the outer port being at the time shut off by the main valve. Valves are provided to put the two cylinder ports at each end in communication to regulate the extent of cushioning. The pump valves consist of rubber disks arranged in chambers above and below the plungers. Each plunger runs without packing in a long grooved ring in a central diaphragm. In operation, one engine, while in full action, moves the valves of the other, when the pistons of the latter gradually begin to move and finally attain full velocity, as those of the first are checked by the steam cushions, and gradually come to rest, the pump valves meantime seating quietly.

The first engine pauses a moment till the second engine admits steam, when it commences a return stroke, and the second comes to rest—the action of one blending into that of the other as each alternately takes up the load—the result being that the discharge is uniform, a uniform pressure is maintained in the main, and the pumps under heavy or light pressure operate without jar or noise.

In the Ninety-eighth Street works there are two compound condensing Worthington pumping engines, each capable of raising 7,500,000 gallons 100 feet high in 24 hours. This is equivalent to 132 horse power each. The high pressure cylinders are 21 inches diameter; the low pressure, 36¾ inches; water plunger, 26 inches diameter; all 48 inches stroke. The high pressure cylinders have cut-off valves in the steam ports, so that part of the expansion takes place in the small cylinder. This is a new feature introduced for the first time on this engine.

According to the department report, these engines are showing a duty of 70,000,000 foot pounds with 100 pounds of coal. They are pumping over 8,000,000 gallons per 24 hours, or about one-eighth more than contract capacity. There are 4 return flue tubular boilers, each 6 feet diameter by 16 feet long, with 75 4-inch tubes. They are set in pairs in brickwork. The stand pipe on delivery main is 6 feet diameter and 150 feet high. It is made of boiler iron, one-half inch thick at the base, and thinner toward the top. The tank on the suction pipe is 8 feet diameter and 44 feet high. Suction and delivery pipes are each 36 inches in diameter.

The engine and boiler house extends from Ninety-seventh to Ninety-eighth streets, and is 50 feet by 200 feet, and has room for a third engine and more boilers. In connection with the main engines there is a Worthington pump of 16 inch steam cylinders, 10¼ inch water cylinders, and 10 inches stroke, which returns the water of condensation of the large engines back into the mains. This small pump exhausts into the condensers of the large engines.

The water is supplied to these works through a 36-inch main from the Central Park reservoir.

Taken all in all, this system of pumping is as fine an example of the direct and economical application of the power of steam as could be desired. The pumping proceeds with perfect regularity, without noise or jar, and is accomplished without rotating shafts, wheels, or gearing of any kind.

The Fastest Steamer.

A recent trial of the new Clyde built steamer Stirling Castle gave results upon which her owners claim her to be the fastest ocean going steamer in the world. Six consecutive runs at the measured mile gave a mean speed, on the Admiralty method, of 18·418 knots, or 21$\frac{3}{10}$ miles per hour. The actual time taken in running each mile respectively was 3 minutes 13 seconds; 3 minutes 23 seconds; 3 minutes 12 seconds; 3 minutes 18 seconds; 3 minutes 13 seconds; and 3 minutes 18 seconds.

On the trial there was a cargo of 3,000 tons dead weight on board. Her length is 430 feet, breadth 50 feet, and depth 33 feet, and she registers 4,300 tons. Her engines are of the three cylinder type, and have developed 8,237 horse power. The diameter of the high pressure cylinder is 62 inches, and the two low pressure 90 inches, with a 5 foot 6 inch stroke. Surface condensers are used with Gwynne's "Invincible" circulating pumps. The boilers are of steel, and present a total heating surface of 21,161 feet; the grate surface is 787 square feet; and the working pressure 100 pounds to the square inch. The propeller is made of manganese bronze, is 22 feet 4 inches in diameter, with a pitch of 31 feet. The number of maximum revolutions at the trial was 66½ per minute, accompanied, the *Engineer* says, by absolutely no vibration, except in the immediate vicinity of the screw shaft. The hull is built of steel, on plans approved by the Admiralty, with a view to national requirements, and is capable of carrying coal for a twenty days' cruise.

