Moonga silk from *A. assama;* Pongees, from China and Japan, from the cocoons of the ailantus moth and of *Bombyx pernyi;* likewise a very valuable silk from the Japanese oak feeding *B. yama-mai;* and he thought that the cocoons of species feeding on the gum trees near Adelaide, New South Wales, which were exhibited that evening to the society, might be utilized in a similar manner. But none of these silks were adapted to the machinery now in use in Europe, and therefore it would be better to allow native industry to collect the produce and fabricate the silks in the countries where produced.

MOLECULAR CHEMISTRY.—No. 5.

Besides the labors of Kopp and Schroeder, described in the last two articles, extensive researches have been made in molecular chemistry by numerous European investigators, notably by Loewig, Boullay, Filhol, and more recently Petterssen; but their work is not now of sufficient general importance to claim our attention.

In 1870 West read a curious memoir before the Société Chimique of Paris, in which he makes the old equivalents O = 200, H = 12·5, C = 150, etc., the basis of his investigations. To find the volumes of bodies, West compares them not at a common temperature, but at temperatures at which they expand equally when further heated. His standard of expansion is that of water at its maximum density, and to this standard the bodies to be compared are reduced to find the temperatures at which their densities give comparable volumes. Where the rate of expansion is not experimentally determined, West employs an assumed rate and looks to the concordance of his results for its confirmation. By this method he finds the molecular volumes of 29 of the elements to be multiples of 2·8125; each of them, moreover, has several volumes. Oxygen, for example, occurs with volumes equal to 12, 24, and 48 times 2·8125, to which he assigns the names of microtome, mesotome, and megatome respectively. Potassium, whose equivalent, according to this system, is 487·5, has three volumes, which are 72, 144, and 288 times 2·8125.

West enumerates 63 amorphous compounds of oxygen, hydrogen, and carbon, whose volumes are equal to the sum of the volumes of their constituents when calculated according to his method. He finds that when carbon is present as a megatome it is tetratomic, *i. e.,* it will combine with four equivalents of another body; when it is present as a mesotome it combines with only two equivalents. Nearly 200 examples are given in illustration. Again, the volume of oxygen determines the chemical properties of a body; the microtome produces acidity, the mesotome neutrality, and the megatome a tendency to combine with more oxygen.

In this country the credit of paving the way for further discovery belongs to Prof. F. W. Clarke, of the University of Cincinnati, the author of a work entitled "Constants of Nature," and published by the Smithsonian Institution in 1873. This book, which has now become indispensable to the chemist, contains not only the densities, the boiling and melting points, and formulas of all substances that have been studied, but provides for the correction of unavoidable inaccuracies by its references to the original authorities.

In December, 1874, Clarke published an important memoir in the *American Journal of Science,* with the object of determining the nature of the difference between water of constitution and water of crystallization; that is, between water intimately combined with a substance and water that may be driven off by heat without destroying the compound. To discover, in the first place, whether water of crystallization had a constant volume or whether it differed for different compounds, he determined the volumes of 31 salts, both when hydrated and when deprived of their water, from a great number of density determinations, and then proceeded as follows: The molecular volume of hydrated chloride of calcium, $CaCl_2 + 6H_2O$, is 133·9; that of the anhydrous, $CaCl_2$, is 49·6. Subtracting the latter from the former, 133·9 − 49·6 = 84·3, the molecular volume of $6H_2O$; dividing by 6 we have 14·05, the volume of water of crystallization in this salt, provided that no change takes place in the volume of $CaCl_2$ in combining or parting with its water. The other 30 salts, which contained from 2 to 18 equivalents of water of crystallization, yielded volumes ranging between the narrow limits of 13 and 15, and averaging 13·76. From this it is evident not only that water of crystallization has a definite volume, but also that no change of volume takes place in the rest of the salt when it combines with such water.

On the other hand, when H_2O is present as water of constitution a great diversity of values is found for its volume in different salts. Thus, the volume of potassium hydrate, K_2O,H_2O, is 54·8; that of the anhydride, K_2O, is 35·4; subtracting we have for H_2O the volume 19·4. Again, in iron sesquioxide we have for the hydrate, Fe_2O_3,H_2O, and the anhydride, Fe_2O_3, a difference of volume equal to 9·0. Hence we may reasonably conclude that when water combines in this intimate manner with a salt *both* undergo a change of volume.

In the *American Journal of Sciences* for April, 1877, Clarke published a list of the fluorides, chlorides, bromides, and iodides of lithium, sodium, potassium, and rubidium, 16 compounds in all, whose volumes proved to be almost exact multiples of 5·5. It was from this list that Schroeder derived some of the data for the support of his steric law.

It was reserved for the genius of Dr. Henry Wurtz, of Hoboken, to evolve entirely new and fertile ideas from the enormous mass of material which had accumulated for the study of molecular volumes. Availing himself of the density determinations collected by Clarke, and verifying them by reference to the original authorities, Wurtz subjected the views of Kopp, Schroeder, and others to the test of accurate computation. A vast number of bodies, simple and compound, organic and inorganic, were examined in this way, and the results showed discrepancies that could not be reconciled with each other or with the chemical relations of the bodies in question. While engaged in this work it struck Wurtz that, as all the molecules of a homogeneous body must occupy equal spaces or volumes, there should exist not simple multiple but *cubic relations* between the molecules of different bodies, especially when they are compared at some uniform temperature. This novel idea he afterward established, to his own satisfaction, by a long chain of evidence.

