POLYTECHNIC ASSOCIATION OF THE AMERICAN INSTITUTE.

[Reported expressly for the Scientific American.]

On Thursday evening, the 23d ult., the usual weekly meeting of the Polytechnic Association was held at its room in the Cooper Institute, this city; the chairman being Professor Cyrus Mason.

MISCELLANEOUS BUSINESS.

Phonetic Alphabet.—Mr. Lewis Masquerier read a paper on phonetic alphabets, presenting the usual arguments of phonography, severely criticising Pitman's system, and proposing a classification of sounds and an alphabet which, according to Mr. Masquerier, are free from objection. Printed specimens of the system were presented to the audience, and the subject was further illustrated by an elegant chart.

Railroad Brakes.—Dr. Reuben read a translation (from the French) of a paper sent in by August Mortara, of No. 114 St. Mark's-place, this city, setting forth the advantages of a system of automatic brakes for railroad cars, to be operated by steam.

The order of the regular subject—"Superheated Steam"—was then called. The following is the resulting

DISCUSSION.

Mr. Robert McCarty—The most economical system of using steam that I have seen was patented by Thomas Craddock, in 1840, and improved in 1846; it has been in successful operation for over 15 years in England. The engine I saw in operation was of 40 horse-power; boiler tubular (3-inch tubes); the steam was carried to a heater in the flue of a chimney, thence to the high pressure cylinder at a pressure of 115 lbs., cut off at 2-64ths of the stroke, exhausted into the low pressure cylinder; and thence to the condenser. High pressure cylinder 10 inches bore; low pressure 18 inches, and 2 feet stroke. Craddock designed to use steam at 200 lbs., and to cut off at 1-64th of the stroke, working the steam at both high and low pressure. The Cornish system is 50 lbs. pressure, cutting off at 4-64ths. The present marine practice in England is 20 lbs., and cut off at ½.

The quantity of water required per day by 40 horse-power engines, is as follows:—Boulton & Watt's engine, gallons, 78,400; Cornish engine, 16,800; non-condensing engine, 4,000; Craddock's, 400.

The annual cost of coal, at 15s. per tun, is as follows:—Engine in which steam is used without expansion, £292; non-condensing engine (steam at 50 lbs., cut off at 2-3ds), £177; condensing engine (steam at 20 lbs., cut off at ½), £170; Cornish engine (steam at 50 lbs., cut off at 4-64ths), £68; Craddock's engine (steam at 100 lbs., cut off at 2-64ths), £39. These calculations have been made in strict accordance with practical results.

Mr. Fisher—Thomas Prosser's boiler is of the upright tubular form, composed of water and flue tubes—water in the annular spaces; 113 feet of surface exposed to water, and 54 feet in the steam room as superheating surface. The average superheating (per report of naval engineers) was 30° when the smoke in the chimney was 40° hotter than the superheated steam. With natural draft, the rate of evaporation was about 3 lbs., per hour per foot of surface—one-fifth of what is obtained in some locomotives. Had the fire been forced, the degree of superheating would have been higher, for the reason that the smoke in the superheating flues would have been hotter; while the vaporization would not have been proportionately increased. In evidence that strong firing, in some cases, makes less steam from the fire-box and contiguous flue surfaces than is made by moderate firing, the experiment of Mr. Johnson (lately shown before the club) is pertinent; a shallow copper cup was heated over a gas flame, and water then poured in, which did not touch the metal, and vaporized very slowly. Jacob Perkins heated a thick iron cup to a white heat, removed it from the fire, and poured a measure of water into it, which vaporized in 90 seconds; a second measure in less time; a third in less still; until the seventh measure, which vaporized in six seconds; the eighth measure did not boil—thus showing that the temperature of maximum effect was low. Mr. Perkins considered it 30° above the temperature of the water.