The Stirling Castle is intended for the tea trade. In view of her performance the recommendation of our board of naval advisers to build "fast" cruisers having a maximum speed of 15 knots would seem to be a trifle out of season. Twenty-five knots should be the figure aimed at.

A Foolhardy Project.

Captain Fred. Norman, who crossed and recrossed the Atlantic with George Thomas in the Little Western (16½ feet long by 6½ feet wide), now proposes to row across the Atlantic alone. He says he will use a boat built under his own supervision, about 12 feet long by 4 feet wide, and from 3 to 2½ feet deep, partly covered fore and aft. He will take a floating sea anchor to keep the boat's head to the wind while he sleeps. He will have no fire but a lamp, and will use prepared food, condensed coffee, and carry about fifty gallons of water. He thinks he could make the voyage in 100 days.

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UNIFORMITY IN CHEMICAL NOMENCLATURE.

We possess authority for the statement that a rose would smell as sweet by any other name, and we have had olfactory demonstration that hydro-sulphuric acid, hydric sulphide, or sulphureted hydrogen retains its characteristic repulsiveness under all its numerous aliases. Notwithstanding that the premises are granted, it must be confessed that too many names for one substance are objectionable. Chemists have long recognized the fact, and while they have no desire (or power) to change the old familiar terms used in trade and in the arts, such as bluestone, aquafortis, and vitriol, they are making a vigorous effort to establish uniformity in scientific nomenclature. A convenient basis for such a change is offered in the circular recently issued by the editor of the *Journal of the London Chemical Society*, containing "Instructions to Abstractors." The nomenclature here advocated is employed in the new supplement to "Watts' Dictionary of Chemistry." As both of these works are widely read and acknowledged as authority on scientific matters, whatever nomenclature is adopted therein must soon become familiar to most English-speaking chemists, and ought to come into use sooner or later in their writings.

Some of the rules laid down in the circular seem rather arbitrary, and many familiar names give place to those that are new or unfamiliar. Without, however, stopping to criticise, we will proceed to describe some of the most important points.

In naming salts, use the name of the metal followed by an adjective representing the acid or negative radical: sodium chloride, potassium sulphate, ferrous sulphate, mercuric chloride. The terminals *ous* and *ic* are used only when there are two salts of the same metal, differing only in degree.

When a metal or alcoholic radical unites with hydroxyl (OH) the compound is called a *hydroxide* instead of a hydrate: thus, potassium hydroxide for caustic potash, or potassa, KOH; and phenyl hydroxide for carbolic acid, $C_6H_5(OH)$. The name hydrate is reserved for compounds supposed to contain water of combination or crystallization.

The term *acid* is applied only to compounds of hydrogen with negative radicals, such as HNO_3, H_2SO_4, H_3PO_4. Oxides which replace acids are called *anhydrides* as before.

Salts in which all the hydrogen of the acid is displaced by the metal are called *normal* instead of neutral salts. The old bisulphate or acid sulphate of soda becomes hydrogen sodium sulphate.

The principle of naming hydrocarbons is best shown by a few examples; thus, CH_4 is methane; C_2H_6, ethane, etc.; C_2H_4 is, as before, ethylene; C_2H_2, acetylene; C_3H_4, allene.

All alcohols have names ending in *ol*; thus, quinol for hydroquinone, resorcinol for resorcin, glycerol for glycerin, mannitol for mannite. Words like indol that now end in *ol* have an *e* added, thus, indole. Furfurol becomes, however, furfuraldehyde. Ethers derived from phenols have names ending in *oil*.

Alcohols are to be spoken of as mono-, di-, or tri-*hydric*, instead of monobasic, etc.

