POLYTECHNIC ASSOCIATION OF THE AMERICAN INSTITUTE.

The regular weekly meeting of the Association was held in their room at the Cooper Institute on Thursday evening, May 15th, the President, Prof. Joy, in the chair.

The preliminary half hour set apart for miscellaneous business was devoted principally to the discussion of

INDIA RUBBER.

Mr. CHURCHILL—Mr. President, here is a tube of india rubber which was burst by steam at a pressure of some 5 or 6 lbs., and it will be seen that some portions of it were forced outward and permanently deformed by the pressure. I have before presented here india rubber pipes which had been altered by the action of steam.

Mr. STETSON—A great desideratum in the arts is a flexible pipe that will resist the pressure and action of steam at the temperature at which steam is used in locomotives. Is there any mode of preparing india rubber so that it will do this, or is there any other substance known that will answer the purpose? Many valuable inventions have failed of success for want of such a material.

Mr. FISHER—I have known two cases in which india rubber was employed for steam pipes with success, and for a considerable time. In one case the pressure must have been nearly the same as is used in locomotives.

Mr. ROWELL—I had occasion this day to ascertain the temperature at which hard rubber is vulcanized, and I asked Mr. Day. He told me that the temperature for hard rubber is 350°, and for soft rubber considerably lower—about 310°. He says that if these temperatures are exceeded in the respective cases the rubber is completely destroyed.

Mr. STETSON—I see by Mr. Rowell's table that the pressure of steam at a temperature of 310° is 62 lbs. to the inch. So it would seem that the result to which we are brought by this discussion is that india rubber may be used for steam pipes at pressures below 62 lbs., but will be destroyed at higher pressures.

Prof. SEELY—When india rubber was first introduced we thought that it would answer for all purposes. I proposed myself to use it as a steam engine in the form of a bellows. But we soon discovered that its properties were destroyed by the action of many substances, spirits of turpentine, acids, &c., and they were altered by changes in temperature and by the action of the air. I procured a very pure sample as white as milk, but the surface soon became dark, and its tenacity was destroyed. It could be scraped off with a knife; it absorbed oxygen and was changed into a resin, like some other hydrocarbons—spirits of turpentine for instance, which becomes first oil of turpentine and then solid rosin.

When the art of vulcanizing was discovered it was thought at first that all of the difficulties were overcome. But experience has shown that vulcanized rubber is acted upon by all the agents which affect the crude material only in less degree, or more slowly. It becomes stiff in the cold, it is softened by heat, is dissolved slowly in spirits of turpentine and benzole, is spoiled if kept any considerable time in contact with grease, and is changed into resin by absorbing oxygen from the atmosphere. But all of these changes go on much more slowly in vulcanized rubber than in the crude material.

There is another difficulty with vulcanized rubber—that is the adulteration. Perhaps there is no other manufacture in which adulteration is so systematically and extensively practiced as in that of india rubber. Some of the articles in market do not contain 10 per cent. of rubber. Notwithstanding these depreciatory remarks, I regard india rubber as a very valuable substance. I should almost agree with Liebig in the opinion that the four most valuable materials for the chemist—naming them in the order of their importance—are glass, platinum, cork and india rubber.

The President then announced the regular subject of the evening,

THE MANUFACTURE OF SOAP,

continued from last week, and called upon Professor Seely to proceed with the discussion.

Prof. SEELY—The chemistry of soap was very ably presented at the last meeting by the President and Mr. Engelhard, and I propose to consider the subject a little more in the same direction, but without going over the same ground. Complex organic substances, on being decomposed, separate into simpler compounds. Woody fiber, for instance, if placed in a retort and distilled, is separated into carbonic acid, water, &c., so that in one sense woody fiber may be said to be composed of carbonic acid, water, &c. Nature seems to have built up the substances of which vegetable and animal organisms are constituted, by forming first some comparatively simple compounds, and then joining other elements to them. These compounds which lie at the root of organized structure are called organic radicals. They are nearly all composed of two elements only, hydrogen and carbon, and on close examination are found grouped in certain orderly series. The series which interests us in this discussion is constituted in this manner:—

$$C_2\ H$$
$$C_4\ H_3$$
$$C_6\ H_5$$
$$C_8\ H_7$$
$$C_{10}\ H_9$$
$$C_{12}\ H_{11}$$

There is a substance formed by the combination of two atoms of carbon with one of hydrogen, another consisting of four atoms of carbon and three of hydrogen, and so on; and I might continue the column up to 60 atoms of carbon and 59 of hydrogen. Now these substances differ in their properties in the same manner that they do in their constitution, that is by regular and equal degrees. C_2 H is a gas, $C_4\ H_3$ is a very volatile liquid, $C_6\ H_5$ is a liquid less volatile, and thus we go on through thicker liquids till we come to solids. There is the same regular increase in the melting points, in the specific gravities, &c.

We now come to the next step in the process. Each of these radicals will combine with three atoms of oxygen and one atom of water, O_3 H O, and this combination forms a series of acids. We have then an acid series of the constitution

$$C_2\ H,\ O_3\ HO$$
$$C_4\ H_3,\ O_3\ HO$$
$$C_6\ H_5,\ O_3\ HO$$

and so forth.

These acids differ from each other by the same regular law as the radicals. Beginning with the simplest at the head of the column, they increase in specific gravity, in the boiling point, &c., as they become more complex.

