or a man to handle without. Some extraordinary sheets were made for special purposes by the use of cranes, in molding.

Before the introduction of the power press and the paper-making machine, the demand and supply kept about even pace, as they do now; and the small quantity of paper then produced so well supplied the market, that prices do not materially differ from the present. In the art of paper making, the great mechanical agency is the beating engine for grinding the rags, which may be a thousand years old as an invention. With that and the process of molding that we have described, they jogged along down till they got into the nineteenth century, that gave birth to power-presses, stereotyping, steamboats, railroads, and telegraphs, when it became necessary to make more paper, and they had to resort to machinery for that. We might give a description of the machines now in use, for making paper; but as papermills can be seen by any one who will take the trouble to visit them, we advise those who are curious, to pursue the course we have done from childhood up—go and see any manufacturing that can be seen, and look into its details, and get intelligence by the shortest possible route.

THE PHILOSOPHY OF ALUM AND DRY PLASTER FILLING FOR FIRE-PROOF SAFES.

The use of alum and dry plaster as a filling for fire-proof safes, is based upon sound chemical and philosophical principles. The two essentials in a fire-proof safe are, that in ordinary use, it shall be perfectly dry, and that, when heated, it shall become wet. So long as it is wet the temperature in the interior of the safe can never exceed 212° Fah., the boiling point of water, at which temperature everything within it is safe, no matter how excessive the external heat may be.

In order that the first requisite (dryness in ordinary use), may be attained, the filling should contain no deliquescent salts. A train of serious evils will result from the use of such salts, as swelling of the filling, and consequent bulging of the plates; corrosion of the metal until it becomes so rotten that a pocket knife may be thrust through its walls; and dampness of the walls, producing mildew and destruction of papers and books.

Potash alum contains $\frac{216}{475}$ of its weight, of water, or nearly one-half. All of this water, with the exception of $\frac{9}{475}$ of the weight of alum, is liberated by a temperature of 356°. At ordinary temperatures it is a perfectly dry substance. It gives off water gradually as the temperature is maintained, and commences to liberate it at 140°. Some other alums contain 55 per cent. of water. A safe, having alum in lumps as an ingredient in its filling, will, when heated, be immediately filled with steam, and, as long as it remains so, must preserve its contents. The dry plaster absorbs the water as it is liberated, and holds it until the heat converts it into steam. Nothing could be more simple than this action, and its efficiency has been often corroborated by the severest tests.

Having deemed it necessary to obtain a new safe for the security of our valuable correspondence, in addition to a number already in use for our books and more valuable papers, we have been supplied with one with alum and dry plaster filling, made to order, at the manufactory of Marvin & Co., of 265 Broadway, this city, which is, in every way, so satisfactory both in elegance of design and finish, that we are constrained to bear testimony to the superior workmanship of the safes made by this firm.

The safe in question has a feature not before used, which is very convenient for filing correspondence. Two doors are provided on opposite sides of the safe, and a double row of tills, of the right capacity for folded letters, built within the walls; access being had to the files through the doors from one side or the other, without the trouble of lifting out one case to get access to another set of pigeon holes behind it. The doors are secured with Sargent's celebrated magnetic combination lock, and the whole safe is a remarkable specimen of good workmanship, both for convenience and in ornamental design. Any one desiring a double safe for their correspondence, or other purposes, will be likely to get some good hints by examining the one at our office before ordering.

ON THE TECHNICAL APPLICATIONS OF DIALYSIS.

BY PROF. CHARLES A. JOY.

A few years ago, Prof. Graham, Director of the Royal Mint in London, discovered that a certain class of substances could be more readily diffused through water than others; he found, for example, that salt, sugar, gum, and dried albumen, if placed in different vessels, and covered with water, will all of them be diffused through the water, but not in the same period of time. The salt spreads rapidly; the sugar requires twice the time, the gum four times, and the albumen twenty times longer. He found, as a rule, that substances which crystallize are diffused more rapidly than those which are amorphous. The first class are called crystalloid, and the second class colloid. When they are both in solution we can employ a thin membrane, or a piece of parchment paper, and, as it were, filter or strain the crystalloid through its pores, while the colloid remains behind. This operation is called dialysis, and the contrivance for effecting it, is known as the dialyser.