Bodies such as acids of the lactic series containing the group OH should be termed *hydroxy-* and not oxy- derivatives.

The term *ether* is applied only to the oxides of hydrocarbon radicals, and the word *esther* is not used.

Compounds of the radical SO_3H are called *sulphonic* acid, or *sulpho-compounds*.

Basic substances have names ending in *ine*, as aniline, instead of anilin, the termination *in* being retained for certain neutral compounds like palmitin, albumin, etc. The compounds of basic substances with hydrogen chloride, bromide, or iodide receive names ending in *ide* and not *ate*, as morphine hydrochloride and not hydrochlorate.

For formulæ dots are employed instead of dashes; Me is used for CH_3, Et for C_2H_5, Ph for C_6H_5, etc.; and the formulæ is written *in one line* if possible. This latter point will make a large saving in the cost of composition, and be a welcome change to editors and printers.

CARELESSNESS AS A CAUSE OF FIRE.

The records of the city Fire Department for 1881 show that the commonest cause of fire was sheer carelessness. There were 1,785 fires in all, in 70 per cent of which the damage was less than $100. Eleven fires were proved to be of incendiary origin, and the causes of 168 were not discovered.

The largest item in the classification of causes was carelessness with respect to matches, smoking, lights, and hot ashes. There were 413 such fires, and nearly as many more were attributed to accidents, not necessarily through carelessness, with stoves, fires, furnaces, and grates.

Sixteen fires were traced to boys' bonfires, 81 to children playing with fire and matches, and 13 to malicious mischief on the part of children. Sixty-three fires originated in kitchens, many of them by the falling of fat meats and the like into the fire. Ten cases are attributed to contact of clothing with stoves. Defective flues, fireplaces, chimneys, stovepipes, and grates caused 62 fires; beams built in flues, 14; overheated stoves and pipes, 41; foul chimneys, 186; falling soot, 41; coals from stoves and grates, 18. Six fires were caused by overturned or leaky kerosene stoves, and 127 by accidents to kerosene lamps. Fires from gas were fewer: 28 from escaping gas; 3 from explosion of gas; one gas meter exploded, and one gas stove was upset, causing fire. Still fewer were the fires charged to electricity, only 4 being attributed to this agent. One of these fires, which occurred in the Germania Theater building, was in its origin decidedly peculiar. According to the Fire Marshal's explanation the insulation of a wire that ran over the tinned arch over the Thirteenth street door was defective, and water that fell around the wire during a rain led the electric current from it to the tin. It melted the solder, burned the tin, and ignited the woodwork under the tin.

There were 24 fires caused by fireworks, the number from this cause diminishing year by year. Window curtains, goods in shop windows, Christmas trees, clothing, drapery, and woodwork were ignited by gas jets, lamps, and candles in 99 instances. In the opinion of the Fire Marshal the placing of gas jets near window frames should be prohibited.

The total estimated fire loss for 1881 on buildings and vessels was $726,291, and on stock, $5,093,968. The estimated insurance loss on buildings and vessels was $54,893; on stock, $1,062,514. Total, $1,117,401. There were two fires with a loss each of from $50,000 to $60,000; one of from $60,000 to $70,000; one of from $70,000 to $80,000; two of from $150,000 to $200,000; one of from $262,000 to $350,000; one of $1,025,800; and one of $2,302,691.

Of the 1,785 fires 1,552 were confined to points of starting; 109 to the building itself; 33 extended to other buildings; 17 were on vessels; and 74 were in woods and such places.

TESTING CHOCOLATE.

In a lecture delivered before the chocolate manufacturers of Cassel, E. Herbst said that, although the adulteration of food is nearly as old as its preparation, yet it had made greater progress in recent times owing to the progress attained in the development of chemical methods. Fortunately the progress of chemistry aids those engaged in detecting and exposing these adulterations equally with those engaged in the opposite pursuit. The more deceptive the methods employed in adulterating the more complete and certain are the methods employed in detecting and exposing them.

