.

These ideas are all very nonsensical, but rather pale in absurdity before that of M. Cros. The moon, to be sure, is only about 240,000 miles away, and our big telescopes carry us to within a hundred miles of its surface; if that million dollar instrument is ever made, probably we shall be able to see with reasonable distinctness whether clusters of habitations exist thereon. But Venus and Mars are respectively thirty and forty-nine millions of miles distant from our planet, and it is only by careful observation that the movements of vast glaciers on Mars are estimated, or spaces near the poles, of forty thousand square miles extent, detected; and even the phenomena noted are merely supposed to be due to the causes ascribed.

Engine Turning with the American Chuck.

Looking at the American chuck, we see that the three teeth are worked to and from the center by a spiral coil, and that, when in correct working order, these teeth are drawn in regularly by winding up the screw, so that at any one time they are all exactly the same distance from the center. Now, by unwinding the screw, these teeth can be removed from the body of the chuck. I removed the teeth, and, putting two of them back into their proper places, I gave the screw one or two complete turns round; then I replaced the third tooth, and the position of the teeth was as shown in Fig. 2. Fig. 1 being the usual position.



The wood is first turned on the true center (Fig. 1), each end being turned down so that the block assumes the form of a right cylinder. The chuck is now altered as shown, and the wood put in and made fast. It is evident that, when the lathe is put in motion, the wood will revolve on a new center; and, by moving the wood round regularly in the chuck, a series of circles can be described as with the eccentric chuck.

In order to keep these circles at a regular distance from each other, I filed a line, *a*, on the face of the chuck, and drew lines across the base of my wood, passing through the center, as shown in Fig. 3. Putting each of these marks—A, B, C, D, E, etc —in turn against the line, *a*, a regular distance was maintained; and by alternating the tooth which I took out, I was enabled to describe a variety of patterns.—*W. E. P., in the English Mechanic.*

The Water Supply of Paris.

Two new artesian wells have been in course of construction for some years in Paris, one at the Butte-des-Cailles, the other on the Place Hébert. The former has been sunk to a depth of 1,725 feet, and it is expected that water will be obtained at 1,890; its cost will be about $125,000. The other well, like that completed after so many years' labor at Passy, presents great difficulties; and although the work is pushed on with activity, the progress is not more than 16 feet per month; and it is believed that 18 months' time will be required to finish the work. The boring tools now in use are worked by means of a steam engine of 40 horse power; a load of excavated soil takes from seven to eight hours to raise it to the surface. The object of this well is not so much the increase of the water supply of the city as the establishment of public baths and wash houses at a cheap rate, as the water, as it issues from the well, will be of about the temperature of 95° Fah.

PROFESSOR HITCHCOCK, of Amherst College, recently explored Miles' Cave, in Salisbury, Mass., with a guide. Hundreds of feet below the surface their torches were suddenly extinguished, and as there was no means of relighting them they remained below for hours. The professor fainted on emerging.

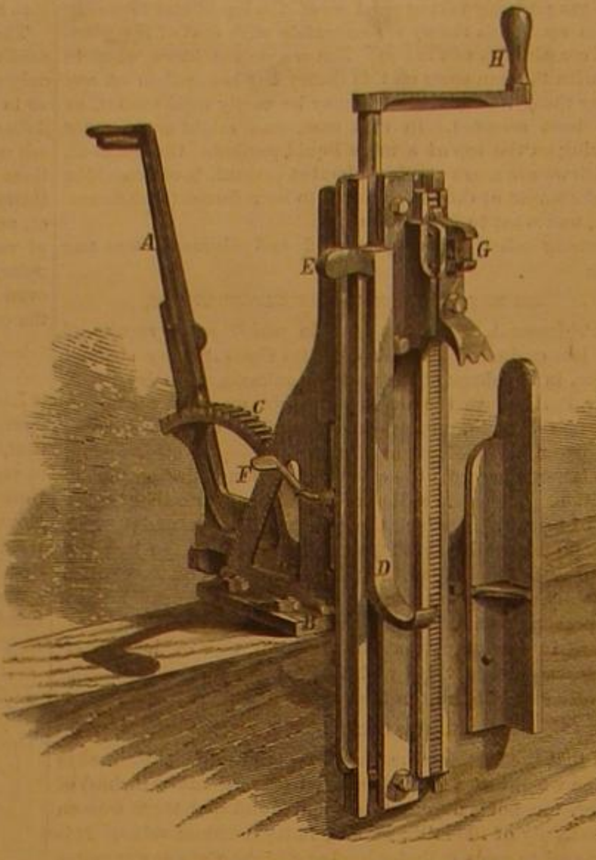
AT the late fair of the St. Louis Agricultural and Mechanical Association, there was a large display of flour samples. The flour was arranged in open barrels without brand or mark by which it could be identified as the product of any particular mill. Thus prepared, a committee, consisting of practical millers, subjected the samples to the severest tests, and made their award. The Anchor Mills, of St. Louis, received the highest award.

SPEAKING of the scheme to warm the Erie canal, the Boston *Post* thinks the invention might be applied to agriculture. "There is no reason," it says, "why the farmers should lose six months in the year just to whim the season." Why not go further and melt the barriers to the open polar sea?

IMPROVED FROST LOG DOG.

The engraving shown herewith is a side view of Brown's frost dog, a new and useful device for holding frozen, knotty, or crooked logs while the same are being sawn. The object is to clutch the log instantaneously and hold it firmly while sawing the first half, or until the log is cut through and through. It is the invention of a practical mechanic and sawyer, who, finding it impossible to hold frozen logs as firmly as desired, with any available means, went to work and, with his jack knife, whittled out the patterns for his device. It has now been in use in circular saw mills in nearly all sections of the country for over three years.

The apparatus is bolted down from three to six feet from the head end of the set beam, where the sawyer has it under his immediate control, and the log is rolled on the set works in the ordinary way and left or held in the position desired. By means of the handle, A, on the back side, the whole dog is drawn toward the log until it comes to a bearing, working in long slides, B, bolted to the set beam. As the operator lets go this handle, it drops down, and is held firmly wherever left by the half circle gear, C. The bottom dog, D, is next drawn up by the handle, E, at the lift until it touches the log and is held up by the little crank, F, which works in a movable nut. By pressing together, with the thumb and forefinger, the two catches, G, the other dog is instantly placed in position on the top of the log. These catches work in the notched slide, to which they are attached, and to which is secured another movable nut, so that it is impossible for the dog to slip up or down while the catches are in action. The sawyer now turns the top crank, H, on the shaft of which there is a right and left hand thread; thus imbedding both dogs in the log and holding the same immovable until it is entirely sawn, leaving only a thin slab in the clutch of the dogs. If it be desirable to turn the log when partly sawn, the crank is simply revolved back a half turn, loosening both dogs; then the knee is thrown clear back in the slides by the handle at the back of it, letting the log have a bearing against the knee at the right, as it is turned over with the sawn side against it. The operation, as before described, is repeated, and the dogs will hold up the last board firm and solid. It is claimed that the device is so arranged that it is simply impossible to run the saw on the ends of the dogs, as the latter are always half an inch inside and clear of the blade.



BROWN'S FROST LOG DOG.

It is stated that the apparatus can be readily attached by the sawyer to any set works in the country having a beam run lengthwise, and it is now in use in at least one hundred and fifty of the principal mills in New England. The operation of dogging a log, as described, is very rapid, and we learn that the whole time it takes for the sawyer to fasten securely a knotty, frozen, hemlock log does not exceed a few seconds.

Patented August 23, 1870, by John S. Brown, of Windham, N. H. For further information address the sole manufacturers, S. C. Forsaith & Co., Manchester, N. H.

COMBINATION CORN SHELLER, BOOTJACK, ETC.

A hand corn sheller, a bootjack, a hammer, a hook claw, a tack drawer, a pot lifter, and a wrench, are all combined

in the single instrument represented in our engraving, the construction of which amounts to simply three pieces of metal fastened together by a single rivet. Mr. Anthony Iske, of Lancaster, Pa., is the inventor, and he clearly deserves credit for no small amount of mechanical ingenuity.

The portion, A, is provided with a hammer at one end, a fulcrum or rest near the middle, and a curved stem, having teeth on one side. The part, B, is S shaped, and its upper curve is provided with teeth facing those on portion, A. Its lower extremity, C, is formed for drawing out tacks or lifting off stove lids. The third section, D, is terminated with a hook which adapts it to various purposes. The position of the pivot is clearly indicated. Fig. 1 shows how the implement is used for shelling corn, the ear being introduced vertically between the toothed portions and the hammer edge placed upon the table. The shelling is accomplished by a downward motion and a quick turn of the wrist. When laid upon the floor, as in Fig. 2, on the hammer end being pressed down by the foot of the operator, the leg or fulcrum raises the handles, which, together, form an excellent bootjack.

Not content with all the applications of his device, as above noted, the inventor also suggests that a recess might be arranged in some portion so as to adapt it to cracking nuts.

Patents on combined implements of this kind and simple household contrivances of easy manufacture, without involving large capital, are the class of inventions most in demand, and meet with ready sale.

Hydraulic Mining in California.

Five years ago, fifty inches of water was considered an unusually large quantity for a company to purchase, says the *Calaveras Chronicle*. It was conducted to the claim through a small canvas hose, with necessarily little pressure, and precipitated against the bank from an inch nozzle. The stream had no more effect upon the gravel than would have been produced by the discharge of a six inch syringe. Miners were forced to "coyote" under the bank and "cave it down" to get gravel to wash—a slow, laborious and expensive method of procedure. The sluices attached to these primitive "hydraulics" were never more than twelve inches wide or high, and yet the capacity was ample for the requirements of mining as then conducted. That whole system of operations has been revolutionized. At present three hundred inches of water is the minimum employed in any claim that aspires to the dignity of a hydraulic. Iron has taken the place of canvas for hose, and the greater the pressure to be obtained the better. Patent nozzles direct the streams that cut down the bank like grass before the scythe, and the mingled gravel and water find passage from the mine through a three foot flume. Really, more dirt is put through the sluices of a modern hydraulic in a week that was formerly washed during an entire season. And yet the cost of running one of the mammoth hydraulics of today is but a trifle, if any, more than the expense of conducting one of the piddling concerns that disgraced the name ten years ago. Water works cheaper than hands, and the employment of that element, to the almost entire seclusion of manual labor, is the principal reason why it costs no more to wash a tun of gravel now than it formerly did to move a single pound.

Hydraulic mining in this country, notwithstanding the progress made during the past two years, is yet in its infancy. A beginning has scarcely been made. Two thirds of the abandoned ground, from one end of the country to the other, will pay for re-working, and new mines are constantly being discovered and opened. As an illustration we will cite one instance: Near Murphys in this county, a gravel mine, one hundred and sixty acres in extent, has lately been located and patented. Beyond a little superficial prospecting no work has been done upon it, and yet a tenth interest in the ground was sold for $10,000, the other day. Some curious individual has made an estimate of the probable yield of the entire mine, basing his calculations upon the "prospects" obtained. The result of his figuring is that the whole one hundred and sixty acres will yield an average of ninety cents per square yard.

New Mode of Liquefying Gases.

By the application of cold and pressure in suitably contrived machines, all of the gases with the exception of six, nitrogen, hydrogen oxygen, marsh gas, carbonic oxide and nitric oxide: have been reduced to a liquid condition This liquefaction was first performed by Faraday and served to prove the fact that gases and vapors are not distinct in their nature. It may be remembered that the simple apparatus used during these initial experiments consisted of a bent glass tube, having a long and a short leg at right angles. Into the open end of the longer portion was placed a substance from which gas could be obtained by heat, after which the tube was hermetically sealed. The shorter limb was then plunged into a freezing mixture, and heat applied to the larger portion, generating large quantities of gas, upon which, being confined in a small compass, the pressure gradually increased, finally condensing the same into liquid form in the smaller receptacle. The facts thus recalled will indicate the importance of a recent experiment made by M. Melsens, a celebrated chemist of Brussels, who, it is stated, has lately succeded in obtaining wood charcoal in an absolutely pure state. So great is the absorbent power of this substance that it will concentrate in its pores a quantity of gas equal to its own weight. This has been used by Melsens in an apparatus similar to that of Faraday above described; and through its agency, he has succeeded in liquefying gases with great readiness. The charcoal, it seems, is placed in the long leg and allowed to absorb as much gas as possible. The tube is then sealed and enclosed in a tin pipe heated to 212° by a current of steam. The gas in the charcoal is thus disengaged and caused to compress itself into the short limb, passing almost immediately into a liquid state. It is stated that from one to one and a half cubic inches of liquefied gas can be quickly obtained.

