

acid, and the alcohol corresponding to the ether which we wish to obtain, and in about equivalent proportions, the reaction which I have before stated takes place, and the formic acid in its nascent state combines with the alcohol. It is better to condense the vapors within the retort, and not to distil until some time after complete decomposition of the oxalic acid. The ether is purified in the usual way.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, October 18th, 1865.

The meeting was called to order with the Vice President, Professor Fairman Rogers, in the chair. The minutes of the last meeting were read and approved. The minutes of the Board of Managers were reported, including the following points of general interest:

Committee on Instruction have reported to the Board of Managers that the lectures will commence on Tuesday, 31st inst. Professor H. Morton lectures on Tuesday evenings on Mechanics, and Mr. Albert R. Leeds on Thursday evenings on Chemistry, for twenty weeks; and that arrangements are being made for some lectures to be delivered at the Academy of Music during the winter, of which due notice will be given.

The Executors of the estate of A. S. Roberts have notified the Board of Managers that Mr. Roberts has devised to the Institute \$1000, to be paid in five yearly installments, to be appropriated to the purchase of books and the improvement of the library.

The following donations to the library were also reported: From the Society of Arts, London; the Board of Public Works, Chicago, Illinois; the Mercantile Library Association, New York; J. B. Lippincott & Co., and Professor John F. Frazer, Philadelphia.

The minutes of the various Standing Committees were then reported.

The Special Committee on Steam Expansion reported that their experiments had reached an advanced state of progress, and that a report embodying their results might be looked for at the next or following meeting.

A paper was then read by Mr. Brown on "The Problem of Aerial Navigation in its Mathematical Relations."

The report of the Secretary on new discoveries and inventions was then read as follows:

SECRETARY'S REPORT.

Engineering Works.—On account of the great time which must yet be consumed before the Mont Cenis tunnel is finished, four and a half miles yet remaining to be executed, it is proposed to supply the break by a temporary track over the summit of the mountain. An experimental line of one and a fourth miles has been constructed on the most difficult portion of the route, with a view of testing the efficiency of this plan, and, as we see by the report of Captain Tyler, of the Royal

Engineers, sent out by the London Board of Trade to examine this work, this distance of one and a quarter miles is ascended in $8\frac{1}{2}$ minutes with a load of 16 tons, though the average grade is so steep as 1 in 13, and at a maximum of 1 in 12. The plan adopted to obtain adhesion is an arrangement of horizontal drivers biting on a central rail.

This plan is much commended in the foreign journals, and is described as new, although to the best of my knowledge it was invented and patented in this country by a member of this Institute very long ago, and was used on some road in this State with satisfactory results. Some of the older members present can probably confirm and give precision to this general statement.

Mr. COLEMAN SELLERS.—The use of the two outside rails and one central adhesion rail, was patented many years ago by Mr. George Escol Sellers. The person to whom Prof. Morton alluded was Mr. Trautwine, the engineer of the Panama Railroad, who advocated the use of this plan across the Isthmus. The engines were so built, but the engineer who succeeded him concluded to cut down the road and use common engines. Since that, there was a road proposed in Pennsylvania, and two engines were built for the road in Cincinnati. An engine was run in New York on this plan, weighing 1100 pounds, which was capable of drawing 30 persons up a grade of 250 feet to the mile with ease. The plan on which they are constructed was better than that at present used in Europe, as they were so constructed that the whole weight of the train should act in producing adhesion, so that, the heavier the load, the harder the grip on the centre rail. We have at present in use at our own works a hammer operating upon the same plan, so that, the heavier the hammer used, the greater will be the bite of the wheels which lift it. I speak of this invention because I think it is due to America to say that it is purely American, and was advocated and used so long ago that the patent has expired; so that you can judge very well that we have precedence of any other country in this case.

Mechanics.—Under this head we would first call your attention to a new form of gas regulator, invented by Dr. Charles M. Cresson, of this city, claiming great delicacy of adjustment, and capacity to pass a large amount of gas, also compensating for the friction of service pipes by increasing the pressure automatically in proportion to the amount of gas passing through.

This regulator consists of a tank with the inlet and outlet pipes, *i* and *o*, passing up through the bottom to above the water level *w*. Within the tank is floated the gas holder *h*.

The adjusting valve *v*, secured to the gas holder by a loose link, is formed from a cylindrical plug (fitted loosely to a long cylindrical seat) having pyramidal excavations in its surface with their apices downwards towards the base of the valve. These excavations run out at different points, usually three in number; one extends entirely to the base. The next is two-thirds the length of the valve, and the third is one-third the length of the valve.

When the valve is but little open, the gas has passage only through

the triangular gutter found by the first excavation, and as the valve sinks to give a greater supply, this gutter gradually increases its sectional area until it is assisted by the second, and finally the third excavation.