A sieve, a half barrel, a drum, a glass jar open at both ends, or even porous earthen cells, will serve for the apparatus. By tying a piece of bladder, or of parchment paper, over one end of any of the above pieces of apparatus, and floating it upon water, we have all that is required. If we pour into such a contrivance a solution of albumen and of common salt, and partially sink it into a larger vessel filled with fresh water, the common salt will very rapidly strain through the membrane into the outer water, and leave all of the albumen behind. Even silicic acid, which crystallizes in the form of quartz, can be separated from compounds in this way, provided it has been previously fused with soda. Graham has performed a series of experiments upon a large class of bodies, a recapitulation of which may suggest some practical applications of his simple device.

He discovered that tannic acid diffused through parchment paper two hundred times more slowly than common salt, and finds in this fact an explanation of the reason why it takes tannin so long to penetrate hides so as to convert them into leather. All processes for making leather rapidly will be found to be based upon the facility with which the substances employed pass through membranes, and the agents used are generally composed of crystalline salts. We are not aware of any practical application of Prof. Graham's discovery to the tanning of leather, but it is certainly worthy of the attention of persons engaged in the business.

Gum-arabic diffuses four hundred times more slowly than salt, and hence belongs to the class called colloid.

The method of dialysis can be employed for the detection of arsenic, emetic, corrosive sublimate, or any crystalline poison, in the stomach, blood, milk, or any organic compounds. The poisons will pass through the membrane into the outer vessel, and their presence can be shown by the usual tests. The same process can be made available in the case of organic poisons, such as strychnine and morphine, and it is further valuable as a method of original research in seeking for alkaloids in any new plants, and it has even been proposed as the best way for the preparation of alkaloids on a large scale. Many plants contains niter and other mineral salts, which can be separated and detected by dialysis better than in any other way.

Nitrate of silver, from photographers' waste, when put into the dialyser, passes through to an outer vessel, where it can be precipitated and saved; the albumen and other organic matter will remain in the inner vessel. For this purpose a half barrel, with parchment tied over the bottom, and immersed in a barrel of water. would be a good contrivance.

Great expectations were raised in reference to the separation of sugar from molasses, and its purification by dialysis. Several patents have been taken out for this purpose. At the Paris Exhibition of 1867, Messrs. Carmichel & Co., sugar refiners and distillers, exhibited dialysers for refining sugar, which they called *osmogenes*. Each apparatus contained fifty or sixty frames, forming partitions one-quarter of an inch in thickness, and furnished with nettings of strings to support the sheets of parchment paper destined to accomplish the work. The frames with water alternate with those for molasses or sirups. Each frame is provided with an interior opening for the hot water, and another for the sirup, so arranged that each section receives, the one the water, the other the sirup. Both liquids start from a hight of three feet, and, after descending to the bottom of the apparatus, return again, at a temperature of 160° to 170° Fahrenheit, and pass out at the top. The water is introduced and regulated according to the extent of purification required.

The inventors of this apparatus claimed for it very important results, and as it was founded upon thoroughly scientific principles, we see no reason to doubt the truth of their statements. The process is particularly valuable in the manufacture of beet sugar, and for removing potash and lime salts from sirups, but it does not appear to have been generally adopted, probably because it is not well understood.

Mr. Whitelaw took out a patent in England, in 1864, for the removal of salt and niter from salted and corned meats by means of dialysis. It is well known that the brine contains a large proportion of the nutritious constituents of the meat, and if we could remove the salt and evaporate the residue we should have all of the properties of a good soup. It so happens that the savory and valuable constituents of meat are colloids, and will not, therefore, pass through a membrane. The salt, which is added to keep the meat from decay, is crystalline, and, as we have before seen, passes very readily through parchment. Mr. Whitelaw takes advantage of these two facts, and puts the brine into porous jars or bladders, which he suspends in water, that must be renewed three or four times in twenty-four hours. After a few days, the contents of the jars will be found to be fresh and sweet, ready for use as soup, or they can be evaporated down to dryness and converted into meat biscuit. In this country, where such large quantities of corned and salted meats are consumed, the saving of the brine is a matter of much practical importance, particularly as what is thrown away is too often the most nourishing portion of the food.