Taxes on Knowledge.

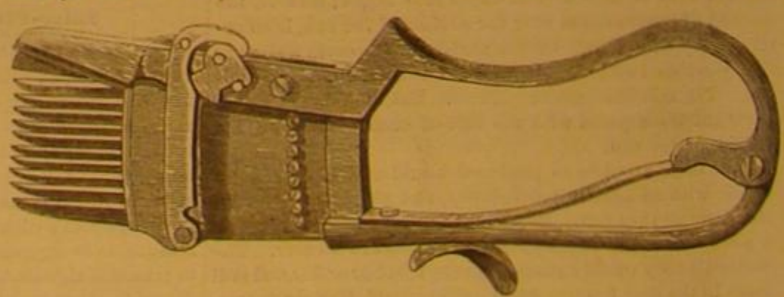
O. M. says: Please ask our next Congress to remove all taxes on means of education, such as the import duty of 40 per cent on philosophical apparatus. "I know of several parties who propose to import telescopes and other scientific implements for their own use; but on ascertaining the fact of that enormous duty, they at once gave it up. I cannot see that it would lessen the profits of those in this country who sell such instruments if the duty were removed, as the goods are mostly imported; nor would it materially interfere with such men as Alvan Clark, Ritchie, Zentmayer, Spencer, and others, whose business depends mostly on their well known skill and integrity. Please lend your influence to assist those whose purses are scant, yet who are trying to educate themselves and others."

Fast Trains in England.

There has been a dispute as to which is the fastest train in England. Precedence has been claimed for the 10 A. M. express from King's Cross. It also asserted that the Great Western express between Paddington and Exeter is faster. Between Paddington and Swindon the distance is 77¾ miles, and both the up and down trains travel it in 87 minutes, including the starting and stopping, or at the rate of 53·62 miles per hour. At full pace, the speed is as nearly as possible a mile a minute. The Great Western railway is built on a 7 feet gage, but many parts of the line have a third rail, allowing narrow (4 feet 8½ inches) gage trains to run on it also.

LIGHTNING SHEEP SHEARS.

This ingenious apparatus, according to the *Ironmonger* will shear six sheep in the time that it now takes to denude one of his fleece. Anybody can operate it and do better

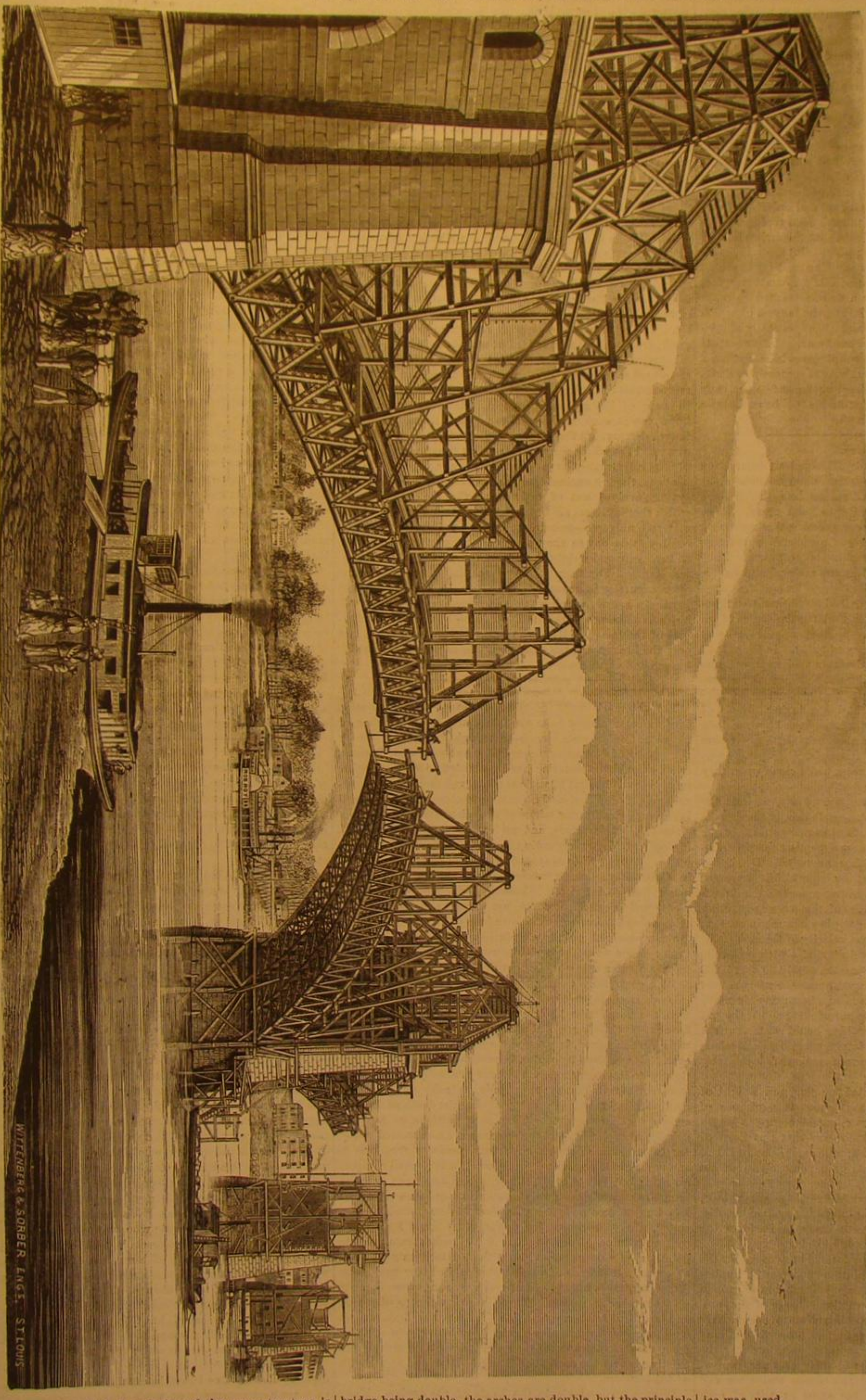


work than the most skillful shearer with the old fashioned shears, and without danger of cutting the flesh. The handle of the knife is arranged with a spring, and the blade, by pressing the former, is caused to travel across the sharp teeth, which are first imbedded in the wool. The movement resembles that of the ordinary scissors blade. When the knife returns, it raises itself clear of the wool, allowing the same to escape uninjured by scraping.

THE GREAT BRIDGE AT ST. LOUIS.

In former numbers of the SCIENTIFIC AMERICAN, we have given various interesting details pertaining to the remarkable work involved in building the granite piers of this great example of engineering. We have also given various illustrations thereof, and of the superstructure. We now present an engraving which will intelligibly illustrate the ingenious manner in which the placing of the superstructure is being executed. This work is now proceeding at St. Louis, and by its novelty attracts the attention of engineers from all parts of the world. The chief engineer of this great work is Captain James B. Eads, of St. Louis, to whose fame as a man of science the success of the structure will add many laurels. It is expected that the bridge will be finished in July, 1874. The following interesting particulars are derived from a letter in the New York *Times*:

The river is spanned by three arches springing from east and west abutment towers to piers in the river. From the abutments to the piers, east and west, the arches have a span of 502 feet; the central arch from pier to pier has a span of 520 feet. These arches are of cast steel. The bridge being double, the arches are double, but the principle can be more easily shown with one part; for as it is built, it is really two bridges joined together, and it could be made indefinitely broader or narrower according to requirement. The arch is composed of tubes, each twelve feet in length, joined together by most admirable couplings. There are four sets of tubes, arranged two above and two below. The top and bottom row form what is technically called a chord, and these are united together by main braces in the form of the letter A. The two chords are united laterally by huge tie rods. That is the whole principle of the matter.



THE GREAT BRIDGE AT ST. LOUIS—ERECTION OF THE SUPERSTRUCTURE.

The *modus operandi* is as follows: The tubes are brought in barges underneath the place where the men are working, and are elevated by a small stationary engine. The ends of the tubes are so nicely grooved that they fit in very tightly, even without the couplings. They are grooved also on the outside, to correspond with the grooves and fillets of the couplings. When the latter have been applied, an enormous pin, with a diameter of five inches and a weight of 100 pounds, is screwed through the couplings, going, of course, also through the united ends of the two tubes. The bridge being double, there are eight rows of tubes, making, for the side arches 340 to the span, and 342 for the central one. The men are working now on the eastern half of the bridge, the other being in such a forward state that it has to be neglected until the rest of the work balances it. In this gigantic work the utmost thought of little things is imperatively needed. The moment that one tube is in place, the tube that balances it on the other side of the pier must be put into position. The strain upon the iron cables that support the tubes until they form a perfect arch is regulated to a pound weight by means of hydraulic rams. When the temperature rises the cables stretch, and the whole fabric of uncompleted arching sinks a little. It has to be raised up, and the rams do this by taking a little gentle pull upon the cables, or, as the mariners would say, "hauling taut." This is effected by pumping a little glycerin into the rams. If, on the contrary, the temperature falls, the cables contract and tilt up the arching a trifle more than is required. Then the watcher over the rams has to pump out a little glycerin, and the pressure on the cables is relaxed. This little place where the rams are may be considered the great artery of the work. The perfect control that Captain Eads and his assistant have over their offspring is sometimes evinced in an amusing way. The method of construction to preserve the just balance is naturally to build the tubes half way from each side of a pier at the same time, so that one half balances the other half. The engineers commenced in this manner with the pier nearest the western bank, building up, at the same time, the tubing from the western abutment. When the latter met the western half of the first pier, the extremely hot weather had expanded the metal, and the tubes would not unite. Baron Fladd immediately bought hundreds of bales of gunny bags, and packed the recalcitrant tubes in ice. All night the thermometer kept rising, but the ice did its work, and they came together so closely that you could not have seen daylight between them. The same result could have been obtained by blasts of cold air, but the Keystone Bridge Company, of Pittsburgh, who have the contract for the superstructure, were in a hurry to close the western arch, so the ice was used.

The workmen now thoroughly understand the handling of the tubes, and are putting them together on the eastern half at the rate of twenty-four a day. The frames, from which the long curves of tubing stand, are all inserted. These are called skewbacks, and are of wrought iron, forged in one piece of three tuns—a very creditable specimen of the handiwork of Pittsburgh. The first tube, which is very short and stout, is screwed to this with four steel bolts, five inches in diameter, which go back into the very bowels of the pier, twenty-eight feet, and are then driven through an anchor plate. This fact will give a better idea of the huge masses of masonry serving as piers than any formal statements or measurements. The men engaged in the construction belong to a class which American enterprise has called into existence. They are bridge builders, working at nothing else; and though not scientifically educated, have a rough and ready comprehension of the work they do, which tends to elevate their minds. They are trained to perfect exactitude in the smallest details. If a bolt does not fit perfectly, there is no thought of assisting it promptly with a sledge hammer; but there is an instant conclusion that, by some accident, the bolts have become mixed, and that this is not the special bolt for that particular hole. For down to the minutest scrap of iron, everything has been fitted at Pittsburgh, and must fit here. To nearly fit will not do; it must absolutely fit. The consequence of such exact training is exemplified in the conduct and manner of the men who are, without exception, the most intelligent and orderly body of workmen I have ever seen. With such men rapid progress is certain, and there can be no doubt that the arches will be completed before the end of November. But the bridge will not be finished then, by any means. The roadways have to be built upon it. The upper one will be for omnibuses, foot passengers, etc., the lower for a double tracked railway. These two will be supported by struts, the longest of which near the piers, will be 56 feet, and then gradually diminished as they approach the center of the arch. These struts will rest upon the heads of the couplings where the tubes are strongest, and, as only a direct weight comes upon them, will be able to bear five times more than the bridge company will ever permit: for the transit of trains will be entirely in the hands of the company's officers.