In practice, it has been found that fire-box plates blister, become thin, crack and leak. Bury's fire-boxes, at two points, were made with two-inch water spaces, and at these points they bulged half an inch. Some anthracite locomotives, with three-inch water spaces, burned out their fire-boxes in six months; but when four-inch spaces were given, they worked a year without perceptible deterioration. The four-inch water spaces in the Liverpool steamers contained only steam, and were rapidly burned out when the firing was free. The tubes of locomotives, when ⅝ apart, have shown evidence of overheating; and, in one instance, 30 tubes were left out, and the rest set ¾ apart, and more steam was made than before. The *Great Britain*, with ⅞ interval between the tubes and narrow down-flow spaces, and 1,769 feet of surface, evaporized 230 cubic feet per hour; while the *Sphynx*, with 11-16ths intervals and wide down-flow spaces, and 952 feet of surface, vaporized 233 feet per hour, with a blast pipe relatively larger; showing 7.7 and 4.1 feet of surface to vaporize a cubic foot per hour. Further; some early locomotives burned 167 lbs. of coke per hour per foot of grate, and worked at 50 lbs., maximum pressure, without expansion; their tubes were worn so thin as to collapse after 3,000 miles; but in recent practice tubes have lasted 75,000 miles with coke, and 130,000 to 140,000 with coal. The recent firing has been more gentle, but the main cause of the durability has been that the higher pressure keeps the foam denser, and therefore more in contact with the metal. Recent boilers, in which the water spaces are from 5-16ths to ⅜, have been disabled from heat, without having done two solid weeks' work.

Prosser's boiler, although it works well with a moderate fire and high pressure, and is saving of fuel, is liable to be burned out in a few days if driven by a strong blast, and the pressure be run down to 50 lbs. or less. In such a case, there would probably not be a drop of water in the crown sheet slab and annular spaces; but superheated steam alone would receive heat and carry it up to the water in the main chamber.

Mr. Dibben—Steam, in contact with water, may be superheated from above to any extent. It is a very poor conductor, and the hottest portion would remain at the top. Steam occupies less space than its elements would if only mechanically mixed; a cubic foot of steam, at atmospheric pressure, weighs about 250 grains; a cubic foot of corresponding mixture of hydrogen and oxygen, say 100 grains.

At the suggestion of the president, the meeting filed upon the sense in which the term *superheated steam* should be used, viz., steam at a temperature higher than that at which it is generated.

Professor Hendricks—Steam follows the law of expansion of permanent gases; after steam is generated, the power that would be realized by superheating would be calculated precisely as we calculate the effect of heat in the caloric engine.

Mr. Seely—Gases expand at the rate of 1-490th of their volume at 32° for each addition of one degree of heat; a gas at 32°, on being heated 490° higher—namely, at 522°—will be doubled in volume; if heated to 1,012°, trebled, &c. A cubic inch of water at 212°, converted to steam, occupies a cubic foot, nearly; this expansion is brought about by the addition of such an amount of heat as would raise the water 1,000°, provided it did not change to steam. But a cubic inch of steam, at 212°, raised 1,000°, would occupy only about three cubic inches. It has been settled by Joule, Thompson and others, that the mechanical effect of expansion is mathematically measured by the amount of heat which causes the expansion—a unit of heat generates a unit of mechanical power of expansion; therefore, *theoretically*, it matters not what substance is taken for the expanding body in an engine. But the expansion of solids and liquids is through such short extent that any contrivance we know of is altogether too clumsy to multiply the motion for practical use. The solids and liquids which expand to vapors at moderate temperatures are only useful. If water vaporized at the temperate of ether, we would find it better for steam engines.

Mr. Garvey—Not more than 1-10th of heat produced is utilized in practice. An engine will shortly be brought out which utilizes all the heat; I am not at liberty to enter into particulars.

Mr. Fisher—The highest standard of engine-working is one pound of coal per horse-power per hour. It is reported that the average duty of Cornish engines, 10 years ago, was 1⅓ lbs., of coal per horse-power per hour.

