POLYTECHNIC ASSOCIATION OF THE AMERICAN INSTITUTE.

[Reported expressly for the Scientific American.]

On Thursday evening, June 21st, the usual weekly meeting of the Polytechnic Association was held at its room in the Cooper Institute, this city; Professor Mason presiding.

MISCELLANEOUS BUSINESS.

Granulated Cork.—Mr. S. W. Smith, of this city, exhibited samples of granulated cork intended as a non-conducting packing for refrigerators. The granulated cork is made of the refuse, by a recently-patented cork-cutting machine. The refuse parings and imperfect pieces of wood are put through a mill which chips them up to about the fineness of very coarse sawdust. The granulated cork is especially recommended as packing under sheet metal roofs, to keep out the sun heat. Its value has been tested for that purpose, and as a lining for refrigerators and water-coolers. The advantages claimed for it over other substances applied to similar use are that it is not subject to dry-rot or other decomposition, that it is light, easy to handle, does not absorb moisture and is cheap. Mr. Smith sells it for 50 cents per barrel.

The president remarked that this substance promised to be of utility in the lining of refrigerator cars. Heretofore, sawdust and charcoal had been used. At present, charcoal is preferred, and a few cars have been lined, at a considerable expense, with slabs of cork closely laid together, but the granulated cork seems to be preferable to either. Refrigerator cars have been found practicable, and will come into extensive use, and anything which promises an improvement for them is worthy of serious attention.

The Re-organization.—A communication was received from the Committee of Arts and Sciences, establishing the re-organization of the Club, as agreed upon last week. The new order of things will be probably put in operation at the next meeting.

Artificial Leather.—Mr. Penniman presented samples of artificial leather or leather-paper, manufactured at North Amherst, Mass. The basis of this leather is the scrapings of curriers, and waste pieces of leather. This material is treated in a paper mill precisely like rags, being reduced to a pulp and formed into sheets. The artificial leather, of course, has not the strength of genuine leather, but in other respects it appears about the same, and may be used as a substitute for leather when no great strength is required. It is especially recommended for the lining of the soles of shoes, cap fronts and dashers for carriages.

Mr. Johnson—Mr. Cooper uses a great deal of waste leather for the manufacture of glue. Glue or gelatine is the chief constituent of leather.

The President—Prussia requires that her soldiers shall return to the government their old shoes, before they can have new ones.

Mr. Butler—This is the reason that prussiate of potash is manufactured so extensively in Prussia.

The artificial leather seemed to meet the approval of the meeting.

The president here announced the regular subject—"The Cut-offs of Steam Engines."

DISCUSSION.

Mr. Stetson opened the discussion with remarks on the importance of the subject. Nearly all of the ten thousand steam engines in and about the city of New York are provided with cut-offs, and engineers and owners of engines generally approve their use. But the exact gain or loss (as some contend) by cut-offs is not clearly understood. If they are useless, we must examine the subject so as to find it out.

Mr. Rowell—Mr. Isherwood, the author of "Engineering Precedents," has examined the details of the experiments recently made at the Metropolitan Mills, and fully endorses our conclusion that there is no advantage in the use of the cut-off. Mr. Isherwood has examined the subject of cut-offs with great care, and his convictions are positive against their use.

Professor Hedrick—In the cylinder without the cut-off, the force of the steam is nearly constant to the end of the stroke; not absolutely constant, for the reason that the piston is moving away from the stroke. When the cut-off is used, the force gradually diminishes, so that if the tension is low and the cut-off short, the force exerted at the end of the stroke is nothing, or is in the contrary direction. If the resistance to be overcome or the work to be done is unvarying, the force employed should be constant. There is, however, a clear theoretical gain in the use of the cut-off, and I shall be able to present it at another meeting.

Mr. Garvey—In the discussion of this subject the difference between dry and wet steam must be kept in view. If cut-offs are of use, it can only be in the case of dry steam.

The Association then adjourned to 8 o'clock P. M., of the 28th.

WATER WHEEL EXPERIMENTS.