It is easy to see that the necessary certainty and clearness has not yet been attained in all cases, since the art of testing food by scientific methods is scarcely more than fifty years old, and because we rarely have to do with simple chemical substances, but mostly with mixtures very difficult to separate. Certainly chemistry should not be blamed for such flaws in its methods, for every science has similar imperfections, but the representatives of those sciences should know these flaws so as to know just how far their methods are reliable and to what degree these reactions are conclusive.

That these self-criticisms are not sufficiently practical by all chemists has frequently been proven by experience. Within the last decade, since the chemical examination of human food has received special attention, we have seen how often the most incredible analytical results used for the judicial prosecution of dealers and producers, and the exaggerated statements which have been made regarding the extent of food adulterations, have excited in the public a mistrust and suspicion which, with the single exception, perhaps, of wine adulteration, is out of all proportion to the actual frequency. One case may here be adduced as proof of what has just been said. Some time since twenty samples of chocolate were tested in Stettin, and declared adulterated, and the manufacturers indicted. Upon an appeal of the indicted persons, the chocolates were again examined, and in the second instance were all pronounced pure and unadulterated.

Unpleasant occurrences of this sort have produced a lamentable sense of insecurity among producers as well as consumers, and a justifiable mistrust of the reliability of chemical tests. They form a welcome tool for the manufacturers with which to combat the enforcement of the food and victuals law. The honest manufacturers oppose the law because they have reason to fear injury to their good name and credit, as well as to their pockets, from careless tests of their goods; while the dishonest parties prefer to conduct their adulterations without any law to fear.

This *explains*, but does not *justify*, the opposition of manufacturers to the law. The honest manufacturer is as much interested as the chemist in deciding just what is deceit and adulteration, and what is allowable.

The lecturer had had occasion to test forty kinds of chocolate in the experimental station at Carlsruhe. He determined the quantity of water, fat, sugar, of dried cacao mass, and of ashes, in all these chocolates. He also tested the purity of the fat, and examined the chocolate microscopically.

The determination of the water by drying a weighed quantity of chocolate at 60° or 80° C. offers no difficulty; to render the mass more porous it is mixed with twice its weight of dry sand. The fat was extracted with ether from 10 grammes of chocolate in Soxhlet's extraction apparatus, and dried at 100° C. before weighing. It was found that the same chocolate, treated in the same apparatus, gave ½ to 1 per cent more fat in the first analysis than in the second; and that in the first analysis the ethereal solution of fat was turbid, but in the second it was clear. The cause of this was found to be that the ether extracted a resinous substance from the new cork stopper the first time it was used, and this contaminated the fat and caused turbidity; hence it is advisable to boil the corks in ether several times before using. The ethereal fat solution had also, almost always, some brown flakes, which were shown by the microscope to be cacao substance, hence it was necessary to filter the solution before evaporating it. The purity of the fat, after drying and weighing, was tested by aid of its melting point and solubility in ether; its odor is not of much use, as it is concealed by the characteristic cacao aroma which adheres to it very tenaciously. The fusing point of cacao fat determined in capillary tubes is not, as frequently stated, between 27° and 31° C., but remains quite constant at 21° C. (70° Fahr.). Since tallow melts under like conditions at 34° to 37° C., any considerable adulteration could easily be detected by the melting point. It would be still more distinctly seen by the so-called ether test. Cacao fat dissolves completely and easily in twice its weight of ether, while tallow requires much more ether for solution, so that when tallow is present a turbid white paste is formed instead of a perfect solution of light yellow color.

Although it is not difficult to detect tallow, many chemists have racked their brains in vain in seeking a test for sesame oil; but really it is scarcely worth the trouble, for experience has shown that it is impossible to put more than four per cent of sesame oil in chocolate without its striking through the paper wrappers; or, if tin foil is used, the chocolate has a greasy and suspicious appearance. The addition of so small an amount of a nutritious substance like sesame oil is not calculated to greatly enrich the manufacturers, and is scarcely added for pecuniary reasons, but rather to give it a smoother and finer appearance, especially on the fracture.