FILTERING OXYGEN FROM THE AIR.

The same principle of dialysis was successfully applied by Graham to the concentration of the oxygen in the air. By passing air through shavings of india-rubber, the rubber retains a portion of the nitrogen, and the quantity of oxygen is increased to forty-one per cent., being twenty per cent more than its usual capacity. An atmosphere with forty-one per cent of oxygen will re-ignite a glowing taper, and, in general, support combustion and respiration in a very active manner. The experiment points out such a simple and cheap way of procuring oxygen from the atmosphere, that it ought to be put to a thorough trial before more money is expended in complicated and costly methods. If, by filtering the air through a membrane, or shavings, or any cheap substances, we can get rid of the nitrogen, we have made a discovery of the highest importance, and the experiments of Graham certainly seem to point out the feasibility of the plan.

Certain physiological phenomena can be very well explained by the doctrine of dialysis; for example, according to Professor Daubeney, of Oxford, gums, starch, oil, or any similar class of bodies secreted in the cells of plants, must be classed among the colloids: they have no tendency to pass through the walls of the cells where they have been elaborated, and consequently arrange themselves into groups. On the other hand, the acids and alkalies are crystalloids, and pass freely through the pores of the cells, and are frequently found on the outside, or they pass to the organs of the plant, where they undergo transformation by action of the vital force. The mucous membrance of the stomach may be compared to the parchment of the dialyser—the crystalloid elements are absorbed, while the colloid remain to be subjected to the action of the gastric juice, which elaborates them according to the laws of nutrition.

The action of different kinds of medicines can be explained according to the same law. Those which are crystalloids will diffuse rapidly through the coating of the stomach, while the amorphous medicines will remain, subject to the action of the gastric juice and the laws of digestion.

The application of dialysis in the dry way has been proposed by a Frenchsavant. He assumed that substances which fused at different temperatures could be separated by passing them through a porous vessel on the same principle. Such an application would be most valuable in metallurgy, but thus far it has not been reduced to practice. In the manufacture of paper from sea-weed, after the weeds have been boiled in caustic soda, the black liquor is thrown away. It would be well to put the waste liquor into porous cells, suspended in tanks of fresh water, to see if the crystallizable salts of iodine would not pass into the outer vessel, where they could be reclaimed.

We have thus hastily noticed some of the leading applications of dialysis. It is a process so very easy, so simple, and so cheap, that it only needs to be better understood to acquire great popularity.—*Journal of Applied Chemistry.*

Alleged Discovery of Petroleum at Wismar.

A strange rumor, says the *Grocer*, is afloat in Germany of the discovery of a petroleum spring at the seaport town of Wismar, in the Grand-Duchy of Mecklenburg-Schwerin. Our Hamburg correspondent informs us that, on March 19th, the workmen employed in digging out the earth for the new sewers in course of construction on the promenade surrounding the town, came suddenly, at a depth of five feet below the surface, upon a spring of oil, which proved to be petroleum of excellent quality, pure, and limpid. It was at first surmised that it might be caused from the leakings from the gas works at no great distance off, but the officials of that establishment declared that such was not the case. The news spread through the town like wildfire, and, in a very short time, hundreds of people rushed to the spot with bottles and pitchers, which they filled with the liquid, and Herr Beckmann, the chemist of the corporation, carried away a sample for the purpose of analyzing it. When one considers that the geological formation of that part of Germany is purely alluvial soil, or at the very oldest of diluvial origin, while the total absence of all rocks, and, on the other hand, the abundance of erratic blocks of Swedish granite of all colors and sizes, covering the surface, suggests a reference to the glacial period, it certainly does appear extraordinary that an oil spring should have been struck within five feet of the surface of the ground. As far as we have been able to ascertain, there are no artesian or other deep wells at Wismar or in the neighborhood, and, therefore, in the absence of any such borings, it is impossible to ascertain, or even approximately to hazard an opinion, as to the nature of the rocky substratum underlying the diluvial surface, though in some parts of Mecklenburg large beds of marl and gypsum have been discovered at a great depth.