We publish the following from the report (just received) of Chief-engineer H. P. M. Birkenbine, to the Select Council of the city of Philadelphia:—

GENTLEMEN:—In answer to your resolution of May 31, 1860, the department would submit the following general report upon the experiments made with turbine wheels at Fairmount Works:—

The experiments were made in obedience to a resolution of the Committee on Water, and by an appropriation of $500 made by councils. An advertisement was inserted in the SCIENTIFIC AMERICAN, calling attention to these experiments. If a detailed report is thought desirable by your honorable body, an appropriation of $350 will be necessary to print it in pamphlet form, with the necessary diagrams and tables to make it fully intelligible and useful.

An experimental apparatus was constructed at Fairmount Works, for the purpose of testing such turbine water wheels as might be presented. The department entered reluctantly into these experiments. First, for the want of time to conduct the investigations with the care and detail which their importance demands; second, on account of the limited appropriation made to carry them out; third, the delay consequent upon the experiments in completing the plans and details of the works, and also the difficulty felt in making deductions from model experiments which would guide us in the selection of wheels of the great power required for these works. So far, however, as these experiments have been prosecuted, they have been carefully done. The tests were made simply for the purpose of ascertaining what proportion of the power employed would be utilized by the different wheels or their co-efficient of useful effect. The wheels were tested under a head and fall of 6 feet, and weights of from 500 to 1,600 pounds were raised from 14 to 25 feet.

Nineteen different wheels were tested, and 122 different experiments made with them. Several of the wheels were removed without submitting them to a public test; of these no accounts have been kept. The accompanying table exhibits the best results obtained from some of the wheels:—

Names.	Weight raised in pounds.	Hight raised, in feet.	Cubic feet of water discharged.	Head, in feet.	Time, in seconds.	Ratio.	Date of trial.
Monroe & Bartlett, Worcester, Mass	850	25	166.29268	6	30	.8569	Oct'r. 7, 1859.
Reuben Firth, Salmon River, N. Y.....	750	25	80.156768	6.1	33	.6132	" 20, 1859.
J. Littlepage, Austin, Texas.....	1600	14	179.384	6.05	25	.5416	Nov. 22, 1859.
T. Tyler, West Lebanon, N. H.....	825	25	77.91516	6	23.6	.7723	Dec. 19, 1859.
N. R. Merchant, Guilford, N. Y.....	1100	25	124.355	6	33	.6412	Jan. 12, 1860.
L. W. Blake, East Pepperell, Mass.....	925	25	98.0156	6	28.3	.7106	" 20, 1860.
Collins, Haydock & Wildman, Troy, N. Y.	900	25	78.8279	6	27.6	.7669	Feb. 9, 1860.
L. Smith, Reading, Pa.....	1300	23	110.55658	6	30.3	.7569	" 21, 1860.
E. Geyelin, Philadelphia, Pa.....	1000	25	81.29076	6	28	.7210	" 24, 1860.
L. E. Stevenson, Paterson, N. J.....	925	25	75.25438	6	23.6	.8727	March 9, 1860.
A. P. Mason, Buffalo, N. Y.....	750	25	59.7548	6	27.6	.6254	" 15, 1860.
Andrews & Kallbach, Berrville, Pa.....	700	25	60.0264	6	16.5	.8197	" 23, 1860.

Mathematical accuracy was not aimed at, but the experiments may be relied upon as practically correct. The apparatus was of the most simple character, and the arrangements such that no mathematical formula was required to ascertain the amount of water used or result produced; but they were actually weighed and measured.

It was necessary to refuse to test a number of the wheels, as the appropriation was all exhausted and the completion of the plans for the wheels could be no longer delayed, and the department was so fully occupied with the extension of the works that time could not be found to pay them the proper attention.

Valuable assistance was rendered in these experiments by the chairman of the Water Committee, O. H. P. Parker, Esq., James Millholland, of Reading, Wm. B. Bement and Charles S. Close, of this city. Among the wheels which produced the best results, and to the makers of which certificates have been given, as shown in the accompanying table, the highest co-efficients of useful results were produced by the Jonval wheels made by J. E. Stevenson, of Paterson, N. J., and E. Geyelin, of this city, and a modification of the Parker wheel, made and patented by Andrews & Kallbach, of Bernville, in this State. The majority of the wheels worked very satisfactory, and the makers of them were mechanics of more than ordinary ability. It is believed that no country could produce, from the same number of wheels promiscuously collected, so satisfactory a series of experiments.