Molecules.

Professor Clark Maxwell lately delivered an interesting lecture before the British Association upon molecules, by which is meant the subdivision of matter into the greatest possible number of portions, similar to each other. Thus, if a number of molecules of water are combined, they form a mass of water. Molecules of some compound substances may be subdivided into their component substances. Thus the molecule of water separates into two molecules of hydrogen and one of oxygen.

The ancient atomic theory, described more than two thousand years ago by Lucretius, was that the molecules of all bodies are in motion even when the body appears to be at rest, and this is the accepted theory of today. In the case of solids, these motions are confined within such narrow limits that we cannot, even with the microscope, detect any alteration in their positions. But liquids and gases may be subjected to experiments which afford convincing proofs of molecular motion. If the gases of ammonia and hydrochloric acid, for example, be placed in a glass tube, with a stratum of air between, the lighter gas, ammonia, above, the gases diffuse through the air and produce a white cloud when they meet.

Air confined in a vessel presses, as we say, against the wall thereof. What we term pressure is simply the impact of the moving molecules against the interior surfaces of the vessel. The amount of the pressure depends upon the number of molecules of air or gas within the vessel. By the application of heat, the movement of the molecules is increased in velocity, and such increase of course causes each molecule to strike harder against the walls of the vessel; in other words, the pressure is increased; the law of such increase of pressure being as the square of the velocity of the molecules.

Dr. Joule has calculated the velocity of hydrogen molecules, at the temperature of melting ice, at a little over 6,000 feet per second. The molecules of ammonia move about 2,000 feet per second. The molecules of common air move with a velocity of seventeen miles per minute; and if they all moved in the same direction, nothing could stand such a wind. But molecules constantly impinge against each other; and by this contact, their directions of motion are incessantly changed.

Professor Maxwell has calculated the size and weight of hydrogen molecules, and finds that about two millions of them, placed side by side in a row, would occupy a length of about one twenty-fifth of an inch; and that a package of them, containing a million, million, million, million of them, would weigh 62 grains, or not quite one eighth of an ounce.

Each molecule throughout the universe, says our author, bears impressed on it the stamp of a metric system as distinctly as does the meter of the archives at Paris, or the double royal cubit of the Temple of Karnac.

No theory of evolution can be formed to account for the similarity of molecules, for evolution necessarily implies continuous change, and the molecule is incapable of growth or decay, of generation or destruction. None of the processes of nature, since the time when Nature began, have produced the slightest difference in the properties of any molecule. We are therefore unable to ascribe either the existence of the molecules or the identity of their properties to the operation of any of the causes which we call natural. On the other hand, the exact equality of each molecule to all others of the same kind gives it, as Sir John Herschel has well said, the essential character of a manufactured article, and precludes the idea of its being eternal and self-existent.

Thus we have been led, along a strictly scientific path, very near to the point at which science, must stop. Not that science is debarred from studying the internal mechanism of a molecule which she cannot take to pieces any more than from investigating an organism which she cannot put together. But in tracing back the history of matter, science is arrested when she assures herself, on the one hand, that the molecule has been made, and on the other that it has not been made by any of the processes we call natural.

Science is incompetent to reason upon the creation of matter itself out of nothing. We have reached the utmost limit of our thinking faculties when we have admitted that, because matter cannot be eternal and self-existent, it must have been created. It is only when we contemplate, not matter in itself, but the form in which it actually exists, that our mind finds something on which it can lay hold. That matter, as such, should have certain fundamental properties, that it should exist in space and be capable of motion, that its motion should be persistent, and so on, are truths which may, for anything we know, be of the kind which metaphysicians call necessary. We may use our knowledge of such truths for purposes of deduction, but we have no data for speculating as to their origin. But that there should be exactly so much matter and no more in every molecule of hydrogen is a fact of a very different order. We have here a particular distribution of matter, a collocation, to use the expression of Dr. Chalmers—of things which we have no difficulty in imagining to have been arranged otherwise. The form and dimensions of the orbits of the planets, for instance, are not determined by any law of Nature, but depend upon a particular collocation of matter. The same is the case with respect to the size of the earth, from which the standard of what is called the metrical system has been derived. But these astronomical and terrestrial magnitudes are far inferior in scientific importance to that most fundamental of all standards which forms the base of the molecular system. Natural causes, as we know, are at work, which tend to modify, if they do not at length destroy, all the arrangements and dimensions of the earth and the whole solar system. But though in the course of ages catastrophes have occurred and may yet occur in the heavens, though ancient systems may be dissolved and new systems evolved out of their ruins, the molecules out of which these systems are built—the foundation stones of the material universe—remain unbroken and unworn. They continue this day as they were created, perfect in number and measure and weight; and from the ineffaceable characters impressed on them we may learn that those aspirations after accuracy in measurement, truth in statement, and justice in action, which we reckon among our noblest attributes as men, are ours because they are essential constituents of the image of Him who in the beginning created, not only the heaven and the earth, but the materials of which heaven and earth consist.

Odd Fish.

The summer's work of the American Fish Commission is of unusual interest from the fact that a large number of queer marine animals have been brought to the surface by the improved dredging apparatus employed; and, besides, much valuable information has been added to our knowledge regarding the habitat of various fishes and mollusks. A correspondent of *Forest and Stream* epitomizes, in an interesting communication, the labors of the scientists who have conducted the explorations, and we extract therefrom the following particulars regarding the progress and discoveries made: A live *calista conveza* (a species of clam), brought up in Casco Bay, has, it seems, upset the opinion that it was extinct so far north. Quohogs, which once existed in plenty and the shells of which are found in the Indian shell mounds which cover Peak's Island on the coast of Maine, are now obtained only in a little cove in Casco Bay; while oyster shells, to which a saddle rock is but a pigmy, are thickly planted below the bottom of Portland Harbor, though as living organisms their species is now extinct.

Down in these ocean depths, the animal kingdom takes from the floral tribe the duty of embellishment, but these flowers wave their graceful petals but to entrance a victim, which, when seized, is pressed close to its mouth and then, even if larger than its captor, is swallowed whole. Holding tightly to its prey, the sea anemone gradually protrudes its stomach from its mouth; and turning it inside out, envelopes its dinner and then lies quietly waiting the death of its food and subsequent digestion. Then such portions as are not suitable are rejected, and the stomach is again stowed away for future use. The sea cucumber (*pentacta frondosa*) is another curious creature. First found, it is a small compact gherkin: but left to itself, it swells and developes into an immense cucumber. Two magnificent specimens of a star fish known as a *gomaster phrygianus* were found in deep water, where an almost icy temperature made for them a constant winter. They are four or five inches from point to point, and of a deep scarlet hue with a surface embossed like shagreen. Hundreds of a pale straw colored star fish (*clenediscus crispatus*), hitherto esteemed very rare, were brought up from these icy depths. Three large specimens of a rare and beautiful anemone (*urticina digitata*), the first perfect ones ever found, were also obtained, a discovery of interest from the fact that none of the species have been recorded as existing nearer the coast than George's Bank and at a depth of 400 fathoms.

Worms predominate in the hauls of the dredge. Many sorts and sizes were found, from tiny creatures, the peculiarities of which are distinguishable only under the microscope, to the grand *cerianthus borealis*, one of the anemone family, a foot in length. All have the same style of house, and exude from their bodies a slime, which probably has chemical affinity for the lime in the water and which causes the mud to adhere. One specimen caught had a tube around him, an inch in diameter and a foot in length. He was thrown into a basin of water where he moved rapidly about, evidently ill at ease. The next day he was lying quiet; and about his neck was a ring of mud formed from the floating particles in his prison. During the evening, he was found stretched out at full length, trying to swallow an anemone that had been imprisoned with him.

The hermit crab is a common but curious creature, resembling a little lobster, armed with powerful claws and a very thick breast plate. He is a quarrelsome customer; but unfortunately for him, the after part of his body is soft and defenceless. Left to his own resources, he is a great coward, but gets an accession of bravery when he discovers an empty univalve shell. This he examines inside and out, turning it over and over until satisfied that there is no weak place in the rear, when he passes into it tail first, and then, calmly folding his strong claws across the entrance, is ready for the fray. When a larger crab finds a shell that suits him, in which a smaller one of his own species has already taken refuge, he unceremoniously inserts a claw and drags the little one out. The shell becomes the home also of a beautiful hydroid which appears like a velvet coat of waving fibers. These, seen through a microscope, resolve themselves into a triune creature, three bodies on one stem, each with its special function to perform, making one little single life. One body absorbs food, another reproduces the young, while a third, armed with tiny jaws, defends the little community against other creatures still smaller.

Another odd specimen found was the goose fish or *lophius Americanus*. It is about two and a half feet long, a flat, thick mud-colored, mis-shapen monster, whose small fins proclaim it not a rapid swimmer. Burrowing close to the mud, it elevates two little fishing rods, each about twelve inches in length, formed of a stiff elastic substance like the spine of a catfish. These spring from the upper part of the nose; and when not in use, lie back flat upon the head. When the first wants his dinner, however, the rods are raised at various angles and moved slowly about; on the end of each dangles a red muscular fiber which dilates and contracts like a worm. Attracted by this bait, the unsuspicious pollak attempts to appropriate it. Slowly the goose fish lowers its lip, and then suddenly engulfs the unwary victim in its mouth, which, set with great fangs, opens like an old fashioned carpet bag.

Another curious find was the egg of a skate, seemingly a dark colored case, of texture somewhat like a beetle's back, but tougher. It was shaped like a fisherman's creel, a rectangle with the ends cut out, leaving a square center with four projections on which to wind the line. The egg shell is not unusual and can be found on sandy beaches, thrown up by the tide, dried and empty, looking like the husk of some nut. The specimen found was opened, and the little creature released and placed in a basin of water, where it swam around for several days. The yolk of the egg remained attached and appeared quite as large as the fish.

Regular Eating.

Half of all ordinary diseases, says Dr. Hall in his *Journal of Health*, would be banished from civilized life, and dyspepsia become almost unknown, if everybody would eat but thrice a day at regular times, and not an atom between meals, the intervals being not less than five hours, that being the time required to digest a full meal and pass it out of the stomach.

If a person eats between meals, the process of digestion of the food already in the stomach is arrested, until the last which has been eaten is brought into the condition of the former meal; just as, if water is boiling and ice is put in the whole ceases to boil until the ice has been melted and brought to the boiling point, and then the whole boils together.

But it is a law of nature that all food begins to decay, after exposure to heat and moisture for a certain time. If a meal is eaten, and in two hours another, the whole remains undigested for seven hours, before which time the rottening process commences, and the man has his stomach full of carrion—the very idea of which is horribly disgusting.

As, then, all the food in the stomach is in a state of fermentive decay, it becomes unfit for the purposes of nutrition and for making good pure blood. Small wonder is it that dyspeptics have such a variety of symptoms, and aches, and complaints in every part of the system, for there is not one drop of pure blood in the whole body; hence, the nerves, which feed on this impure and imperfect blood, are not properly nourished and, as a consequence, become diseased. They "complain"; they are hungry—and like a hungry man—are peevish, fretful, restless. We call it nervousness, and no one ever knew a dyspeptic who was not restless, fretful, fidgety, and essentially disagreeable, fitful and uncertain.