Calculating Areas by Weight.

The *Engineer* contains a very novel method for computing areas by weight; an accurate square of homogeneous paper of uniform thickness being used for plotting the map of the area to be measured. The whole is accurately weighed in a delicate balance, and then the tracing of the boundary is cut out, when the weight of the piece cut out, divided by the entire weight of the square will give the ratio of the surface to be measured to that of the square, both being drawn to the same scale. Areas of the most irregular form may thus be very readily and quite accurately determined.

THE Brazil (Ind.) *Miner* says that the furnace of the Indianapolis Furnace and Mining Company, at Brazil, is the largest establishment of the kind in the United States. The furnace, or rather the double furnace of the Western Iron Company, at Knightsville, two miles east of Brazil, though not so large as the one first mentioned, has been a paying institution from the start. The cost of the first stock was nearly $100,000, and the profits of the concern paid for it inside of six months after it first commenced operations.

OVER ninety per cent of the rays issuing from most kinds of artificial lights are according to the German chemist, Landsberg, calorific or heat rays, and as such non-luminous. Sunlight has only fifty per cent of heat rays. He attributes the painful effect of artificial light upon the eyes to this large amount of heat rays. By passing artificial light through alum or mica, the heat rays are interrupted and the light is rendered much more pleasant and less injurious.

A CURIOUS experiment is said to have been recently performed in France to ascertain whether fishes can live in great depths of water. The fish were placed in vessels of water made to sustain 400 atmospheres, under which they lived and preserved their health. It is therefore concluded that fishes may penetrate to very great depths in the ocean with impunity.

During the past seven months, there have been in the United States sixty-one boiler explosions, the great majority of them involving loss of life.

Improved Brake for Velocipedes.

Messrs. Mercer & Monod, of No. 3 William street, New York city, are among the most enterprising velocipede men in the city. At their school they use machines of elegant pattern and excellent action, and adopt improvements as fast as suggested. In the accompanying engravings a new improvement is represented for the management of the brake, and for which a patent is now pending through the Scientific American Patent Agency.

Fig. 1 is a perspective view of the velocipede with the improved brake. Fig. 2 is an enlarged view of the brake and its contiguous parts. The brake shoe, A, is faced with hard sole leather, or some similar substance calculated to hug the tire closely. It is pivoted in a slot through the reach and furnished with a spring, B, that lifts it from the wheel when not forced against the wheel's perimeter by the rider. Its upper end is connected by a forked rod, C, to an arm of a bell crank lever, pivoted just in rear of the driving wheel support to the clip, which also sustains the saddle spring. The other arm of the bell crank is engaged with a strap that may be wound up on the steering bar, D, that revolves in its standards.

It is evident that by this device the rider has entire and perfect control of his vehicle by his hands, the whole muscular force of the arms being readily applied at will. In no case, however, is this force required, only a slight exertion being necessary to prevent the wheel from revolving, even going very steep grades. The adaptation of this brake in no wise weakens the vehicle in any of its parts, and it presents an elegant appearance.

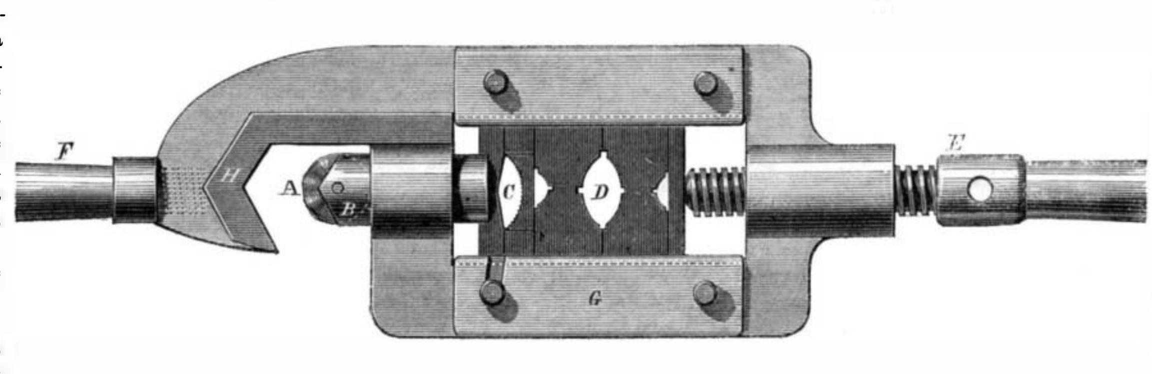
Further information may be had of Mercer & Monod, No. 3 William street, New York city.