The best result was procured from the Jonval wheel made by J. E. Stevenson, of Paterson, N. J., which gave an actual useful effect of the power employed of nearly 91 per cent. The wheel of Andrews & Kallbach, of Pennsylvania, is remarkable for its simplicity; and, had it been constructed with the same amount of care and finish as that of some of the others, it is believed that the co-efficient of useful effect would not have been surpassed by any. Two of these wheels placed upon a horizontal shaft might make a most desirable arrangement for our new works; but the department is not prepared to recommend their adoption, as it might involve a risk of a failure, and we are adverse to making any experiment at so great an expense and loss of time which might result to the city. We have been unable to find any wheels now in operation of the aggregate power that we will require, or arranged in the above manner, or under similar circumstances to our requirements.

The department, therefore, see no reason to change the plan of the works, and will adopt the Jonval turbine, arranged and geared similar to the one now in use at Fairmount.

In coming to the above decision, and recommending the Jonval wheel, the department has been influenced by the following considerations:—

First, They have always been esteemed among the most efficient wheels, and, although other forms of wheels have been removed to give place to Jonval turbines, the department does not know an instance where the turbine wheel has been taken out to introduce another form of wheel. Our experiments upon the turbines have also proved them the most effective, giving the highest co-efficient of useful effect.

Second, They are the best adapted to our particular situation, on account of the comparatively small fall at Fairmount and the large amount of power required for each wheel (a mean of 125-horse power), and the low velocity they run as compared with other turbines, making less reduction of the speed necessary by means of gearing.

Third, Their durability, and the facility with which repairs and renewals can be made.

Fourth, They can be constructed and connected to the pumps at as small cost as any other form of turbine wheel. No objection can be urged against the Jonval wheel, arranged as proposed, except that involving mere mechanical arrangements, viz.: the step and bevel gearing necessary. Practically, these are not objections; the step of the present wheel at Fairmount Works has required but one renewal since it has been erected, which is the only repair found necessary to the wheel; and, as regards the bevel gearing, or reducing the velocity for the proper speed of the pumps by two or four wheels, there is only an apparent additional loss by friction, but none in reality, as a little reflection will demonstate.

Fifth, The favorable experience the city has had with the wheel of this kind at Fairmount, built by Emile Geyelin, which has been in constant use since December, 1851.

The reasons of rejecting the plan of two wheels upon a horizontal shaft, as recommended by the former chairman of the Committee on Water. are as follows:—

First, Our minimum head and fall is but 8 feet. To produce 125-horse power by two wheels would require each of them to be 50 inches in diameter, and they would occupy so large a proportion of the head and fall that the co-efficient of useful results would of necessity be low.

Second, The experiments made by the department at Fairmount proved that two wheels arranged upon a horizontal shaft will not give as good results as one on a vertical shaft. Two Parker wheels arranged upon this plan gave but a co-efficient of 67 per cent, while a Parker wheel by the same maker, on a vertical shaft, gave a co-efficient of 75 per cent. Two Jonval wheels, upon a horizontal shaft, gave but a co-efficient of 68 per cent, when one Jonval wheel, by the same maker, on a vertical shaft, produced a co-efficient of 82 per cent.

Third, The velocity of the wheels would be so great (from 70 to 96 revolutions per minute with the two wheels, while the one Jonval wheel upon a vertical shaft will make but from 31 to 42 revolutions per minute), and the reduction of the speed, by means of gearing; to the speed of the pumps would therefore involve much greater loss by friction than could in possibility be the result of the plan adopted for the gearing of the Jonval wheel, as proposed.

In obedience to a resolution of the Committee on Water, the department addressed letters to J. E. Stevenson, of Paterson, N. J.; E. Geyelin, of Philadelphia; Andrews & Kallbach, of Bernville, Pa., and Levi Smith, of Reading, Pa. In answer to these, the following propositions were received and opened by the Committee on Water, April 24th:—

From Emile Geyelin, of Philadelphia, for three turbine wheels	$6,900	00
Gearing for the same	16,500	00
Total	$23,400	00
From J. E. Stevenson, of Paterson, N. J., for three turbine wheels	$15,000	00
Gearing for the same	14,500	00
Total	$29,500	00
From Levi Smith, of Reading, Pa., for each turbine wheel	$4,130	00
Gearing for each wheel	4,360	03
	$8,490	00
	3	
Total	$25,470	00

And, at a subsequent meeting of the committee on May 22d, a proposition was received from Hunsworth, Eakin & Co., of this city, for three turbine wheels and gearing, $26,566.80.

