AMERICAN INSTITUTE---POLYTECHNIC BRANCH.

The usual weekly meeting of this association was held on Thursday evening, Dec. 6th, Prof. Tillman presiding.

After the reading by the Chairman of the usual summary of scientific news, Prof. Fleury presented a new application of the old reacting steam engine, described by Hiero of Alexandria, 130 years B. C.

IMPROVED EOLIPILE.

The object to be attained by the use of this apparatus is purifying the vitiated air of churches, theaters, and crowded lecture rooms. The engine consists of a metallic disk-shaped vessel provided with four horizontal jet pipes, the open ends bent at right angles, the whole revolving on a vertical axis. On the application of heat, perfumed water within the vessel is given off as steam, which, disseminated by the rotation throughout the apartment, absorbs and precipitates the poisonous matters present. The apparatus may be made serviceable in other ways, such as destroying flies, mosquitoes, and moths, by projecting into the air steam from liquid preparations poisonous to these insects, but harmless when inhaled by man.

Mr. F. W. Bacon, of 84 John street, New York, described the construction and operation of the

STEAM ENGINE INDICATOR.

As the stethoscope shows to the skillful physician the secret workings of the inner system, and detects any minute derangement, so this instrument is valued by the engineer as furnishing similar information for the steam engine. Its employment determines whether his valves are set so as to take and relieve the steam at the proper moment; it notes the pressure in the cylinder at each point of the piston's stroke, at what part the cut-off begins, and demonstrates the advantages of using steam expansively. Coeval with Watt, the infrequency of its employment at present has been owing to inaccuracy in results at high pressures, but within the past five years the instrument has been brought to a high degree of perfection, and its use is now as satisfactory, with a rapid velocity of piston and high pressure of steam, as was the old McNaughton indicator applied to slow-working engines. The leading points in construction are, first, a piston having an area of exactly one-half square inch, moving without friction in a cylinder, the motion being restricted by a spring of known rigidity. The varying pressure of steam is recorded by a pencil as a continuous line drawn on paper placed on a drum, which latter revolves by a connection with the cross-head or point coincident in motion with the piston. The invention was ascribed to Watt, by the speaker; the chairman dissenting, a debate arose as to how much credit Watt was deserving of as an original inventor. As the subject required more time for discussion, it was appointed as a special topic to be taken up at some future meeting.

OCEAN CURRENTS.

Dr. Stevens re-opened this subject. In the investigation of the unknown, fragmentary truths are gathered and serve as a skeleton from which speculative minds form theories or hypotheses.

The origin of this earth has been a fruitful theme of investigation for philosophers. A brief reference was made by the speaker to the views advanced and defended at different times by able theorists, one school believing the planet to have assumed the spheroidal state while in a molten mass; that, losing heat by radiation, a crust was formed on the outside; that this crust fell in on the formation of a vacuum beneath, the surface then appearing as ridges, or mountain chains. Herschel, Laplace, and, later, Herbert Spencer, accepted the nebular theory or the condensation of nebulous matter into definite forms. The Plutonic theory of Hutton ascribes the origin of mountains to the action of internal fire.

The ocean, in either case, held no creative power, but its action was, change and reform. "Anthony's Nose" on the Hudson, the Iron Mountain of Missouri, and an important peak among the Rocky Mountains, were the leading features of our continent in the earliest times. The tidal wave was the agent by which the intervening areas were filled, carrying and depositing the debris from the dissolution of a previously existing continent.

Further elaboration of the speaker's view was not permitted owing to a misunderstanding on the part of Prof. Grimes, who, believing that the remarks were intended in some way as objections to his views, occupied the remainder of the evening until a late hour with a re-statement of his theory of ocean currents, presented at the last meeting, and fully laid before our readers in a previous report.

THE LAW OF MARIOTTE---ITS RELATIONS TO THE LIQUEFACTION OF GASES.

We receive sometimes inquiries about the pressure of air under certain circumstances, which indicate that the above mentioned law is not as universally understood as it deserves to be.

The law of Mariotte is this: *The volume of a given weight of gas is inversely as the pressure to which it is exposed;* that is, the greater the pressure the smaller the volume, and *vice versa*; so if the volume is reduced to one-half, the pressure will be double, if the volume is reduced to one-tenth of the original bulk, the pressure will be ten times greater, etc.

Applying this to air and gases of which the mean pressure is 15 lbs. to the square inch, we find that by reducing the volume to one-half we have 30 lbs., to one quarter 60 lbs., to one-tenth 150 lbs., and to one-fortieth we have 600 lbs. pressure to the square inch, and this rule is correct for common use; but when great accuracy is required, deviations have been found, differing among themselves for different kinds of gases.

In the first place, in those gases which will liquefy by increased pressure, the law is only tolerably correct as as long the pressure keeps the gas far enough from its point of liquefaction; but the compressibility will strongly increase when the gases reach the point; that means, the volume will be less than the law would deduce from the pressure, as soon as the gas is about to be liquefied.