The stomach is made up of a number of muscles, all of which are brought into requisition in the process of digestion. But no muscle can work always. The busy heart is in a state of perfect repose for one third of its time. The eye can work twice in a second, but this could not be continued five minutes. The hands and feet must have rest, and so with the muscles of the stomach; they only can rest when there is no work for them to do—no food in the stomach to digest. Even at five hours' interval, and eating thrice a day, they are kept constantly at work from breakfast until the last meal is disposed of, usually ten o'clock at night. But multitudes eat heartily within an hour of bed time: thus, while the other portions of the body are at rest, the stomach is kept laboring until almost daylight, and made to begin again at breakfast time. No wonder is it that the stomach is worn out—has lost its power of action. Many girls become dyspeptic before they are out of their teens, in consequence of being about the house and nibbling at everything they lay their eyes on that is good to eat.

In the *Chronique de la Société d' Acclimatation*, M. Ruimet states that, by feeding silkworms on vine leaves, he has obtained silk of a fine red color; and that by giving the worms lettuce leaves, they have produced cocoons of an emerald green color. M. Delidon de St. Gilles, of Vendée, has also, by feeding silkworms—during the last twenty days of the larva period—on vine, lettuce, and nettle leaves, obtained green, yellow, and violet cocoons.

THE AYRSHIRE COW.—The Ayrshire is bred, and has been bred, for milk; her inheritance is all in the line of milk producing. Her form indicates it; her records prove it. When aged and dry, the same functions which ordinarily fill the udder fill her muscles with fat; but while milking, inheritance, intensified yearly by selection, turns the energies of her system towards extracting materials from her food, and secreting the larger and richer part in the udder. As the shorthorn stands with the grazier, who has tried their quality, so does the Ayrshire stand with the dairyman. By seeking improved breeds, the farmer is adding materially to the profits of his farm, for he is utilizing the great power and unerring certainty of inheritance.—*Dr. Sturtevant.*

Recent American and Foreign Patents.

Improved Apparatus for Extracting Cane Juice.

Duncan Moffat, New Orleans, La.—This invention consists in the arrangement of a holding device with the delivery rolls of the mill and the rotary cutting apparatus; also of a vat containing a secondary steaming compartment under the one into which the crushed and chopped cane is first received, containing revolving chopping and beating blades; also, stationary ones to continue the disintegrating process until the cane is reduced to pulp. The bottom of said compartment is perforated to filter the juice from the pulp as much as possible; and has a spout leading from it to conduct the pulp to an endless carrier, by which it is delivered to pressing rollers to expel the remaining juice. The two compartments of the steaming vat are separated by a valve, which is turned from time to time to deliver the cane to the lower compartment in batches, which have been subjected to the steam in the upper compartment a sufficient length of time. Below the filtering bottom of the lower compartment there is a trough, which receives the juice falling down from said compartment, and conducts it to the evaporator.

Improved Needle Threader for Sewing Machines.

Thomas Schofield, Grass Valley, Cal.—The body or handle part of the needle threader is of thin sheet metal, and the instrument may be placed in an upright position. At one end of the handle is a forward projecting guide piece which passes up and down along the side of the needle, until a hook strikes the eye of the needle and enters through it. The hook has a curved end of very small size, which takes up the thread and draws the same back through the eye of the needle. The rear part of the hook is bent in U shape, and held in a groove in handle by means of a plate and screw. A small set screw regulates the distance of the hook from guide piece, to be adjusted to needles of different thicknesses. At the other end of handle a hook and needle guide are placed in similar manner, but under a right angle to the body of the handle, so that needles may be threaded from the sides, back, or front.

Improved Propelling Mechanism for Vessels.

Lindsay Murdoch, Marble Hill, Mo.—This invention consists in a horizontally sliding frame and a bar carrying at its lower end paddle floats sliding vertically therein and horizontally therewith. By this arrangement the paddles have parallel vertical and horizontal motions, so that they are presented to and leave the water edgewise and move against it directly in the line of the motion of the boat.

Improved Saw Sharpening Device.

John B. Drake, Goshen, Ind.—The file guide has, at one end, jaws to hold the file, and is rounded at the other to slide in a hole through an adjustable guide, by means of which it may be placed at any desired hight. This apparatus is applicable to vertical saws as well as to circular saws. By means of it the file is carried in a straight line across the saw.

Improved Automatic Fire Escape for Safes.

Ira Parke, Mineral Point, Mo.—It is proposed to have a safe resting on a platform having wheels, and pivoted at one end, while the end next to the wall of the building is suspended by an easily combustible rope or other contrivance, to be destroyed by a fuse or a gun discharged against it, or burned off to let the platform fall. The platform, which is arranged in front of a trap door in the wall opening into the street, is to unfasten the door in its fall and force it open, and the door is to form a continuation of a descending track, of which the platform is the other part, on which the safe will roll into the street, and thus be saved from the fire. Fuse may be connected with the suspending rope, and arranged throughout all parts of the building, to ignite the rope or discharge the gun against it when the fire breaks out in any part of the building; and the fuse will also be arranged to communicate the alarm to the office or other apartment.

Improved Tap Holder Attachment for Beer Coolers.

Joseph Hyde Fisher, Chicago, Ill.—This invention consists of an attachment to beer coolers for packing the hole through which the faucet projects to prevent the escape of the cold air, which is composed of metal clamping rings, and a rubber packing ring, arranged in two parts, of which one is fastened to the box, and the other to the door, in connection with the tap hole.

Improved Boy's Sled.

Samuel D. Mott, Milford, Pa.—The rear ends of two springs are secured to the frame work of the sled, to the forward ends of which is attached a cross bar, in such a position that the rider, when sitting upon the sled, may rest his feet upon the said cross bar, either upon the outer or inner sides of the side frames of the sled, as may be desired. To the center of the cross bar is pivoted a small runner, which is made of a much less hight than the sled, and the springs are made of such a strength as to hold the said runner away from the ground, except when pressed down by the rider's feet, resting upon the cross bar. To the runner is attached a cross bar, to which are attached the ends of cords. By pressing the runner down to the ground with his feet, and pulling upon one of the cords, the rider can incline the runner to one or the other side, and thus guide the sled as desired.

Improved Fountain Hand Stamp.

Francis J. Coutant, New York city.—This invention relates to the construction of stamps for certifying checks and for similar purposes, having special reference to what is known as the "ribbon stamp;" and consists in a fountain for the ink and in a movable pad. The shafts being immersed in ink, the ribbon is of course saturated with it. As the ribbon is drawn from the fountain it passes between two packing pieces, the object of which is to strip off the surplus ink from the ribbon and to keep the fountain closed. These packing pieces are made of elastic material, compressed by means of the metallic plates and screws. After leaving the packing pieces, the ribbon is drawn over the rollers and beneath the type plate, and then upward and into the fountain. By this invention the trouble and expense of frequently renewing or saturating the ribbons are avoided. The pad, by means of a lever, is thrown upward against the ribbon and type, instead of operating the stamp, in the usual manner, by a blow on the stem. With a pad constructed in this manner the stamping may be done with the same hand that holds the paper, or with one hand.

Improved Metal Planing Machine.

John T. Kichner and William H. Odenatt, Philadelphia, Pa.—This machine is specially designed for planing the valve seats of locomotive and other engines, it being secured to the engine by screwing its stand bolts into the holes of the steam chest bolts when the steam chest is removed, and to adapt it for attaching it to different engines, in which the holes vary in the distance apart. The top frame or disk on which a revolving disk is arranged is provided with short radial arms for attaching the stand bolts to, which are adjustable radially and circumferentially. The feed screw is turned by a star wheel, which is brought in contact with one or more stationary pins each time it makes a circuit.

Improved Car Coupling.

August Schorg and Benjamin Van Valkenburgh, Cobleskill, N. Y.—A band which slides on closes the drawhead, and is operated by a forked lever. The drawhead is made in two parts, one of which is attached rigidly to the truck by means of clips. The other part is hinged, and drops down by its own gravity when unsupported. The parts are each recessed out to form the mouth and opening of the drawhead, and are held firmly together by the band when the latter is slipped forward. At the top and bottom of the flange is a loop, which the forks of the lever enter. The lever is held in position by means of a forked iron attached to the timber of the truck. The handle end of the lever is bent upward to make it convenient to handle as well as to fasten. When the handle end of the lever is thrown up to the truck, the band is thrown outward, so as to keep the drawhead closed and the coupling link confined. In this position the lever is confined by a pin in the forked iron. When the lever is thrown outward, the band is thrown back, which allows the part of the drawhead to drop down ready to receive the link of the opposite coupling.

Improved Apparatus for Graining Wood, etc.

Charles Falke, New York city.—In using the extension roller, the requisite width of the article to be grained is first taken, and the apparatus is then adjusted by loosening the handle frame, setting the female screws and shells to the desired width, fastening the handle frame again, inserting the band rollers and flexible band fitting that width. The roller is pressed over the color board, which leaves the imprint of its grain on the periphery of the cylinder. The grain marks are thence transferred to the surfaces to be grained.

Improved Nut Lock.

Daniel Sawyer, Washington, Ind.—A washer plate is placed upon the bolts before the nuts are screwed on, to which is secured one or more pieces of steel, which are made thin and fastened edgewise, and upon the upper part of each is formed a spring, standing out a little upon one side, preferably upon the side next the nut to be locked. A plate is pivoted to the pieces near one end, and is slotted so that it may be turned down upon the washer or turned back. The inner edge of the slotted plate is turned up at right angles, and the steel piece is placed at such a distance from the nut to be locked that the turned up part of the plate may rest against the side of the nut, and thus prevent the said nut from turning. By this construction, when the plate is turned down, the steel piece passes through the slot in the plate and the spring springs out over the said plate, preventing it from rising.

Improved Snow Plow.

William J. Roberts, Cold Spring, N. Y.—A revolving bucket wheel is arranged in front of the locomotive on a vertical shaft, and is revolved by means of a belt, or gearing may be substituted, from a pulley on the axle of the locomotive to the pulley on the vertical wheel shaft. The wheel is the frustum of a solid cone. The outer edges of the buckets are parallel with the side of the cone, the ends being cut on the plane of the base and upper surface of the cone. A loose upper clutch revolves with the shaft, and is dropped down by means of a screw or otherwise, and engages with the pulley clutch when it is desired to run the snow plow. As the locomotive moves forward, the wheel clears away the snow from the track and throws it to one side.

Improved Faucet Attachment.

James Church, St. Louis, Mo.—This invention consists of a cup of India-rubber or other elastic material, or partly of elastic material and partly of metal, combined with the faucet in such a manner that, when the barrel is tapped, by driving the cork into the barrel with the end of the faucet, the cup will prevent the escape of the liquid while the faucet is being adjusted and before it is made sufficiently tight to stop the leak.

Improved Refrigerator.

Charles Camp, Mott Haven, N.Y.—This invention consists in a removable ice box, fitted into the upper part of the smaller of two compartments of the main box, so that it may be conveniently taken out and put in when desired. The cold air from the ice chamber passes through a pipe and into a horizontal hollow shaft, and escapes through the holes in the sides of said shaft. To the end parts of the hollow perforated shaft are attached two four-armed plates, to the ends of the arms of which are pivoted the turned up ends of shelves, so that the said shelves will always hang downward and be right side up, however the shaft may be turned. This construction enables any desired shelf to be turned toward the door so that anything can be readily put upon and taken from it. The shelves are secured in any desirable position by a long screw which passes in from the front of the box through the end wall of the said box, so that its forward end may bear against the side of the end of the shaft, and thus prevent it from turning.

Improved Washing Machine.

Arthur M. Campbell, Kline's Grove, Pa.—This invention consists in the combination of the binding frame with the suds box of a washing machine to strengthen said box against the pressure of the operating mechanism; in the U spring, in combination with the lever and the rigid arm attached to the presser board, which allows the end of the lever to be readily adjusted upon the arm to adjust the presser board to the amount of clothes to be operated upon. By suitable construction, as the presser board moves forward, the clothes are pressed between said presser board and a stationary presser board, pressing out the water, which carries the dirt with it. As the presser board moves back, the back rush of the water sweeps the clothes back from the stationary board, and turns them over so that they are operated upon by the presser each time in a different place, and are thus cleaned thoroughly in all their parts.