In this manner a small amount of gas is passed through a channel of small dimensions and great length; but when a large amount is required, the valve presents the area of the three excavations, and at their largest section.

With ordinary pressures the valve has one inch of motion for use with one burner, whilst the two remaining inches will furnish a supply for twenty burners.

The gas holder H is a frustrum of a cone, the result of which form is to present to the lifting pressure of the gas a constantly diminishing area as it sinks into the fluid to open the valve, and consequently gives

an increasing pressure whilst increasing the supply of gas. The amount of coning has been adjusted by experiment so as to increase the outlet pressure sufficiently to compensate for the loss of pressure in the fittings by the addition of many lights.

The fluid preferred for use in the tank is crude glycerine, as it does not freeze easily nor evaporate, and has no corrosive influence upon the metal of the instrument.

The experimental trials made with the instruments were as follows:

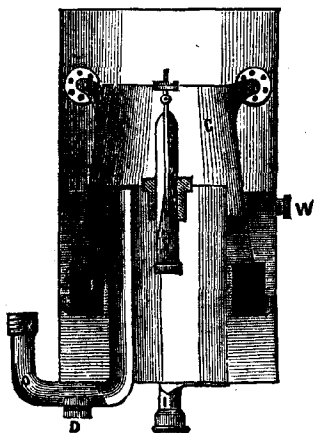
For delicacy of adjustment. Gas was passed through the regulator to a branch upon which were burning twenty-one lights. All of these with the exception

of one (a union jet at its maximum) were suddenly extinguished by a master cock, the single burner remaining without change, the pressure gauge showing a vibration of less than one-twentieth of an inch.

The pressure upon the inlet of the regulator was then increased successively to two and three inches without change upon the gauge upon the outlet of the regulator, as was also the case when one burner or all were lighted.

To show the result of checking off at the meter stopcock, as is frequently done where no regulator is used, the branch with the burners was connected directly to the street main without the intervention of the regulator, ten of the burners lighted, and the pressure adjusted by a stopcock to eight-tenths of an inch. When all but one were extinguished, the pressure rose to thirteen-tenths, the burner blowing. When twenty burners were lighted, the pressure fell to three-tenths of an inch.

An experimental trial was then made as to the quantity of gas consumed by the burners when under regulation to their maximum econ-



omy, and also the amount consumed by the same burners when subjected to the ordinary variations of street pressure, as observed during the present evening.

The result showed that with the regulator there was uniformly 78 cubic feet of gas per hour consumed by twenty-one burners, or 3.7 cubic feet per hour per burner. Whilst without the regulator the same burners consumed from 106 to 140 cubic feet per hour, the average being 126 cubic feet, or 6 feet per hour to each burner, the amount of light being not nearly proportionate to the increased cost. The burners being in the first instance properly adjusted to the wants of the consumer, all increase of light would be waste and loss.

Again we would call your attention to a plan for sharpening the teeth of saws, by grinding on a wheel of emery and vulcanite or hard rubber, the invention of Joseph F. Tuder, of this city. The effect of grinding on a wheel is, of course, to give a hollow face to the teeth, which causes them to cut better and for a longer time than when they are made flat or even rounded, as must be the case in filing.

The famous instrument maker of Paris, Deleuil, has brought before the French Academy an air pump in which all lubrication and packing are dispensed with. The piston is made very long, (twice its diameter,) is fitted very accurately to the cylinder, and has a number of horizontal grooves cut around its surface.

It is then found to be air-tight by reason of the capillary attraction of the air in the narrow space included between the cylinder and piston. With a small receiver on the pump plate, a vacuum of four millimetres of mercury can be obtained by this apparatus.

In the *Practical Mechanics' Journal* for September, we find the translation of an article on the mechanical puddler employed at the Clos-mortier forge, by MM. Dumeny and Lemut. This article is accompanied by many drawings, and is of great interest as showing the exact means employed in this important modification of iron working, and many of the results obtained by the new method.

A report has been made by the Société Industrielle de Mulhouse, on the Lenoir gas engine, the main conclusions of which may be thus briefly stated:

1st. That this motor consumes per horse power per hour 105 cubic feet, while a steam engine of like effect would consume 11 lbs. of coal in the same time.

2d. The gas engine requires an immense amount of oil, as much, in fact, as $2\frac{1}{2}$ pints per horse power per day.

3d. The gas engine, again, requires constant and close attention on the part of the person running it, rendering it impossible for him to do any other work at the same time.

4th. The cost and care of the battery working the induction coil, which ignites the gas, is an item not included in steam motors.