MONOD'S IMPROVED BRAKE BICYCLE.

Himmer's Patent Gasfitters' Tool.

The implement shown in the accompanying engraving is designed for fitters of gas, steam, and water pipes of iron, to reduce the number of tools ordinarily carried about, and to provide a handy combination instrument in their stead. By it the pipe is cut, the scale or rust cleaned off, the thread cut to receive the thimble, tee, or cock, and the pipe held while being screwed up.

The stock, or frame, holds a rotary cutter, A, with its stud, B, a scraper die, C, and a set of screw-cutting dies, D. The whole are operated by the screw handle, E. The handle, F, is screwed into the opposite end of the stock, to be used only when threading the pipe. It is readily removed by means of a driver fitting a hole in the handle, as in E. For quick removal of the dies the plate, G, is pivoted near one end and slotted near the other. The stud, B, has a cross piece that steadies it, as seen. It is evident that the dies may be replaced by others instantly. When used as a cramp, or wrench, the cutter, A, is removed by pushing out the pin that forms its axle, when the apex of the stud may be set against the pipe by the screw handle, E, and it is held firmly between the stud and the jaw, H.



COMBINATION TOOL FOR GASFITTERS' USE.

In operation, when it is desired to cut off a pipe, the handle, F, is removed and the pipe inserted under the jaw for cutting off, the stud, B, and rotary cutter, A, are forced up by the screw handle, E, the frame, or stock, is rotated, and the work is readily done. To clean the end of the pipe from corrosion or scale, the pipe is inserted between the scraper die, C, and its bearing block. The thread is cut by the dies, as in an ordinary screw plate, and the implement is used as a wrench, as before shown.

Patented Sept. 29, 1868, by Jacob Himmel, who may be addressed to the care of Edward Gamm, 126 Hester street, New York city. The patentee wishes to dispose of the entire patent.

A LONG REQUIRED NEED SUPPLIED.

Shortly after the close of the exhibition of the American Institute, in the fall of 1867, we recommended that society to establish an inventor's exchange, or perpetual fair, and subsequently sketched a plan of operation. Nothing came of it, and we had begun to despair of ever seeing any such project started.

Inventors and agents have for years exhibited their models, machines, and specimens in the receiving rooms or offices of hotels, where they were temporarily stopping, or carried them about, when portable, from pillar to post, having no central and convenient place for the exhibition of their patented improvements. The inventor, proprietor, or agent showed his device and explained its operation at his hotel only on sufferance, and one hotel near our office that has heretofore been noted as a headquarters for this class of visitors has peremptorily forbidden the further use of its rooms for these purposes. This is not to be wondered at, as the annoyance was great and the profit little, if anything. The only recourse of the inventor or manufacturer was, therefore, the establishment of a New York agency by constituting some dealer in articles similar to that he manufactured a partner, in a certain sense, or a sharer in the profits. But the inconvenience and annoyance was felt more by the purchaser. If a stranger in the city, his labors and time in traveling from one point to another were very considerable; but if he did not expend both, he had little opportunity to compare articles intended for the same purpose, but built by different makers on different plans. Or if he did procure opportunities to see different machines, by visiting as many places as there were machines, he could not compare the two except as he remembered the points of those he had already examined; there was no opportunity to examine them side by side. The anxiety on the part of the resident agent to make a sale (an anxiety entirely proper), also militated against the chances of the purchaser securing either the best article or the one he really wanted. The advantages of the particular machine he was then examining were rendered so apparent by the eloquence of the salesman, and the difficulty of detecting the fault, or faults, in the machine, without close and immediate comparison with another, was so great that it is not surprising he frequently felt, after trying his new acquisition, that he had not been fairly treated.