Improved Printing Press.

Jacob G. Peterson, Morgantown, N. C.—The rollers are arranged in a reciprocating carriage, which is suspended on the type bed by the upper roller. The bearings of the lower roller are immovable in the carriage. The bearings of the upper roller are capable of moving up or down in the carriage, and have an adjusting screw by which the pressure of the rollers in the bed is regulated. The carriage has two toothed bars, extending from one side, between two wheels on the crank shaft and the presser rollers, which are mounted in stationary housings. The crank shaft being turned forward and backward by a half revolution each way will cause the presser rollers to move forward beyond the type and back again, which makes the impression on the paper. After each operation the tympan is raised, the printed sheet is removed, and an unprinted sheet is applied, and the tympan is lowered for the next operation.

Improved Quilting Attachment for Sewing Machines.

William H. Null, Blandinsville, Ill.—This invention relates to an improvement in the class of machines for supporting, stretching, and moving quilts or other fabrics across the feed plate of a sewing machine; and consists in a peculiarly constructed carriage and a tilting roller frame, on which it is supported, and in devices for holding and adjusting the fabric.

Improved Plow Carriage.

Henry M. Bullitt, Louisville, Ky.—This invention consists of independent axles for the truck wheels, having a long upright arm at right angles to them inside of the wheels, said arm having a series of holes at short distances apart, and connected by a short axle, which can be shifted higher or lower by changing it in the holes. From the center of this arm the beam is hung by a crotchet hanger, and is connected by adjustable braces with the lower ends of the arms to maintain them in the upright position. The depth of the furrow is governed by the position of the suspending axle in the arms, and the plow is supported entirely above the ground, for transporting it from place to place, by adjusting the suspending axle in the top holes.

Improved Pruning Instrument.

William H. Collings, Raytown, Mo.—A pole of any desired length is made hollow to receive a wire, which passes through it longitudinally. Upon the upper end of the wire is cut a thread to screw into the shank of the saw which projects above the end of the pole, and fits into a dovetailed groove or socket in the side of a ferrule attached to the upper part of the pole, where it is secured by a set screw. By this construction, in using the instrument, the hook is passed over the twig to be cut, and the wire pulled down through the pole. The saw is operated by the reciprocating movement of the wire and pole upon each other.

Improved Self-Closing Faucet Attachment.

Robert McConnell, William Truesdell, and Fredrick Mertsheimer, Omaha, Nebraska.—An inside collar, at the end of the faucet tube, serves as shoulder rest for a spiral spring, which coils around a tubular valve, resting with its other end against a shoulder of the same. Apertures at the end of the valve allow the liquid to pass out through the tube when that end projects outside. A solid extension of valve, of smaller diameter than the same, is threaded, and holds, by nut, a soft rubber disk and a strainer on the end of the tube. The rubber disk is of the same diameter as the tube end, the strainer fitting closely over the same. By the joint action of the spiral spring and nut, the disk is pressed firmly against the end of the tube, closing the same effectively, so that no liquid can escape. The faucet, when it is desired to draw off the fluid, is turned in far enough to strike the valve, forcing the same back, so that the disk is carried toward the inside of the vessel, and the apertures of the valve pass to the outside of the tube. The liquid enters, therefore, through the strainer and apertures into the valve and the faucet, and is easily allowed to escape.

Improved Boring and Drilling Machine.

John J. Sheridan, New York city.—This invention has for its object to furnish an improved device for drilling, boring, cutting screw threads, etc. The machine may be adjusted by means of set screws, and its base is secured to the table by bolts, so that it may be further altered in position by simply loosing the nuts of said bolts. Screws, which pass down through the base and rest against the table, enable the machine to be conveniently adjusted horizontally or plumbed, and the bolts secure it firmly in place when adjusted. The upright frame of the machine is made in the form of a segment of a hollow cone, in two parts, flanged and bolted together so that the upper and lower parts may be adjusted upon each other. The tool holding shaft passes up through the hub of a bevel gear wheel, so that the said wheel may carry the said tool holder with it in its revolution, while the said tool holder may be free to move longitudinally in said wheel. The latter revolves in bearings in the frame, and engages, by a gear wheel and also by pulleys and band, with the driving shaft. The shaft is provided with two sliding clutches, and is made to carry the band pulley or gear wheel with it in its revolution, according as one or the other of the clutches is thrown into gear. A three armed lever has forks upon two of its arms, which enter grooves in the clutches, so that one of them may be thrown into and the other out of gear by a single movement of the lever. The third arm of the lever serves as a handle. Power is applied directly to the shaft by means of another shaft meeting it at an angle and connected with it by bevel gear wheels. To the upper side of the gear wheel, through which the tool holder passes, and upon the opposite sides of the center, are attached studs, the upper ends of which are connected by a bar. To the middle part of the bar is swiveled a screw, which screws into the upper end of the tool holder, so that the tool can be fed down to its work or raised from its work by turning the said screw in one or the other direction. By suitable mechanism, each revolution of the gear wheel feeds the tool shaft down the distance of one thread of the swiveled screw. By a suitable device, when a female screw thread has been cut, the cutter may be withdrawn from said thread, allowing the holder to be run out quickly, and without danger of injuring said screw thread.

Improved Bee Hive.

George Miller, Battle Ground, Wash. Ter.—This invention consists in an improved bee hive formed of a number of cells, provided with a roof, and supported by a single shaft or post from a base. Around the foot of the post is placed a vessel to receive water to prevent ants and other insects from crawling up. The main frames are formed of an upper and a lower plate within the cells, connected at their side edges by two or more bars. In the top and bottom plates of the main frames, and midway between the side bars of said main frames, are formed grooves to receive the top and bottom bars of the single frames, so that the said frames attached to them may be drawn out conveniently and without breaking or otherwise injuring the comb, or the comb in the main frames. The bottom plates of the main frames are slotted, to give free passage ways to the bees. The lower or open ends of the cells are closed with plates, which are secured in place by buttons pivoted to the partition walls. The buttons are semicircular in form, which enables them to be turned to release one plate without releasing the other.

Improved Propulsion of Vessels.

George Boucher de Boucherville, Quebec, Canada.—This invention consists in an improved wave motor for turning the propeller screw of a ship, vessel, or boat. A heavy platform is suspended by pivoted rods so as to vibrate freely with the pitching of the ship. The after rods are extended each some distance upward, and to their upward ends are pivoted bars which are also pivoted to vibratory rods which carry reversed spring pawls. These pawls move alternately ratchet wheels which are rigidly attached to independent sleeves that are loose on a shaft, and have each a large bevel spur wheel. Between these wheels and engaging with both is a small bevel pinion on the propeller shaft, which, by the motion of the two large wheels, is turned by either alternately in the same direction. The vibrations of the platform are thus utilized and transferred to the propeller. Patents on this invention have also been obtained in England and various countries on the continent.

Improved Inclinometer or Grading Level.

Dr. John Thomley, Charlottesville, Va.—This invention has for its object to furnish a simple and inexpensive but efficient instrument for readily determining grades, inclinations or angles of various surfaces; and it consists in applying a graduated extensible bar to the ordinary carpenter's or mason's level, and providing such means for adjustment and clamping the same as will enable it to support the level at various inclinations and indicate the grade.

Improved Bee Hive.

John H. Stockwell, Bronson, Mich.—This invention consists in making the honey frame of a bee hive in separate sections, so as to turn like the leaves of a book, thus facilitating inspection, and in making the case in sections, locked detachably by suitable projections and recesses, to enable too large a swarm of bees to be easily divided.

Improved Gage Cock.

Albert A. Murray, Baltimore, Md.—This invention consists in a cock valve and seat, the former arranged to rotate about the stem in combination with a spiral spring that yields sufficiently to allow readily the rotation of the valve and yet to hold it in any position desired.

Improved Car Coupling.

William W. Haver, Schuyler, assignor to himself, James Atwell, of same place, and William Gates, Frankfort, New York.—The coupling pins are passed through the bumper head, and are made with shoulders upon their upper ends, which rest upon the upper sides of the bumper heads and are secured in place by pins passed through them at the lower side of the said bumper head. Upon the upper ends of the pins are formed hooks, which point toward the car bodies. The coupling link couples the cars by being dropped over the hooks of the pins. A short standard is connected with the middle part of the coupling link and receives an arm which is pivoted to said standard by a pin passing through a longitudinal slot in the said arm, to give the link the necessary play to accommodate itself to the various movements of the bumpers. The other or inner end of the arm is attached to a short shaft, which is pivoted and to which is attached a short arm, to the outer end of which is pivoted the lower end of the rod which passes up through a keeper attached to the car body. To the rod is attached a double stop to hold it in place. By this construction, by raising the rod the link will be raised from the hook pins, uncoupling the cars; and when the rod is lowered, the link will be lowered upon the hook pins, coupling the cars.

Improved Feather Renovator.

Wason B. Cooper, Monticello, N. Y.—The outer casing forms, together with the semicircular bottom of sheet metal or other suitable material, a steaming chamber, the upper part of which is of hexagonal shape and arranged with hinged lids, and perforated screens below them. A hollow shaft passes centrally in longitudinal direction through the chamber, and carries, near the side walls of the same, drums, with perforations of the sides facing toward the interior. Longitudinal strips connect the drums, and act as stirrers on their rotation. The steam is admitted to the hollow shaft from its opposite end, and passes through the perforated drums to the interior of the chamber, being led out again by means of tubes at the top of the casing. The doors are tightly closed during the steaming process, to produce a thorough cleansing of the feathers. The condensed water, together with the dirt, collects at the bottom of the chamber, and is drawn off through a dumping box. The drying chamber extends from the lowest point of the steam chamber along its full length on the side opposite the dumping box. It is provided with the entrance and exit pipes through which the steam is admitted and let out for drying the feathers after the steaming process is completed. The outer doors or lids are opened during the drying and cooling process to allow the free passage of a current of cold air through the feathers.

Improved Manufacture of Steel.

Hilaire Andre Levallois, Paris, France.—This invention relates to a compound prepared from soft iron, tungsten, and nickel, which forms a cast steel of superior quality. The proportions used are: for the first quality, soft iron, ninety-three parts; tungsten, six and one half parts; nickel, one half part. For the second quality, soft iron, ninety-five parts; tungsten, four and one half parts; nickel, one half part. For the third quality, soft iron, ninety-seven parts; tungsten, two and one half parts; nickel, one half part. The furnaces and crucibles employed are the same as those ordinarily used in the manufacture of cast steel. The tungsten and nickel are mixed together and inclosed with a suitable flux in a soft sheet iron tube, which is placed in the center of the charge, said charge being sprinkled over with a quantity of the flux, varying (in proportion to the quantity of the metal treated) between one half part and two parts of flux to one hundred parts of metal. As soon as the mass has become liquid it is run off in the usual way into a sand or metal mold, the latter being lined with a mixture of clay and percarburet of iron. Before and during the process of running off the fused metal, a vacuum is produced in the mold by covering the bottom of the funnel with a diaphragm of parchment, which is destroyed by the contact of the fused metal. When the alloy is run into a metal mold, the ingot is removed as soon as it becomes solidified. It is then annealed in a closed vessel, and allowed to cool gradually. The steel produced as above described may be hammered in the same way as ordinary steel. The flux is composed of biborate of soda, calcined silex and carbonate of lime, pulverized in a mortar, mixed together, placed in small quantities in a crucible heated to a white heat, and, when liquefied, run off on a fluted cast iron plate. Finally, the flux thus obtained is crushed into small particles before it is used.

Improved Vessel for Transporting Grain in Bulk.