All these are drawbacks to the machine in question. On the other hand, it presents the following advantages:

1st. It consumes fuel only while actually running. Thus, when

required for intermittent work, it may compare well even in economy with a steam engine, whose fire must be constantly burning.

2d. Its perfect freedom from danger.

3d. Its convenience of form, admitting of its introduction into any building, as it requires no furnace, fire, or the like.

Lastly, under this head of mechanics, we would bring to your notice this little apparatus called an atomizer, for scattering perfumed or medicated liquids in impalpable spray through the air of an apartment. It consists (as you see) of two glass tubes placed at right angles to each other, and kept in position by a little bracket of brass. We dip the longer of these in a vessel containing the liquid to be scattered, and then blowing through the other across the upper end of the first, produce a rarefaction in this, which causes the liquid to rise in it so as to be scattered in a fine mist from the upper end by the powerful blast of air. This instrument is invented by S. Maw, of London.

Optics.—Under this head we would introduce to your notice a plan for constructing cheaply large parabolic mirrors, of an enduring and light material, invented by Mr. J. Marshall.

In this case the frame or mould is formed of thick paper, moulded or otherwise worked into the required shape. To the inside of this are attached scales of mica, plated with metallic silver. The result is a reflector, light, durable, easily repaired, powerful in its reflecting action, and cheap in its first cost. Several of these mirrors, of various dimensions, were then exhibited, and their efficiency practically demonstrated. One of them, intended for lighting a skating pond, was four and a half feet in diameter.

Attention was here directed to a plan by which chemical and other reactions could be exhibited to a large audience, by the employment of a magic lantern, but the experimental demonstration of these was deferred until after the adjournment of the meeting.

Chemistry.—We have to notice two important plans for the preparation of the common alkalis directly from mineral substances found in great quantities and easily obtained.

Potash from feldspar. Feldspar, fluorspar, and chalk are pulverized, mixed, and calcined. Fluoride of silicon is disengaged, silicate of lime is formed, and the potash set free,—may be dissolved out by boiling water,—and freed from any lime present by carbonic acid. Some feldspars are, however, found to contain large quantities of soda, and yield on treatment that base.

Soda from cryolite. Cryolite and lime are pulverized and calcined, insoluble fluoride of calcium is formed, and a soluble compound of alumina and soda. This is dissolved out with water, which is then treated with carbonic acid, by which carbonate of soda is formed, and the alumina is precipitated. The Pennsylvania Salt and Alkali Manufacturing Company sent out last winter their chemical superintendent, Mr. Henry Pemberton, together with Mr. S. Lewis, to Copenhagen, where these gentlemen arrived about the 1st of December. They there made arrangements with the owners of the cryolite mines in Greenland,

Messrs. Shure & Sons, and with the Danish government, for the right of mining that material. Ships were then chartered in England, in Quebec, and in our own ports, to proceed to Ivigtus, Greenland, lat. 59°, load with the mineral, and bring it to this port. Six thousand tons have thus been imported up to this time, and a portion of the material is already undergoing treatment at the works of the company near Pittsburgh.

At the request of the members present, Mr. William Sellers then stated some of his observations during a late visit to England, as follows :

Whilst in England, I noticed great progress in all the industrial interests, the most remarkable being in the manufacture of steel. Formerly this business was confined to the manufacture of steel for cutlery purposes and other small objects, the use of it in large masses being unknown; but within the last six years, the general introduction of the Bessemer process, as well as that employed at Mr. Krupp's works in Germany, have revolutionized the trade, so that work which, under the old system, would require an immense number of hands, can now all be done upon the Bessemer plan by a few, making the steel thus produced comparatively cheap, so that it can be applied to ordinary purposes where iron has heretofore been used. It is probably true that this process will not produce the best quality of steel, but the material obtained is, at least, far better than any other equally cheap. By the Bessemer process, up to the point of converting into steel, labor is almost dispensed with, the operation of puddling being entirely abolished. The various movements required are all performed by hydraulic machinery controlled by one man, and it is interesting to see with what facility large masses of molten metal are handled, ten tons often being taken off at a heat. The pig metal is melted in an ordinary reverberatory furnace, and the speigleisen in another smaller one from which they are run into the converting vessel. This is a large egg-shaped vessel open at the top, and suspended upon trunions, so that it may be tipped upon an angle in order to bring its upper or open end under the spout, from which it receives its molten charge of iron. The bottom of this vessel is double, so as to form an air chamber, communicating through the trunions with the blowing cylinders, which produce the blast. The tuyeres are between the air chamber and the inside of the converting vessel, and when this is tipped on one side to receive its charge, the tuyeres will be above the molten iron. The blast is then applied, the converter tipped back to a perpendicular position, and the air rushes through the molten mass, burning out its carbon. When this is accomplished, the converter is turned on its side, the blast shut off, and the mouth passed under another spout to receive its charge of speigleisen. This produces a violent ebullition, and when this has subsided the conversion into steel has been completed.