Care has been taken by the department not to commit the city, either in the advertisement or in letters addressed to makers of wheels, in such a manner as to give to the maker of any wheel which might be presented for test a claim upon the city. This was done that the department might not be embarrassed in considering simply the interest of the city in selecting and constructing the wheels. In regard to the form of the wheel recommended, none of the Jonvals tested claimed any patent or peculiarity of construction, but simply differed in proportion and mechanical finish.

At the recommendation of the Committee on Water, the department has made arrangements with Emile Geyelin, of this city, to construct two Jonval turbines for the works. Respectfully yours,

HENRY P. M. BIRKENBINE, Chief-engineer.

THE JAPANESE AMBASSADORS AND THE NEW YORK CHAMBER OF COMMERCE.

During the visit of the Japanese ambassadors to this city, a committee of the Chamber of Commerce waited upon them and presented a series of inquiries in reference to commercial relations. The following were the topics first introduced by the embassy:—

1. As to the nature and objects of the Chamber of Commerce, and whether it has any connection with the government?

2. As to any duty levied by the United States on goods exported to foreign countries?

3. What are the duties on foreign imports?

4. What discrimination, if any, is made between foreigners and citizens of the United States, as to duties charged them on importations from abroad?

5. Whether foreigners have the same privileges and terms as citizens in the purchase of goods?

6. Whether the government of the United States has the right to prohibit the export of specific articles to other countries?

7. Whether the rates of freight charged by American vessels depend at all or are affected by the longer or shorter duration of the voyage?

Full answers were given by the committee to the foregoing and subordinate questions, and a deep interest was evinced on the part of the ambassadors in the replies given, and especially as to the magnitude of the commerce of this port with China and other nations.

In reply to the questions propounded by the committee, the following is the substance of the remarks of the Japanese:—

1. That the mines of gold, silver and copper in Japan are a monopoly of the government.

2. That they rarely get out more copper than is wanted for home use, and only occasionally does a surplus exist for export.

3. That the coal mines are owned partly by the government and partly by wealthy individuals.

4. That there exist no appliances for working the coal mines to any great depth.

5. That the tea districts of Japan are extensive, and that the production could be greatly increased if the foreign demand required it.

6. That in Japan their preference is for green teas, and that they have some doubt whether the kinds of tea grown in Japan would suit the American market.

7. Rice is abundantly cultivated in Japan, and forms a chief article of food. The export is generally prohibited, under the belief that a large export would advance prices, and thus operate oppressively on the common people.

8. In answer to the inquiry of the committee as to whether tea could be packed in the style of the Chinese, with a lining of lead, the ambassadors replied that they have lead in abundance, but it is not applied to such use.

9. In reply to the inquiry as to the price of farm hands and common laborers in Japan, the information was not very definite, but the inference drawn was that the prices are somewhat higher than in China.

10. In reply to the question as to the production of raw silk in Japan, it was observed that the cultivation for home use was still going on, and that the production could be largely increased if trade with other nations demanded it.

When one of the committee stated, in reference to the sixth answer above given, that he had received samples of the Japan teas, and that the qualities were approved of, the ambassadors expressed their surprise and pleasure.

It was deemed advisable that a more detailed series of inquiries should be presented in writing, to which the committee would make full replies, and also submit questions on their part, which would elicit information regarding the trade and resources of Japan.

The conversation was carried on through the double translation by the Japanese and English interpreters, and of course occupied much time, and was not wanting in animation and the manifestation of good feeling. Each question propounded by the Japanese was first translated into the Dutch language, and thence by Mr. Portman, the interpreter, into the English language.

ART IN THE ARCTIC REGIONS.