Francesco Demartini and John Chertizza, New York city.—Cross stays are placed about half way between the deck and the bottom of the vessel, and are connected for the support of the sides. Stanchions are placed on each of the cross stays, supported at right angles with the deck, and have partition boards upon each side, which divide the portion of the hold above the cross stays into three compartments. The partition boards on the insides of the stanchions extend from the deck about one third the distance to the stays. Those attached to the outer sides of the stanchions extend from the cross stays upward a short distance above the lower edges of the inner partition boards, so that the two boards of each set of stanchions lap past each other. The compartments are connected by the spaces between the stanchions, so that the grain may pass over the outside partitions from the outside compartments, and under the inside partitions into the central compartment. This is done as the vessel rolls and is careened. The result is, the central compartment is soon filled after the vessel commences to roll, and the grain in that compartment is retained. By this improvement, shifting of cargo, it is claimed, is so prevented that no damage can occur, and the vessel is navigated as easily as it is when laden with immovable cargo.

Improved Folding Camp Baker.

Frederick Lehnen, Marquette, Mich.—The object of this invention is to provide (for the use of surveying parties, expeditions, and others, who are obliged to encamp in the field at some distance from human habitations,) an improved baker, which can be readily folded up after use. The invention consists of a main part with two side wings and a top hinged to it, which are arranged and connected by suitable rods for carrying the baking pan. The latter is placed in a horizontal position by elevating the main part by means of hinged supports. The main and hinged parts may be folded up so as to incase the pan and lock all the parts safely together.

Improved Combined Padlock.

Wm. C. Langenau, Cleveland, Ohio.—This invention relates to permutation lock and consists in novel means by which the combination of numbers may be conveniently changed. The peculiarity of this permutation locks consists in pivoting a plate on a stud that has projections which act in conjunction with notches on a subjacent plate and thus allow the changes of combination to be easily effected.

Improved Broom Hanger.

Mary A. Clifford, Boston, Mass.—There is a metallic spring loop and an open spring band, the two being connected by eyes. This band is made large enough to receive the small end of a handle, so as to hold it by friction. The loop is hung upon a nail, and thus suspends the broom.

Improved Windmill.

George Stearns, Eldorado Mills, Wis.—This invention consists of novel contrivances for causing a pumping windmill to start and stop self-actingly by the influence of the water raised up into the tanks and by weights It also consists of an ingenious contrivance for adjusting the vanes to take the wind more or less, by the influence of the wind; and it also consists of an extension of the frame to the front side of the wheel, to furnish a bearing for the front end of the shaft.

Improved Wheel for Vehicles and Mode of Detaching Horses.

Rolls R. Jones, Pillar Point, N. Y.—The tire is semicircular in form, or has its edges bent inward, so as to enter grooves in the felly. A nut is inserted in an open cavity in the felly, and a sheet metal cap is then applied over the felly at that point, and its flange covers the lateral opening of said cavity. A screw having a head passes through nut and cap. The end of the spoke tenon rests or abuts on the screw head. The sheet metal socket is divided longitudinally to adapt it to be fitted over the screw head, and is tightly clamped around the nut and around the spoke tenon by rings. When it is desired to disconnect the felly and spokes, the bands are slid off the socket, and the latter may then be sprung off the head of the screw. Another improvement in wheels by the same inventor consists in a metal plate, let into the felly in the axis of the spoke, and secured by a pin. The bearing piece for the end of the spoke is clamped on the felly by a key. The cap has flanges overlapping the sides of the felly to secure it against splitting. The bearing piece may be cast together with the cap. The spoke is slotted at the end suitably to be fitted on the plate and key, and it is firmly secured thereon by a plate bent around the spoke and secured by bands, which are driven on tight and secured by solder. An elastic washer is placed between the band and cap to lessen the shocks. The same inventor has also patented an improved device for detaching horses from shafts. Near each end of the whiffletree is attached a short arm, in the outer side of which is formed a recess to receive a projection formed upon the inner side of a similar arm, which is pivoted to the end of the whiffletree. With the pivoted arm is connected a spring so as to draw back the arm whenever it may be released. To the outer side of the short arm is attached a loop to receive the tug and prevent it from sticking upon the projection of the other arm and being carried with said arm when it is drawn back. To two levers is connected an eye by means of which the levers are operated to withdraw catches and allow the pivoted arms to spring back, releasing the tug. The eye may be operated by hand, or by a wire extending to the carriage and secured in such a position that it may be readily reached by a person in said carriage to detach the horse when desired.

Improved Mode of Operating Bellows of Furnaces.

Hugh Crumlish, Buffalo, N. Y.—This invention consists in the means for causing the bottom of the bellows to remain always parallel with the top while being moved up and down.

Improved Machine for Shaving Shingles.

Thomas H. Carter, Bremen, Ky.—This invention consists in combining with rotary radial drivers, cutting blades set in the direction of chords less than the diameter of the circle within which the driver rotates; also in the relative arrangement of regularly intervaled drivers and blades, the sets of each differing in number; also in combining rotary drivers and stationary knives with guides and springs to hold the shingle blank in operation. This machine is entirely without cog wheels, or any other mechanism so liable to get out of order, require frequent repair, and create delay as well as expense. The power required is very small indeed in proportion to the amount of work that may be accomplished. Of course, on the same principle, a large or small machine may be constructed, the number of knives and drivers, as well as other parts, being variable; but, with one horse, seventy-two thousand shingles may be shaved in a satisfactory manner, in a working day of ten hours, by careful and practised workmen.

Improved Horse Hay Rake.

Burton J. Downing, Mitchell, Iowa.—This invention has for its object to furnish an improved horse hay rake so constructed that the teeth can be conveniently raised to dump the hay when desired by the advance of the machine. By suitable construction, when a sufficient amount of hay has been collected by the teeth, the driver with his foot pushes forward the end of a lever which throws the parts of a clutch into gear, and the movable part of said clutch is carried around with the axle. This draws a chain forward, the first effect being to raise a pawl from a rack. The second effect is to draw the upper arm of a lever forward, which raises the rake teeth and discharges the collected hay.

Improved Coal Scuttle.

Amasa S. Thompson, Little Falls, Minn., assignor to himself and Louis Vasaly, of same place. This invention relates to coal hods or scuttles; and it consists in the cover, made in two parts, which are hinged at opposite sides so as to be opened and closed by the bail.

Improved Machine for Manufacturing Carpet Lining.

Edward H. Bailey, Brooklyn, N. Y.—This invention consists of apparatus combined with the machinery used for arranging the bat and the paper sheets together, by which odoriferous substances are sprinkled upon and mixed with the bat in regular and uniform quantity while the lining is being made and before the bat is inclosed between the papers. The invention also consists of apparatus for pasting the paper to cause it to unite with the bat, gaged to the paper rolls by rollers, and caused to rise up to the paper rolls as they decrease in size by cords and weights.

Improved Wagon Seat.

Michael Likes, Mansfield, Ohio, assignor to himself and J. H. Barr, of same place.—This invention consists in providing the wagon seat with risers or supports, which are of angular form in one direction, and pivoted to the sides of the wagon box, and produced under a certain angle, so that the seat is not only thrown forward, but inclines at the same time beyond the foot board.

Improved Children's Building Blocks.

Abraham Oberndorf, Jr., Baltimore, Md.—This invention relates to blocks wherewith children may be amused and their minds instructed by the combination of said blocks so as to present the semblance of well known objects. The invention consists in making these blocks of such relative shape that, although comparatively few in number, houses, bridges, arches, chairs, rockers, cupolas, tables, fences, windmills, the letters of the alphabet, chandeliers and other articles of furniture and of an architectural character, may all be produced by their different combinations.

Improved Hay Elevator and Carrier.

Cyrus H. Kirkpatrick, Lafayette, Ind.—This invention furnishes a device for raising hay from the load, in a perpendicular line, to any required hight, and then carrying it in a horizontal line to any part of the barn, after which the car is returned by a weighted cord and the empty fork lowered to the pitcher without any exertion on his part. It consists of an iron bumper and latch pivoted together and held in a car which hangs on a track suspended by hooks from the rafters of the barn. The latch has an elbow, extending downward, which is forked and forms a rest for a trip block placed on the rope; so that, when the trip block strikes the bumper and unlatches the car, the forked rest is thrown under and supports the load while traveling back into the barn. When the car returns over the load or floor, it is latched fast, the forked rest flies from under the trip block, and the fork is lowered for another load. The car slides on hard wood slides, and the track is spliceable and supportable at any point.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents*. This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawing, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them, they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure my Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office. Such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Rejected Cases.

Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate Address MUNN & Co., stating particulars.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co. 37 Park Row, for full particulars.

Design Patents.

Foreign designers and manufacturers, who send goods to this country may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row.

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Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Canadian Patents.

On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee $20) or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, N. Y., who will give prompt attention to the business and furnish full instruction.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

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Notes & Queries

J. K. asks: How can I obtain a varnish or other liquid, that would be perfectly oil proof, and not crack when spread on a flexible surface? Soluble glass will not do.

G. W. B. asks: What is the best preparation for dyeing felt to a glossy black?

L. W. asks: How can brass be made of a permanent dark brown color without the use of paint?

G. W. C. asks: If two locomotives were placed at the summit of an incline and allowed to descend of their own gravity (all things being equal except the size of wheels, which are four feet diameter on one and six feet diameter on the other), which will reach the foot of the hill first? If either, why? [This is a good problem for some of our younger readers, and we would be glad to hear from them on the matter.—Eds.]

H. M. H. asks: How can I prepare test lead for assayer's use? I want to get it free from silver, copper, etc., and to have it as nearly pure as possible.

C. E. R. asks: How can I make ink which, if used on blue writing paper, will take the color out, leaving a clear white letter?

Answers to Correspondents

C. C. says: I wish to make a small speculum for a reflecting telescope. 1. Can I electroplate the surface of my mold with speculum metal? 2. If so, how can I polish the surface of my mirror? 3. Is there any way to determine the dip of the speculum that will be necessary to overcome all aberration? Answers: 1 and 2. Speculum metal, being an alloy of copper and tin, you cannot plate with it; but you can of course plate the surface of your mold with silver, which, when polished, gives an excellent reflecting surface. Polish with chamois leather and Paris white. 3. A parabolic form given to the mirror of a speculum will prevent aberration.

C. A. C. asks: 1. How can I bleach or whiten sponge? 2. How can I make a silver-coating solution? Answers: 1. Sponge can be bleached by first soaking it in very dilute hydrochloric (muriatic) acid to remove calcareous matter, and then in cold water, changing it frequently and squeezing the sponge out each time to remove all traces of the acid. It is next soaked in water holding a little sulphurous acid, or (better) a very little chlorine in solution. The sponge afterwards is repeatedly washed and soaked in clean water, scented with rose or orange flower water and dried. 2. You can silver brightly polished articles of copper or brass by using the following mixture: Silver dust (fine) 20 grains, alum 30 grains, common salt 1 dram, cream of tartar 3 drams; rub them together to a fine powder, make into a paste with water and rub on the surface of the copper or brass. The silver powder is made by precipitating it from a solution of nitrate of silver by means of a copper plate.

W. H. W. M. asks: What vegetable or mineral substance does the grape vine absorb from the earth in order to color the grape skins purple? Is the change due to the action of the sun? If so, what transformation does the grape go through? 2. What is the best and cheapest manner of preparing skeleton leaves for ornaments? 3. How can I remove ink from a Brussels carpet? Oxalic acid appeared to take it all out; but when the carpet dried, the dark color of the ink returned. Answer: 1. The change of color from the green unripe fruit to the purple grape is due to a molecular change, caused by the chemical action of light, or the natural organic changes in the fruit, on coming to maturity. A molecular change does not indicate any chemical change in composition. The influence of heat in effecting this change may be seen in the case of ordinary yellow and red phosphorus. Heat has effected a molecular change without altering the chemical composition. 2. Collect dry leaves and boil them for an hour or more in the following mixture: Dissolve 4 ozs. washing soda in 1 quart hot water, and add 2 ozs. quicklime; boil together 15 minutes, and pour off the clear portion after settling. Boil the leaves in this solution until the fleshy matter of the leaves is soft. Put the leaves then into cold water, and rub the soft portion away. Then place them for about 15 minutes in a solution of bleaching powder (chloride of lime) with a little vinegar. Lastly wash in cold water and dry. 3. Damp the spot with boiling water and rub quickly into it some finely powdered oxalic acid. Repeat if necessary.