The converter is now once more tipped upon one side, and the steel is poured into the ingot moulds, which are arranged in a semi-circle about the centre of the hydraulic crane which carries the

converting vessel, the whole process being completed in almost as little time as it requires to describe it. After the ingots are sufficiently cool, they are removed to the heating furnaces, and from this point to the hammer or rolls, the subsequent processes are the same as in the manufacture of iron, although requiring machinery of more massive character, owing to the greater density of the material to be operated upon. In the process followed at Krupp's, and other similar works, the metal is melted in small pots, and then poured into one large enough to contain the quantity required for the intended casting, and from this it is let into the mould by withdrawing a plug in the bottom. I have seen gear wheels of excellent finish cast in this way, and large quantities of railway wheels and tires are thus made, the field for its use continually widening. The character of the steel made upon this process is as yet much superior to that made upon the Bessemer principle, and, it will be observed, there is one radical difference, the one rigidly excluding the air from the molten metal, whilst in the other, it is intimately mixed, but whether this is the cause of the difference in quality must be determined by more extended experience. Those engaged in the manufacture expected to make farther improvements, and from what I learned of their operations I believe that in a few years they will cast as large a piece as a twenty-inch gun of steel.

PROF. ROGERS.—They are making Bessemer steel in Troy, N. Y. Mr. Lamborn, of the Iron and Steel Association, is not here, or he would tell us something about it. Did you observe anything new in machine tools.

WM. SELLERS.—I knew they were preparing to make Bessemer steel there, but was not aware that any was produced as yet. The introduction of steel in masses has necessitated larger and stronger machine tools, but I did not observe any other change; that of size, however, is remarkable. Sir Wm. Armstrong's works, at New Castle, in the Ordnance Department, contain many fine specimens of tools, but they are for special purposes. The tools required for rolling and dressing cast steel tires are also remarkable for their enormous size and strength.

COLEMAN SELLERS.—Is the tire round, or is it necessary to turn it?

WM. SELLERS.—They turn it out on the inside at the works. They have made special machinery for the whole of this work, and nearly all steel tires as yet have been made from pot metal. The process of casting from pots is very interesting. From the great number of pots used, and the necessity of bringing them to the proper heat, and pouring into one reservoir at the same time, it is necessary to have all the men as thoroughly drilled as a regiment.

COLEMAN SELLERS.—You spoke of the movement of these large masses of metal. How is it accomplished?

WILLIAM SELLERS.—Entirely by hydraulic pressure. All the operations are performed in that way, excepting in the rolling of armor plates; in that case they use a traveling crane over head, and upon that

a steam engine and boiler. From this all the movements are obtained, the whole being under the control of one man.

The Vice President announced that the two turreted iron-clad *Monadnock* would leave the Navy Yard in a few days, for San Francisco, by the Straits of Magellan. She will be part of the squadron under the command of Commodore John Rodgers.

As she will go from north to extreme south magnetic latitude, and through a difference of longitude in which the declination of the needle will vary greatly, the opportunity of making observations connected with the permanent and variable magnetism of the ship and the action of her compasses will be an uncommonly good one.

Professor Harkness, of the Navy, late of the Naval Observatory, will go out in her, expressly for the purpose of making observations, which he may find necessary or possible.

The vessel will probably be swung at thirteen or more ports on the way, and careful shore observations will be made at the same points.

Altogether results may be expected which will materially extend our knowledge of the magnetic behavior of these new iron vessels.

The Vice President also mentioned that he had been experimenting lately with asphalte as a flooring for stables. The artificial asphalte, made from coal tar, such as is used in gravel roofs, was used, mixed with clean gravel in the ordinary manner, and laid on the hard clay to a thickness of two and a half inches, finer gravel being used at the top than at the bottom. The top was finished with a coat of hot, fine gravel, pressed into the asphalte, and the loose gravel swept off.

The use of the *artificial* asphalte for a floor for horses to stand upon, is believed to be new, and the result of the experiment as to wear will be reported after it has been tested.

The meeting was then, on motion, adjourned.

HENRY MORTON, *Secretary*.

BIBLIOGRAPHICAL NOTICE.

Curious Facts in the History of Insects. By FRANK COWAN. Philadelphia, Lippincott & Co., 1865. 12 mo. pp. 396.

An excellent little book, making no pretensions to technical science, but showing great industry and research on the part of the author, excellent taste in the selection of his materials, and good literary powers in presenting them. We found it very readable and amusing, and it is excellently presented to the public by the publishers. We hope this will not be the last we are to hear from the author.