The sugar is determined in the chocolate from which the fat has been extracted by ether. It requires some attention and experience to obtain figures not entirely unreliable. Herbst employs the extraction with alcohol as the handiest and best. The chocolate mass is wrapped in filter paper and boiled in fifty per cent alcohol as long as it imparts to it a reddish brown color. It is not advisable to employ water alone to dissolve the sugar, as that dissolves the cacao starch, and the result would be much too high, especially when there is flour in it.

By evaporating this extract to dryness and weighing the residue, figures are obtained that may be six per cent too high, because the alcohol dissolves other extracting substances present in chocolate. It is, therefore, necessary to dissolve the residue in cold water, filter, evaporate again, and dry at 100° C. in a stream of coal gas.

One circumstance deserves notice here, that may cause the manufacturer and analyst to differ. In most cases a chemical analysis shows a rather higher percentage of sugar than the proportions used in making it. One reason for this is that in making chocolate the substances are weighed in a moist condition corresponding to the moisture in the atmosphere, and are afterwards dried, so that the percentage composition, when finished, differs from that of the recipe. Then, too, a small part of the starch in it may easily be converted into sugar. As yet Herbst never has found the amount of sugar to differ more than two per cent from that required by the recipe.

The mass from which fat and sugar have been removed is dried and weighed. The sum of water, fat, sugar, and residue must equal 100. [He seems not to take into account the extractive matter dissolved by alcohol.—ED.]

As pure cacao contains, on an average, fifty per cent of fat, the quantity of fat found in manufactured chocolate ought to be about equal to one-half the weight of the chocolate after deducting the sugar. For example, chocolate made from 63 parts of sugar and 37 of cacao mass would normally give about the following results:

Moisture	2 per cent.
Fat	17 "
Residue	18 "
Sugar	63 "
	100

If this chocolate contained much more or less than 100—63÷2 per cent of fat, we should suspect adulteration, and carefully test the extracted fat.

The percentage of ash in normal chocolate should not much exceed two per cent. It may, of course, be tested for mineral substances, like ocher, bolus, and barytes, which are added sometimes to give weight or color.

Microscopic examination serves to detect flour, sago, chiccory, acorns, etc.

From the results of the above-given tests it is not difficult for a chemist to judge of the value of a sample of chocolate and to detect gross adulterations worthy of punishment.

In constructing a law to regulate and prevent the sale of adulterated chocolate, the above facts must be taken into account, and then the legal definition of chocolate would be nearly as follows: "Chocolate is a mixture of nearly equal parts of sugar and ground cacao mass, with the addition of certain flavors and spices, but excluding all foreign fats and grease.

An addition of flour can only be permitted when the kind of flour is plainly stated on the label." This would work no injustice to manufacturers, while it would indicate to the chemist what to direct his attention to, and would benefit producers and consumers equally.

As regards the chemist himself, if he is unable to recognize the foreign fats with sufficient sharpness, he will be aware of the flaws in his own knowledge and keep silent until he has filled up the gap, or until he has found a reliable test for the purity of cacao butter. In this, as in every other case of the chemical examination of food, much injury is done by chemists who claim to be able to do the (at present) impossible, and make their reports too sweeping. It were better to confess ignorance than to try to palm off an ingenious guess for a scientific analysis.

The Secret of the Keely Motor.

Some weeks ago the Keely Motor Company brought suit against Mr. Keely to make him keep his promises and take out patents.