We may arrange the gases which have been liquefied by pressure into a table, adding this pressure in atmospheres and in pounds to the square inch, at the temperature of 32° Fah.:

Name of gas	Pressure in atmospheres.	Pressure in lb to square in.
Sulphurous acid	1·5	23
Cyanogen	2·4	36
Hydriodic acid	4	60
Ammonia	4·4	66
Chlorine	9	135
Sulphureted hyd'n	26	330
Nitrous oxide	30	450
Carbonic acid	40	600

If the temperature be higher than 32° Fah. the pressure will be greater (at 90° it will be about double); if the temperature be lower the pressure will be less, therefore during the liquefaction process cold is always employed in addition to the pressure.

Not only have these gases and several others been liquefied, but these liquids have been frozen; we give here the temperatures at which liquefied gases freeze below zero:

	Deg. Fah.
Cyanogen	31
Hydriodic acid	58
Carbonic acid	76
Ammonia	103
Sulphurous acid	105
Sulphureted hydrogen	125
Nitrous oxide	150

Quite recently experiments have been made by Natterer with powerful condensing apparatus, by which he exerted a pressure of 3,000 atmospheres, or 45,000 pounds to the square inch; it was found that only 7 gases are left which withstood the pressure without being liquefied, out of some 40 which were liquefied. These uncondensable gases are:—air, oxygen, nitrogen, hydrogen, carbonic oxide, marsh gas, and nitric oxide.

It was also proved that these gases, at moderate pressures, followed the law tolerably correct, but at very strong pressures, say of 100 or more atmospheres, their volume was much larger than after Mariotte's law the pressure would require, so that at 1,000 atmospheres' pressure, it is only one five-hundredth part, and at 3,000 atmospheres only one seven-hundredth to one-thousandth part of the original volume.

In our next article we shall treat the relations of Mariotte's law to steam pressure.

AREA OF STEAM PORTS.

The proper area of a steam port, or any passage between a boiler and its engine, depends mainly on the following facts:—

First—That the boiler makes the steam at a uniform rate, say as many cylinder fulls as the engine makes strokes in a minute, if we take the cylinder as the unit of measure.

Second—That the rate at which the engine uses this steam at any point of the stroke depends upon the corresponding position of the crank and connecting rod with each other; for example, when the crank and connecting rod are in the same straight line the engine is using no steam, and when the rank and connecting rod are square with each other the engine is using steam fastest.

Third—That the pressure of steam must be the same in the cylinder and boiler during the admission, or until it is cut off, in order to have the engine work economically.

Fourth—If the port is so small as to cause the steam to move through it faster than at the rate of one hundred feet in a second (about one-twentieth of the velocity with which steam would rush into a vacuum) the steam will be "wire drawn," that is, the pressure of steam in the cylinder will be less than that in the boiler.

From the above it is plain that the port should be large enough to allow the steam to pass through it at a rate not exceeding one hundred feet in a second when the piston is at about the middle of its stroke, or at the moment when the speed of piston is the same as that of the crank pin. It is also plain that the proper area of the port is directly proportional to the area of the cylinder and speed of the crank pin, and inversely proportional to the *proper* speed of the steam when passing through the port *fastest.*

Therefore we can get the proper area of a port by multiplying the area of the cylinder by the number of feet that the crank pin passes through in one second, and dividing by one hundred (or simply cutting the two right hand figures from the product).

Example—What size should the port of a steam cylinder be, which is twelve feet stroke and seventy inches in diameter, in order that the engine may make seventeen revolutions in a minute? Area cylinder=70×70×7,854=3,848 square inches. Speed of crank pin=12×3$\frac{1}{7}$×17÷60=10$\frac{1}{2}$ feet per second. Area steam port=3,848×10$\frac{1}{2}$÷100=404, square inches.

The Canada Gold.

The recent gold discovery at Madoc, C. W., is the subject of increasing excitement. Miners, speculators, and prospectors throng into the little village at the rate of a hundred in a day, filling up the inns and farm houses for miles around; and one Yankee is preparing to put up a large hotel. Several thousand acres of land have been taken up by speculators, in Madoc, Hungerford, Huntington, Tudor, Marmora, and other neighboring townships. The noteworthy peculiarity of this region is that the discoveries of gold have all been made in the surface quartz on the hill tops; an extraordinary circumstance, from which is inferred the existence of very rich deposits at a proper depth, as well as of rich placers in the valleys. The latter are too much obstructed by water at present to allow of prospecting. It is remarked that in this instance, not for the first time, the prognostics of geologists in respect to gold were at fault, a professional survey having not long since resulted in a decision that gold did not exist in this region. It lies in Hastings county, about fifty miles north of Lake Ontario, and twenty-eight miles north of Belleville on the Grand Trunk Railway. It constitutes but a small portion of a country of similar general character, covering the shore of Lake Ontario for a hundred and fifty miles, and extending as far to the interior; broken, rugged, and filled with innumerable little lakes and streams. Probably the whole of this region will be alive with exploration and excitement, next season, if the rich reports of the two or three openings made at Madoc should be fully confirmed.

A bridge on the Mississippi is to be commenced at Quincy, Ills., in January.