The Photographical Society, at its last meeting, made arrangements to send a photographer with the expedition of Dr. Hayes, which is to sail for the Arctic regions at the end of the present month. The project must meet with favor from all concerned, and if carried out liberally, will be productive of a great deal of good. If good photographic views are brought back, we shall be able to study Arctic geology, natural history, and even the climate, all by our cheerful firesides. A photographic view always shows more than any pencil sketch, and we are sure it tells "the truth, and nothing but the truth." The camera takes in *everything* before it; and it may be that the Arctic photographs will enable us here to discover important facts which would escape the attention of the traveler chilled with cold, however zealous he might be.

A SMALL brass cannon has been found at the bottom of a deep well of the Castle de Cluey, in France, with the date of 1258 upon it. The date of the invention of cannon has historically been assigned to the year 1324—66 years later.

A COLUMN OF VARIETIES.

Copper, containing 24 per cent of phosphorus, will resist a strain of 48,000 lbs. on the square inch.

Beeswax is now employed, instead of tallow, for coating rifle cartridges in the British army. It is an efficient lubricator, and does not corrode the metal.

Great care should be exercised in making the joints of gas pipes in streets perfectly tight, so as to prevent leakage, because the escaping gas of bad pipes is absorbed by the soil and finds its way into cellars, which are thus rendered very unhealthy.

Electricity, under certain circumstances, produces the same effect upon sugar as fermentation in transforming it into alcohol. M. Niepce de Saint Victor, by passing electric currents through sweet wine, rendered it more alcoholic; some of its sugar was converted into alcohol.

Manchester, in England, is the greatest manufacturing city in the world. In its factories and foundries there is employed, daily, a motive steam power equal to that of 1,200,000 horses. This requires 30,000 tuns of coal for raising steam, which amounts to 9,390,000 tuns per annum.

The increase of heat in the earth is about 1° for every 45 feet of descent. At a depth of 7,290 feet, the temperature will therefore be 212°—equal to boiling water—allowing the surface to be 50°; at 25,500, it will melt lead; at 7 miles it will be at a red heat; at 74 miles it will melt cast iron, and at 100 miles it will be a lurid fluid mass, the fountain of volcanoes.

Wooden docks on the rivers in cities are sources of disease, owing to their constant decay and the receptacles which they form for filth. The Sanitary Convention, which recently held its meeting in Boston, discussed this question, and recommended the building of stone in place of wooden docks. In New York, stone docks, although by far the most expensive at first, would be the cheapest in the end, because, if well constructed, they would last without repairs for several centuries.

Highly superheated steam passed through coal tar produces, it is said, an illuminating gas of great richness, and generates it with astonishing rapidity. It is said to be a permanent mixture by the French *savant* who has lately manufactured it, and it is asserted to be superior to common coal gas in illuminating power. The value of these assertions can easily be tested in any gas-works. At present, they appear incredible.

The French astronomers are applying photography to the science of the heavenly bodies. Pictures of the sun's disk were lately presented to the Academy of Sciences, which gave the exact co-ordinates of the spots on the great luminary. Pictures were also taken of several planets. A movable plate in a machine is made to follow the motion of the planet until a photographic impression is obtained.

Dr. Alban has worked an engine at a pressure of 600 lbs. of steam on the square inch, and he asserts that it did not require so much lubricating material as one working with low-pressure steam. He once worked an engine under a pressure of 1,000 lbs., and found the piston run quite tight, although he used hemp gaskit for packing, instead of metal rings.

A tubular boiler, in which an artificial circulation is maintained through the tubes by a pump, has been tried for about a year at Messrs. Hawthorn's engineering establishment, at Newcastle, in England. The boiler was once worked day and night, without intermission, for 14 days, and was fed with salt sea-water; the pressure of the steam being 80 lbs. on the inch. At the end of this period, the tubes were examined, when the lower ones were found encrusted with a scale of only 1-16th of an inch in thickness, but there was hardly any scale perceptible in the upper tubes. This experiment favors the use of such pumps in steamships.

In various parts of the world, there are subterranean gas-works. In most of the petroleum regions of our country—such as the Kanawha district of Virginia, Oil Creek, in Pennsylvania, and in several sections along the shores of Lake Erie—a supply of natural gas is obtained for illumination by pipes connected with the petroleum or oil springs. The same kind of gaseous exhalations are found extending over a large district on the shores of the Caspian Sea; and in some parts of China the natives obtain a supply of underground gas for illumination by sinking bamboos a few feet under the soil.