It was charged by the company, who, it is said, have put $150,000 into his schemes, that he agreed to apply for letters patent by July of last year. The company's attorneys, it was arranged, should superintend the preparation of the necessary papers, and they were to tell the secret to no one. When July came Keely asked until November to put the finishing touches to his inventions. This was granted, but it resulted in nothing, and the shareholders were obliged to resort to the law to force Keely to keep his contract. Keely's defense was purely technical. Joshua Pusey, who represented him, argued that the inventor could not be made to expose that which was hidden in his own brain. If he were directed to divulge his secret, who could say whether what he might say would be a secret or not? The court could not make a decree, he said, because there were no reasonable means of enforcing it.

Nevertheless, after hearing the argument at length, Judge Pierce, of the Court of Common Pleas, Philadelphia, overruled Keely's demurrer, and ordered him to make known his process according to his contract with the company. The court, no doubt, treated the suit with becoming seriousness, but it is suggestive, to say the least, to see that the order was given April 1.

A Manometer for High Pressures.

To avoid the use of very long and cumbersome mercury tubes, Dr. M. Thiessen, in Berlin, has invented one consisting of several short tubes. These are arranged vertically and terminate at both ends in a larger steel tube provided with stopcocks, so that the tubes can be cut off from each other in pairs, so that Nos. 1 and 2 are united at the top, 2 and 3 at the bottom, 3 and 4 at the top, 4 and 5 at the bottom, etc. The apparatus is first filled with water, avoiding air bubbles, and then part of the water is displaced with pure mercury, so that when all the cocks are opened each tube will be half full of mercury. The tubes are then shut off from each other in pairs as above described, connecting alternately above and below. When pressure is exerted on the water in the first tube, the mercury will rise to about the same height in every tube, but the pressure exerted will nearly equal the pressure represented by the sum of the differences of levels of the mercury in each tube. For greater accuracy in arriving at results for scientific purposes the columns of water must be reduced to mercury pressure and each tube corrected by previous experiment. By making use of a suitable comparator for measuring difference of height it is said that very accurate results can be obtained.

P. N.

The Kingship of Cotton.

Whoever controls the cotton goods of the world controls the exchanges of the world. In this sense, "Cotton is king." The great mistake of the Southern people, in thinking that cotton was king, consisted in believing that raw cotton was king. There was a little of truth in their belief, as there is in most wide-spread popular delusions. Whoever controls the cotton cloth is a king, and powerful though not an unlimited monarch. Very few people want raw cotton; or can do anything with it, individually; every one wants cotton cloth, in some form, and every one can individually turn it to his purpose. The Southern people did not see this truth, and therefore never perceived that they were more completely dependent on the *manufacturer* of cotton than almost are the raisers of any other agricultural product whatever upon the consumer of that particular article. Of all the great products of agriculture, cotton in its raw state is one of the least necessity to the individual man. It requires the capital, skill, and mechanic arts to make it available.—*Senator Bayard.*

Dangerous Car Couplings.

The needless maiming and killing of brakemen and yard men in making up railway trains has often been deplored in these columns, and the belief expressed that such unaccidental "accidents" might easily be prevented. We are glad to see that a court in Orange County, in this State, has awarded John Gottlieb, a brakeman on the Erie road, $5,000 for damages so received. Automatic couplings, or couplings safely operated from the side of the car, will be generally adopted just as soon as the courts make the present style unprofitable to the railroad companies.

Large Arrival of Immigrants.

Thursday, April 6, was a busy day at Castle Garden, New York. There were landed that day 6,481 immigrants, the largest number received at this port on any day this season. All were in good health, and there is every reason to expect that the great majority of them were desirable additions to our working force as a nation. The next day the arrivals were sufficient to swell the number to nearly 10,000. Last year there were two successive days in which the arrivals exceeded 11,000.

Inventions Needed.

A writer on cranberry culture, in the *Rural New Yorker*, says that there is much needed a machine for separating the rotten and frozen cranberries from the sound in preparing them for the market. A machine of this kind that will do perfect work is not known. A machine for harvesting the berries is also greatly needed.