L. H. W. asks: What will be the difference between the power of a steam cylinder three inches in diameter with six inches stroke of the ordinary construction, making two hundred revolutions per minute, and that of a rotary steam engine with the same amount of steam surface on the periphery of a seven inch drum, making four hundred revolutions per minute? Will the same proportion hold good in all sizes of engines? Answer: You can readily calculate this for yourself in any case. The power exerted by the reciprocating engine = area of piston in square inches × twice length of stroke × number of revolutions per minute × steam pressure ÷ 33,000. The power of the rotary engine = area of piston in square inches × mean circumference of revolution × number of revolutions per minute × steam pressure ÷ 33,000.

J. N. N. says: When a common house fly dies upon a mirror or pane of glass, it is found surrounded by a kind of opaque vapor, or substance resembling vapor, for about a sixteenth of an inch in all directions. Can you tell me the cause? Answer: It is a mold or fungus that springs from the decaying body of the fly.

W. C. C. asks: Why do railroad men continually grumble about cast iron wheels, and yet cannot be prevailed upon to use any other? Answer: Chilled cast iron wheels are considered by many railroad men to be the best. The principal objection to wrought iron and steel wheels is the cost.

D. asks: If a patent is granted for an article of product in the United States, can a party put up the same article in Canada, and export it across the water or ship it into the United States for sale on paying duty? Answer: In this country no person has the right to sell, use, or make a patented article without the consent of the patentee.

E. W. C. asks: 1. What is the greatest horse power obtainable by a turbine water wheel? 2. What is soluble glass, and how is it manufactured? 3. What is the analysis of salt? Answers: 1. The horse power capable of being exerted by a turbine wheel is limited only the hight of fall, quantity of water and size of wheel. 2. Soluble glass is a silicate of potash, or of soda, or a double silicate of both. It can be made by fusing together 1 part silica and 2 parts carbonate of potash or soda, or 54 parts dry carbonate of soda, 70 parts of dry carbonate of potash and 192 parts silica. 3. Common salt is chloride of sodium, a combination of the two elements chlorine and sodium. It contains, when pure, 60 of chlorine and 40 of sodium in 100 parts.

A. R. asks: Is it true that a locomotive engine, when towed for a short distance, would fill the boiler (by suction) full of air, taking the supply through the exhaust nozzles, making the boiler a compressed air receiver, and by this means store up power sufficient to propel the engine? The engine is supposed to be in full working order, with the cylinder cocks closed. The pressure (over a certain amount) would, I maintain, be relieved by the air escaping by the way it entered. Answer: Such an occurrence might take place under certain circumstances, depending upon the direction in which the engine was moving and the position of the link.

M. H. S. asks: What is used for bronzing small cast iron pieces, so that the bronzing does not corrode or wear off? Answer: The method most commonly employed is to use a bronze lacquer. Sometimes bronze powder is put on with sizing.

D. asks: What will destroy cutch brown on silk or wool, and not injure the goods, so that a good black can be dyed on it? Answer: Wash the goods thoroughly and expose them in a close chamber to the fumes of burning sulphur, or plunge into water moderately impregnated with sulphurous acid gas. Afterwards wash thoroughly and dry.

D. J. J. says: 1. I have a blue flannel shirt with a white flannel bosom; the latter cannot be taken off, and I would like to know how to clean the white flannel without injuring the blue flannel. Will ammonia or ether do it? What will clean the blue flannel without injuring it? Answer: Wash your flannel in the ordinary manner, but immerse at once in warm water, not in cold, and let the operation of washing be done as quickly as possible. This will prevent, in some cases, the removal of the coloring matter, and also shrinkage.

G. H. asks: 1. Is there any chemical compound which will give to dark hair a permanent, natural gray color? In other words, can you destroy the vitality of the hair without injuring its growth? 2. What is the nature of the dye that some ladies use to give their hair the appearance of age? 3. Is this dye permanent? 4. Has it ever been demonstrated that explosions of boilers, not manifestly due to low water, are caused by generation of electricity or by some power greater than steam, inside of the boiler? If not, what is the accepted theory on this point? Answers: 1. We think not. 2, 3. They employ a powder. 4. Our theory of boiler explosions is that they occur because the pressure of the steam is greater than the boiler can sustain.

S. T. W. asks: What is the American standard for a horse power, and what difference is there between the American and the English standards? Answer: The English and American units for horse power are the same, namely, the work performed in raising 33,000 lbs. one foot high in a minute.

S. P. asks: If a rope has a horse hitched to each end, the horses pulling in opposite directions with a force of 500 lbs. each, what is the strain on the rope? Answer: 500 lbs.

J. S. asks: What ingredients are used to render neutral to each other two or any number of different colors of oil paint, so as to keep them from running together on water or while wet, and the process of mixing the paints with such substances? Answer: If you have in view the finishing of water colors with oil paints, a method to prevent the different colors running together is to cover the water color, when perfectly dry, with a thin coat of size, carefully applied.

J. G. D. T. asks: Does confined gunpowder, when ignited, expand gradually until it breaks its enclosure, or does it create an explosion without any gradual expansion? Answer: Expansion is necessary to explosion. In the case of gunpowder, it takes place quickly.

S. B. L. asks: How can I temper small tools? Answer: You should heat the articles to a straw color, and plunge them into water which has the chill taken off. You may be able to produce a better temper by dissolving some soap in the water. To heat to a straw color, place the articles in a pot of melted tallow, over a fire. When the tallow is heated to such a degree that it just commences to smoke, withdraw the articles, and plunge them into the water.

W. M. asks: What will take the stains of pears and apples out of linen and cotton? Answer: Wash the articles thoroughly in hot soap and water, and then apply, with a rag or sponge, a little *aqua ammonia*, commonly called spirit of hartshorn.

C. N. asks: Does not the use of a bucket pump, instead of a double acting one, involve the loss of over ½ of the power that would be available by the use of the latter? Suppose that the head be 102 feet, which gives a pressure of 45 lbs.; to this head add 10 feet, as the pump is set in the water, which will add about 4 lbs. to the lift on the bucket, the diameter of the bucket being 57 inches: 57 inches diameter=2551·7616, which × 49 lbs. pressure gives a load on the bucket of [illegible] lbs. The diameter of the plunger (being 40 inches) gives an area of 1256·64, which × 45 gives a water load of 56548·8. Answer: The double acting pump ordinarily has a check valve at the bottom of the delivery pipe, so that the head of water in the pipe is not available in the down stroke. It would appear, then, that the only loss in the bucket pump, which is not also incident to the double acting one, arises from not utilizing the weight of the bucket and pump rod in the down stroke.

W. F. S. asks: 1. Is it safe to blow off at 60 or 70 lbs., the certificate allowing me to carry 80 lbs.? The boiler is 5 years old and in good condition. 2. I am greatly troubled about keeping packing in around valve rod and piston. The engine runs very hot. It makes 250 revolutions and the packing burns out very quickly. 3. Is it easier to keep up steam with a little over one gage of water, or is it better to have the boiler full, after it once raised to the required pressure? Answers: 1. *If you are in doubt about your boiler, the best plan would be to test it.* A convenient method was given in our answers to correspondents, a short time ago. 2. Try asbestos packing. 3. We do not believe there is much difference in either case.

W. W. J. asks: How can I temper malleable iron, or convert it into steel? Answer: We suppose you refer to the case-hardening of iron. Heat the iron to redness, cover it with prussiate of potash, and plunge it into cold water. A better process is to heat the iron in an airtight box, containing animal carbon, which may be prepared by slightly burning horns or hoofs, and reducing them to powder. Keep the box at a light red heat, for an hour or more, and then empty its contents into cold water. Either process hardens the iron on the surface, but does not convert the whole material into steel.

R. M. says: I have a steam engine, 14 inches cylinder and 20 inches stroke, making from 100 to 120 strokes per minute, running without governor. The valve has very small lead, scarcely one thirty-second of an inch. I want to know if more lead would not give me more power, and also let the engine run more easily? About twenty years ago I had an engine of 2 feet stroke, with but small lead; I had occasion to change the run of the engine; and in doing so, I happened to give her nearly ½ inch lead, which made her run, I think, one fourth faster, with the same amount of steam. Answer: The proper amount of lead can best be determined by experiment, and you can probably hit upon it after a few trials.

J. says: In riding in the bed of a creek, I came across a spot that sounded hollow; no outlet could be seen; the bottom was sand and gravel, and the creek was moderately full only. What would be the result of digging? 2. Does it injure a shot gun to oil it inside? If oil is used, what kind is best? Answers: 1. If you should dig over the spot where the hollow sound was perceived, you would probably tap a cave, or natural hollow in the earth. Such are produced, especially in limestone districts, by water, which has dissolved or washed away the mineral substance which originally filled them. 2. If you use any oil for your gun, use some kind that will not oxidize or thicken, such as watchmakers' oil; and use very little of that.

F. X. M. says: Our men in the shop use soft soap to remove the grease and dirt from their hands when they quit work. This, they find, causes cracks to come; but if they dip them in vinegar just after washing with the soft soap, their hands will remain soft and smooth, and any cracks on the hands will immediately heal up. Can you give the chemistry of this? Answer: In the ordinary careless manufacture of soft soap, there is apt to be sometimes an excess of alkali or lye, above that necessary for complete saponification. This has a caustic action on the skin, making it rough, and otherwise injuring it. After using soap of this kind, washing in vinegar removes the excess of alkali from the hands. Vinegar, being an acid, combines with the alkali, forming a neutral and soluble salt.

D. F. asks: Will carbureted air burn in an atmosphere of its own carbonic acid, under a pressure of 60 lbs. to the inch? Answer: No.

S. R. asks: What can be done to make gasoline gas burn steadily when a draft of air or gust of wind strikes the flame? Coal gas is not affected by winds nearly as much as that of gasoline. Answer: The peculiarity you speak of is due to chemical causes which it is difficult to obviate. Coal gas or heavy carbureted hydrogen is a complete chemical compound with little or no mechanical mixture of incombustible substances. Its combustion, therefore, gives rise to a steady flame, the light being produced by incandescent particles of carbon, and a complete chemical decomposition of the hydrocarbon taking place. In carbureted air, however, made by passing atmospheric air through naphtha, etc., we have merely a mechanical mixture of a hydrocarbon vapor with an incombustible gas, namely, the atmosphere. The nitrogen, by far the larger portion of the air, not being combustible, is rapidly driven off through the flame, giving rise to the flickering unstable flame of carbureted air.

M. asks: What should be the form and size of the fire box for a vertical boiler (without flues) 3 feet by 1½ feet, made of No. 14 iron; and what pressure will such a boiler safely bear? Answer: The boiler should have a flue all around it, extending nearly up to the top (the smoke pipe connecting at one side), and the grate should be as large as the diameter of the flue. The boiler will sustain with safety a pressure of about 35 pounds per square inch, if, as we suppose, its diameter is 18 inches.

E. E. H. asks for an explanation of our recipe for preserving cider. Answer: Read ½ pail of sugar instead of ½ part. We have since learned from the manufacturer that the sugar may be omitted, with advantage, when the juice is good. The sugar is apt to cause too great a fermentation. If sugar be added, however, experience would teach what quantity to use.

J. R. asks: When an electric battery is applied to a person for some time, and he keeps shaking afterwards as if he still had hold of the handles, is it right to apply the battery to take it off him again, or to let the electricity remain in till it goes of itself? Answer: Any trembling or shaking of the muscles or limbs after an electric shock is a sign that the shock has affected the nerves too severely, and not that any free electricity still continues to circulate in the body. Another application of the battery would only make matters worse.

J. T. asks: How is it that steam taken from a boiler will force water into same boiler, that is, force it against itself? Answer: In the action of the Giffard injector, steam is condensed, and the power previously existing in it is expended in the propulsion of the water.