The substances which we have been considering so far are known only to the chemist, but the next step brings us to things with which we are familiar. It is not natural for acids to be alone, and they are always ready to combine with bases forming salts. Any of the acids in the series which we have been considering will combine with a certain organic substance called the oxide of glyceryl, which is formed by the combination of one atom of carbon with three of hydrogen, and one of oxygen, $C_6\ H_3$ O. This is the constitution of oils and fats. One of the acids in the above series is butyric, and if this acid combines with the oxide of glyceryl it forms butyrine, the principal ingredient of butter.

The salts formed by the combination of the several fat acids with the one base—the oxide of glyceryl—constitute a series which differ from each other in the same way that the acids and the radicals differ, that is by regular and equal gradations—the solidity, the specific gravify, and the boiling temperature all increase regularly with the complexity.

Now if any fat is brought in contact with an alkali or alkaline earth at a high temperature, the acid of the fat will leave the weaker base with which it is combined and will enter into combination with the alkali. This forms soap. Soap is a salt formed by the combination of a fat acid with an alkaline base.

Now I come to the point to which my remarks have been tending, and which it was my special object in speaking to present. That is, that as each acid in the series will form a soap by combining with an alkali, we have a series of soaps differing from each other, like the acids, by regular and equal gradations. Samples of these soaps for the complete series would constitute a very interesting collection for a learned society, like the American Institute.

Prof. Joy then gave an account of the ordinary mode of making soap, such as has been repeatedly published, and the Society adjourned.

Variations of the Needle in Iron Ships.

There is in Liverpool a Compass Committee who are making researches in the variation of the needle on iron ships. They are collecting many curious facts, and in a recent report make the following statement in relation to the steamer *City of Baltimore*:—

The azimuth compass of this vessel, which is placed about four feet above the deck-house, nearly 11 feet above the deck and about 30 feet before the mizenmast, when the ship's head was placed north, correct magnetic, showed a deviation to the west of 7° 30′; when she was heeled 10° to starboard, the deviation was 25° 30′ to the west; and when she was heeled 10° to port, the deviation was 15° 30′ to the east; showing a difference of 41° due to heeling alone, without in any way changing the direction of the ship's head, or an average of 2° of deviation for each degree of list. It will be seen that the deviations occurred when the ship's head was to the north. Considering that all our steamers carry canvas, and that with a fresh breeze they must heel over to some extent, it is important to understand that in steering a north or south course, the variation is considerable, but that there is little or no deviation on a west or east course. The committee sought for an explanation of this magnetic polarity of Mr. Bennett, a compass adjuster, of Cork. He discovered that in his locality, the vessels had been built on the northern shore of the river, which runs east and west. Vessels had, therefore, been built in the line of the magnetic meridian, and the ships exhibited southern polarity aft and northern polarity forward. Mr. Bennett thereupon prevailed upon Mr. Robinson, the builder, to construct a ship with her head to the south, and launch her stem on. The polarity in this vessel was reversed. When her head was east and west, a compass placed aft had much less error than in any former ship, and much less than in the forward part of this ship, and consequently it required less magnets to adjust her. As a deduction from this natural law, Mr. Bennett advises the keels of ships to be laid east and west.

Length, Weight and Measure.

The French standard of length in the meter, which is one ten-millionth of the distance from the equator to the pole; it is equal to 39.37079 inches, or very nearly 3.281 English feet. One mile contains 5,280 feet, or 1,760 yards. The acre contains 43,560 square feet. One mile square contains 640 acres. The circumference of a circle is equal to the diameter multiplied by 3.1416. The area of a circle is equal to the square of the diameter multiplied by 0.7854. The United States standard gallon contains 231 cubic inches; and the United States standard bushel contains 2,150.52 cubic inches. A cubic foot of water weighs 62.5 lbs.; a foot of hard wood, green, 62 lbs., air-dried, 46 lbs., kiln dried, 40 lbs.; a foot of soft wood, green, weighs 58 lbs., air-dried, 30 lbs., kiln-dried, 28 lbs. A cubic foot of cast iron weighs 450 lbs.; of wrought iron, 480 lbs.; coke, 50 to 65 lbs.; coal 75 to 95 lbs.; sandstone, 140 lbs.; granite, 180 lbs.; brickwork, 95 lbs. No. 1 iron is 5-16 inch thick; No. 3 is 9-32 scant, No. 4 is 1-4 inch; No. 5 is 7-32, and No. 7 is 3-16 inch thick.

A GOOD SUGGESTION.—A writer to a London paper proposes that the £200,000, which it is thought the different Prince Albert memorials will cost, be devoted to buying American sewing machines for the twenty thousand poor needlewomen in England. The correspondent in conclusion says: "I have no connection with sewing machines, and am by no means wedded to them. Other forms of benevolence and beneficence—dear twin-sisters—may be much to be preferred. Almost any thing is better than calf worship."

A THIEF lately stole from a church in Genoa the sacramental service, and, taking it home, tried to melt it down in a brazier. While at the work he was overpowered by the fumes of the charcoal; his cries for help brought people to the spot, who thus observed his occupation and discovered the theft.

FLEAS IN DOGS.—I have found, says a correspondent, the following receipt most effectual in killing fleas in dogs, viz., to rub them well over with whisky—it acts like magic, killing them *instanter*; if all are not polished off in one application, another will be necessary.