Mr. Dibben—I am not acquainted with any very reliable experiments as to superheating steam after it has left the boiler; statements made are conflicting and uncertain. In marine engines, the steam travels 25 or 30 feet from the boiler to the cylinder; thus requiring considerable superheating to prevent condensation. Pipes for superheating are soon burned out; the rapidity of burning is greatly increased on the stopping of the engine, as there is then no circulation in the pipes. I have seen a contrivance for letting water on the superheating surface whenever the engine is stopped.

The President—All our discussions of the arts are finally reduced to a question of *economy*. The benefactors of mankind are those who lessen the cost of production. In a mining operation with which I was once connected, it required two tuns of coal to one tun of ore; then it was cheaper to carry the ore to the coal. Now much less than one tun of coal will do the work for which two were used.

Mr. Seely—We now know how to calculate the exact value of coal or any other fuel; and we know precisely how much heat we waste.

Professor Reuben—Any heat going up the chimney is lost; also, it may be lost in an engine in the passage from the boiler to the cylinder. Cornish engines utilize only 14 per cent of the heat produced.

Mr. Dibben—Marine engines do not utilize so large a per cent. Caloric engines utilize a fair per centage; but the advantage is compensated by increased friction, rapid destruction of the heating surfaces, &c.

Mr. Larned—I consider it a duty to myself to state that I am the inventor and patentee of the essential feature of the boiler named here as Prosser's. For steam fire-engines (Lee & Larned's), we use the boilers in question. We use steam from 50 to 200 lbs. When all is in order, we get pretty dry steam, due, first, to the high pressure (keeps down the water); and second, to the large upper steam-heating surface. We observed water in a spheroidal condition in the boilers three years ago, but not lately. We get a great benefit from the superheating; we are positive on that point.

Mr. McCarty—If steam-heating pipes burst, little damage may be anticipated, compared with a boiler bursting.

Major Serrell then compared the working of the steamer *Bay State* with that of a locomotive, and said:—"The conclusions are based on accurate data, as follows:—

"The steamer:—Diameter of cylinder, 76 inches; stroke, 12 feet; steam, at 27 to 30 lbs.; revolution, 16 to 18 per minute; cut off, ½; trip, 170 to 180 miles; time, 10 to 11 hours; coal burned, 50 tuns; cargo, 170 tuns; passengers, 100.

"The locomotive:—20-inch cylinder; 24-inch stroke; effective pressure, 120 lbs; wheel, 4.8; 30 miles an hour.

"The result of the calculation from such data is the development for the power of the *Bay State* of 51,716,444 foot (pounds) per hour, and that of the locomotive of 64,204,800 foot (pounds). When the steamer reaches Fall River, one small locomotive runs away with her whole cargo and passengers!"

In a conversation which ensued, similar statistics and calculations were presented with reference to the steamers *Commonwealth*, *New World*, &c. The subject was then ordered to be resumed on the following week.

STATISTICS OF LITERATURE.—The tables of literary mortality show the following appalling facts in regard to the chances of an author to secure literary fame: Out of 1,000 published books, 600 never pay the cost of printing, &c.; 200 just pay expenses; 100 return a slight profit; and only 100 show a substantial gain. Of the 1,000 books, 650 are forgotten by the end of the year, and 150 more at the end of three years; only 50 survive seven years' publicity. Of the 50,000 publications put forth in the seventeenth century, hardly more than 50 have a great reputation, and are reprinted. Of the 50,000 works published in the eighteenth century, posterity has hardly preserved more than were rescued from oblivion in the seventeenth century. Men have been writing books these 3,000 years, and there are hardly now more than 500 writers throughout the world who have survived the outrages of time and the forgetfulness of man.

THE steamship *Adriatic* has made a trial trip to sea for a few days, and it is said that her new valves work well.

© 1860 SCIENTIFIC AMERICAN, INC.