G. W. asks: 1. What is Javelle water? 2. What is the easiest and most economical way of procuring oxygen gas? 3. How is soda water made? 4. Where can I get Bloxam's "Chemistry?" Answer: 1. See, p. 278 vol. 26. 2. Heat the binoxide of manganese to a dull red heat in an iron retort. 1 lb. of good commercial binoxide of manganese will yield from 5 to 6 gallons of oxygen. 3. By charging water under pressure with carbonic acid gas, procured by the action of sulphuric acid on marble dust or any carbonate. 4. See our advertising columns for publishers.

C. A. D. asks: When, where, and by whom were spectacles invented, and what first suggested their use? Answer: Spectacles were first invented in the thirteenth century. Francisco Redi, in a treatise on spectacles, says that they were invented between the years 1280 and 1311 A. D., by a monk of Florence named Alexander de Spina. Muschenbroeck says that it is inscribed on the tomb of Salvinus Armatus, a nobleman of Florence, who died in 1317, that he was the inventor of spectacles. By others Roger Bacon, in England, who died in 1292, has been considered the inventor.

T. B. W. asks: If a steam boat runs eight miles in an hour, from point to point (in still water), what distance would she run with the help of a four mile current? Answer: The speed of the vessel would be increased by the speed of the current, if the resistance of the air is neglected.

J. S. H. P. asks: 1. How is carbolic soap made? What proportion of the (pure) acid is used? 2. In midwinter, when the thermometer in the room stands at 80° or 85°, though clad in thick under and outer garments, we call it only comfortably warm. But in summer at the same temperature, though clad in the thinnest possible garments, we loll in the shade and call it intolerably hot. Why is this? Answers: 1. Carbolic acid soap is made by adding from 5 to 20 per cent of carbolic acid, according to the use to which it is to be applied. 2. We do not always feel the same degree of temperature, for example, 85° Fah., to be invariably oppressive or hot. This is owing to the fact that the atmosphere at this temperature sometimes contains more moisture than at others. The drier the warm or hot atmosphere, the less the heat is felt, owing to the rapid evaporation of perspiration from the surface of the body. During a cold clear winter's day the air contains much less moisture than in summer, so that, although we may be in a room artificially heated to 80° Fah. or above, it may not feel uncomfortable, the insensible perspiration rapidly passing off and cooling the body.

C. W. E. asks: How can I make an electro-magnet to be operated by an earth battery? Answer: You can make an earth battery by sinking two large plates of copper and zinc in moist earth, and connecting them by conducting insulated wires attached to each. Such a battery was constructed by Bain in 1841. You can make an electro-magnet by winding stout copper wire, covered with silk, around a piece of soft iron bent in the form of a horse shoe, care being taken that the coils are wound in the same direction around each bobbin, either from or towards the axis of the magnet. The more numerous the coils, and the greater the power of the electric current, the stronger the magnet.

W. S. B. asks: How can I anneal gold after it has been cast? Answer: We think you can do it by heating the gold, and allowing it to cool slowly.

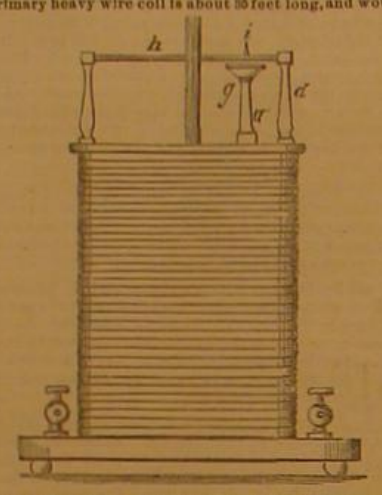
C. R. asks: 1. What is the best and most economical constant battery? 2. I have heard of a thermo-electric battery. Is there one of practical utility? Answers: 1. Daniell's battery is recommended for constant action. It is not expensive, and no gases escape from it. It consists of a cylinder of copper, in which is placed a cylindrical vessel made of unglazed biscuit ware, or porous earthenware. Into this porous vessel a rod of amalgamated zinc is placed. The copper vessel is filled with a saturated solution of sulphate of copper with a little sulphuric acid. The porous cell is filled with dilute sulphuric acid, and on a perforated shelf, fixed to the upper part of the copper cylinder, are placed crystals of sulphate of copper (blue vitriol) to keep up the strength of the solution. 2. Thermo-electric batteries have been made of considerable power, but we know of none that have ever come into practical use.

D. H. M. asks: How can I separate iron from copper and brass? Answer: If you heat the metals in a crucible, the brass will be melted first, and can be poured off.

S. asks: 1. How is aniline made from coal tar? What apparatus is necessary? 2. How are bronze powders made? 3. How are the various colors produced from aniline? 4. Can you give me a good recipe for Worcestershire sauce? Answers: 1 and 3. The basic portion of coal tar or coal tar naphtha, that is, the least volatile products of the distillation of these substances, is strongly agitated with hydrochloric acid in excess. This is done on the large scale in vessels lined with lead. The clear portion of the liquid is then decanted and evaporated until acid fumes appear. It is again filtered and neutralized with potash or milk of lime and distilled. The portion that passes over at 360° Fah. is crude aniline. By the action of bichromate of potash on sulphate of aniline, rich shades of purple and violet are produced. 2. To make a bronze powder, mix peroxide of tin and sulphur, of each 2 parts, sal ammoniac 1 part. Expose to a low red heat in an earthenware retort until sulphurous fumes cease to be given off. 4. The following recipe gives a fine sauce: Port wine and mushroom ketchup, of each 1 quart; walnut pickle 1 pint; soy ½ pint; pounded anchovies ¼ lb: fresh lemon peel, minced shallots and scraped horseradish of each 4 ozs.: allspice and black pepper (bruised) of each 1 oz.; cayenne pepper and bruised celery seed of each ¼ oz. (or curry powder ¼ oz.); digest for 14 days, strain and bottle.

W. W. B. says: In making gas from petroleum, there are several difficulties of which the most serious is the deposit of carbon in the shape of dry powder in the retorts, and other troubles between the retort and the gas holder. Petroleum is the finest gas-making material we have, taking into consideration its price; it will yield from 6,000 to 8,000 feet per barrel, and the supply seems to be inexhaustible. It is a question of great importance to the oil producer to get a steady market for his oil, and to the people to get a cheap and good light. Both of these objects would be attained by a practical solution of this question: Can gas of good quality, and cheap, be manufactured from crude petroleum on a large scale? I say that it can, and it can be done by any mechanical arrangement to inject air and petroleum in graduated quantities into the retorts; and I also say that it will convert all the petroleum into gas of high illuminating quality and leave no carbon in any shape, either in retort or pipes. I have proposed the question to many gas men, but nobody seems to know anything about it, except that petroleum is a difficult thing to handle in gas making. I write to you to ask: 1. Will not the injection of air and petroleum into the retort convert all the petroleum into gas? 2. Would there be any deposit of carbon on the retorts or pipes? 3. Would it be a permanent gas or a mechanical mixture? 4. Would there be danger of explosion from injecting a graduated quantity of air into the retort? Answer: Petroleum being a mixture of various hydrocarbons, that is, various chemical combinations of hydrogen and carbon that are for the most part liquid at ordinary temperatures, it is obvious that it cannot be changed into a permanent gas without decomposition, or a new interchange of its elements, forming new chemical compounds. It is found that, when petroleum is submitted to a high temperature without access of oxygen, decomposition takes place, a quantity of uncombined carbon being deposited. It is evident, then, that the permanent gas formed is a hydrocarbon with a less proportion of carbon than the liquid petroleum. To convert all the petroleum submitted to heat into a gaseous body, something must be supplied that will combine with the extra carbon and form either another illuminating compound or one that can be removed by subsequent purification. When petroleum burns in the air, its elements combine with oxygen, forming carbonic acid gas and vapor of water. The injection of air or oxygen into the decomposing retorts would therefore defeat the object in view that of making a permanent illuminating gas. It would simply cause a combustion of the petroleum more rapid than that which takes place in the open air, besides the risk of explosion. It would be far more philosophical to inject hydrogen with the petroleum into the retort, or to decompose the petroleum in an atmosphere of hydrogen. This hydrogen could be readily formed by decomposing superheated steam by means of red hot anthracite coal. Indeed, superheated steam alone in contact with the decomposing petroleum might yield a portion of its oxygen to the extra carbon, thus obviating its deposition on the retort, forming carbonic acid gas which could be removed by water. If free hydrogen were liberated, it would increase the heating properties of the flame. We simply mean here to indicate the philosophical method of experiment, bearing in mind the constitution and affinities of chemical bodies. Nothing but practical trial in this way can solve the problem of the utilization of petroleum in the manufacture of illuminating gas.

J. M. asks: How can I make an induction coil to use with two large Grove's cups? With this arrangement, can I make an electric light? Answer: You can make an induction coil as follows: In the figure, the primary heavy wire coil is about 35 feet long, and wound



round a glass tube. Outside of this is wound the secondary fine wire coil of about 1,400 feet. Battery contact is broken and renewed by the rotation of a soft iron bar, h, which, mounted between two brass pillars, is placed immediately over the axis of the coil, in which is placed a bundle of soft iron wire. The current of the battery passes through the pillar d and the axis carrying the iron bar, and contact is broken and renewed by the point i dipping as h revolves into and out of mercury in the brass cup g, on the pillar a, through which the circuit is completed. The binding screws in front connect with the ends of the coarse interior coil, and for connection with the battery. Two screws behind connect with the ends of the fine wire coil, from which the secondary current is derived, and from which shocks may be taken, water decomposed, etc. You cannot make the electric light with this arrangement. That requires that the fine wire coil should be wound round a soft iron horseshoe magnet, which is made to revolve rapidly in front of a permanent or temporary electromagnet.

J. K. asks: Is there in existence a means or contrivance to start, and keep in motion for one minute only, a machine which uses 5 horse power? The power which runs the machine is unable to set it in motion, and cannot even assist in it. What may I employ to start the machine? Answer: We hardly get your idea; but as the question is stated, it would seem possible to apply some other power, say that of a steam engine, to start the machine.

A. L. B. says: In your answer to I. E. E., the method by which the Lexington Avenue Synagogue is lighted by electricity is incorrectly stated. The burners in the Synagogue are not lighted by the galvanic current heating a platinum wire, but by induced electricity, produced by a new frictional apparatus and condenser, contained in one small case. The electricity, generated by turning a crank, is stored up in the condenser, which, when a sufficient quantity and intensity is arrived at (depending upon the number of burners to be lighted), is discharged, producing a spark at each burner—the circuit being there broken—and ignites the gas which has been turned on immediately before the discharge.

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

J. E. H.—Siliceous earth, apparently infusorial. Infusorial earth is used as a polishing material, under the name of electro-silicon.

J. R. E.—Blue clay, a silicate of alumina.

P. S.—Hypersthene (or Labrador hornblende) with iron.

W. W. B.—Galena (sulphide of lead).

T. F. H.—Galena (sulphide of lead).

J. W. C.—Micaceous iron ore.

COMMUNICATIONS RECEIVED.

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

On Crucibles. By L. T. C.
On Silicon Steel. By C. W. H.
On Heat. By H. C. F.
Gn Perfect Combustion. By C. R.
On a White Blackbird. By J. S. B.
On Using Heat Twice. J. A. H. E.
On Transit on the Canals. By R. D. R.
On the Art of Inventing. By K.
On Lunar Acceleration. By J. H.

Also enquiries from the following:
C. K. C.—P. W.—W. H.—W. H. S.—E. J.—E. H. K.—S. E. J.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal" which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

October 14, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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26,860.—MAKING TINWARE.—S. J. Olmsted. Dec. 31.
26,902.—LAMP.—G. Neilson. Jan. 7.
26,467.—SINGEING PIGS.—A. Denny et al. Jan. 14.

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25,796.—JACQUARD MACHINE.—A. Babbett.
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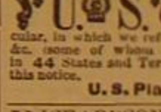

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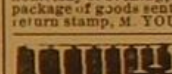

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