This state of things was also injurious to the inventor or manufacturer. Most members of these classes desire, and invite comparison and competition; each feeling assured that even if in some one or two respects another's device may be better, his, on the whole is to be preferred for superior advantages. Such competition is healthy and no conscientious manufacturer objects to it, but, on the contrary, courts it. Then, if the customer is not satisfied with the article first shown, and goes to visit some other repository, he will frequently purchase what he is still less satisfied with rather than go back and acknowledge his error. Some centrally located, fairly conducted establishment, where the inventor, the patentee, the manufacturer, and the discoverer could exhibit, side by side, their products, seemed to be demanded by the interests of each and also of the purchaser. For these reasons we have repeatedly advocated the establishment of a central bureau for inventors located in New York city, the commercial metropolis of the country.

Such an establishment we visited a few days ago. It is called the "Whitlock Exposition," from the name of its projector. It is located at Nos. 35 and 37 Park Place, west of Broadway and near the City Hall Park. The building is five stories above the street and two below, the different floors devoted to different classes of articles, from roots, plants, and seeds to sewing machines and works of art. One of the floors, a hall of 50 by 80 feet, is devoted to trials of velocipedes. Offices for permanent occupancy are let to permanent agents or proprietors, while temporary exhibitors have their letters directed to the establishment, and are furnished with stationery and desks with which to conduct their correspondence. Steam power is furnished for such exhibitors as require it, and each exhibitor is entitled to an advertisement in two periodicals, conducted by the company, issued monthly and semi-monthly.

The exhibitors are charged a very moderate price for the room and power occupied and used, and permanent exhibitors a very low rent for their offices. If the company make sales (which they do without drawing invidious comparisons between competing articles of the same class), they expect the usual commission. The establishment is a perpetual exhibition, free to all who choose to visit it. Already it has become one of the features of the metropolis.

Duty to the great body of inventors, as also to the enterprising projector, impels us to this notice of the new exposition which deserves to be known. It supplies a want long felt, and its success is already assured.

A Monster Rope.

A new rope, made by the Universe Works, at Birmingham, England, is of such extraordinary dimensions as to merit special notice. The rope, which is intended for shipment abroad, is 11,000 yards long, measures, 5¼ inches in circumference, and weighs over 60 tuns. These figures are enough to take one's breath away; but when we come to see how the monster is built up, there is cause for still greater surprise. The rope (made of Messrs. Webster and Horsfall's patent charcoal wire, laid round a hemp center) consists of six strands, with ten wires in each strand; each wire measures 12,160 yards; so that the entire length of the wire reaches the enormous total of 726,000 yards, or 412½ miles. To this has to be added the length of yarn used for the center—namely, twenty-seven threads, made from Petersburgh hemp, each thread measuring 15,000 yards, and giving a total length of 405,000 yards, or about 230 miles. Adding together the wire and yarn, we have a grand total of 1,131,000 yards, or 635 miles of material—all going to make up a monster wire and hemp rope a little under six miles long. Such a rope certainly has never yet been made; and we doubt whether, excepting in Birmingham, such a one could be made. As it lies in vast coils in Messrs. Wright's machine room, it looks like a miniature Atlantic cable, multiplied by five times the cable thickness. Of course such a rope will bear an enormous strain, and its capacity in this respect is increased by the perfection of the machinery employed in the manufacture, giving the strands an exactly uniform "lay," and imparting the regularity and the precise angle of "twist," which experience proves to possess the greatest resisting and holding strength.

It is said that an ingenious Frenchman, in Philadelphia, skins frogs by drawing out all their interior parts through the mouth, and then stuffs and mounts them in a variety of curious attitudes, as billiard players, velocipedists, dentists, barbers, etc.

Morgan's Trade Journal for April publishes the whole of an original article on "Tobacco Pipes," written expressly for the SCIENTIFIC AMERICAN and credits it, unduly, to the *Tobacco Trade Review*.