Before giving his proofs it will be well to state his method of interpreting the very considerable discrepancies that are often found in the densities of the same body by the most accurate experimenters, and that have proved a snare to many investigators of molecular volumes, who did not resist a very natural partiality for such numbers as would agree with their preconceived views. Wurtz believes that we are not warranted in rejecting any density determinations by reputable experimenters on the ground of personal errors or of impurities present in their specimens. In the case of common salt, NaCl, for example, we have the following densities: By Playfair and Joule, 2·011; Unger, 2·03; Sterry Hunt, 2·135; Stolba, 2·163; Hassenfratz, 2·2; Filhol, 2·24; Mohs, 2·26. He considers such variations of density as due to real differences of molecular volume produced by divers causes, such as the temperature at which the body was formed, the condition of the liquid from which it crystallized, etc. That he does not stand alone in this opinion is shown by the remark of Favre and Valson in the *Comptes Rendus* of the French Academy of Sciences for 1873, who were led to believe by their researches in crystalline dissociation "that the density of a salt is not an absolutely fixed element, but that it may vary slightly with the circumstances of its formation, *e. g.,* according as it has crystallized slowly or has been precipitated more or less rapidly from the mother liquor." As regards the figures just given for common salt, Wurtz believes that we have here a number of modifications or allotropes of the same substance, and also that the tendency to vary in density and consequently in volume is almost universal throughout the whole range of chemistry.

Another noteworthy feature in the mode of operation of this investigator is an attempt at obtaining greater accuracy in the comparison of the various density figures of two different compounds for the purpose of arriving at the value of some constituent common to both. Instead of simply averaging each series, each individual number of one is compared with all the numbers of the other. Thus, if there are four densities given of one body and six of another, twenty-four values are obtained, which are then averaged.

The starting point for the new system was found in the density of peroxide of hydrogen, H_2O_2 = 1·452 by Thénard. This specimen contained 2·6325 per cent of water. On making allowance for this impurity the density becomes 1·4642, and this divided into the equivalent of H_2O_2 = 34 gives us 23·220 for the volume. Now we have only to subtract the volume of water, H_2O = 18·000, to obtain the volume of the extra equivalent of O contained in the peroxide: $H_2O_2 - H_2O = O$ = 23·220 − 18·000 = 5·220. Again, on the supposition that the two volumes of oxygen in H_2O_2 are equal, we have only to subtract their value from the volume of H_2O_2 to obtain, 23·220 − 2 × 5·220 = 12·780, the value of H_2, and this divided by 2 gives us for the hydrogen volume 6·390. Subsequent research proved these values to be slightly inaccurate, and 5·184 was definitively settled upon for the oxygen and 6·1408 for the hydrogen volume. It will suffice to select one among the many means of verifying these figures. The volume of liquid N_2O is 47·913, that of liquid N_2O_4 is 63·4625; difference, O_3 = 15·5495, and O = 5·1832.

When the new oxygen volume was substituted in a number of carbonates, the volume of carbon was found in nearly all cases to come out almost exactly 8. The approximations in these and other computations were the closer the nearer to 0° C. the densities had been determined. Now, 8 is the cube of 2.

Perhaps the reason that no one had before observed the close approximation of some volumic values to even cubes lies in the fact that they all contain a decimal point. The density of the diamond, for example, is 3·55. Dividing this into the equivalent 12, we find that carbon in this form has a volume of 3·380. Now, *we have only to omit the decimal point* to see that we have here as close an approximation to the cube of 15 = 3375 as we have any right to expect from the unavoidable imperfection of our experimental processes. If we make the equivalent of hydrogen 1,000 instead of 1, and thus multiply all the equivalent numbers by 1,000, all our volumes will come out as whole numbers, and cubic relations will at once become apparent.

Bunsen found the density of ice to be 0·91674. Its molecular volume is, therefore, the equivalent 18·000 divided by 0·91674 or 19,635. The cube of 27 is 19,683.

When Kopp found the volume of CH_2 = 22 = 21·8 at zero, if he had multiplied by 1,000 he would have obtained 21,800, which is not very far from 28^3 = 21,952.

Clarke's volume for water of crystallization = 13·76, treated in the same way, becomes 13,760, and suggests the cube of 24 = 13,824.

The carbon volume 8, alluded to above, when multiplied by 1,000 is exactly the cube of 20.

As solids are to each other as the cubes of their diameters, the numbers obtained by extracting the cube roots of volumes may be regarded as molecular *diameters.* Thus, 20 represents the diameter of the carbon molecule in carbonates, 15 that of the diamond molecule, 27 that of the ice molecule, etc. This conception gives rise to a new system of notation, in which the numbers expressing diameters are placed directly under the symbols of the substances designated. To represent the common salt of Filhol and Mohs, Wurtz writes:

$$\underset{23}{\mathrm{Na}} \cdot \underset{24}{\mathrm{Cl}} = 2{\cdot}251.$$

This means that the volume of Na is 23^3 = 12,167, and that of Cl is 24^3 = 13,824. Their sum, 25,991, divided into 58,500, the molecular weight of NaCl, gives us the density 2·251. (The density of a substance is its weight divided by its volume.)

We cannot do more here than indicate the vast amount of labor performed in these researches by simply stating that every important class of chemical compounds has been studied, tabulated, and shown to conform to the laws presently to be explained. For detailed information we refer to a memoir entitled "Geometrical Chemistry," in the *American Chemist* for March, 1876, and to later and more accurate publications in the last edition of "Johnson's Cyclopedia," chiefly under the head of "Volumes, Molecular." Since then Wurtz has continued his investigations with unremitting zeal, not satisfied with his generalizations until he had convinced himself of their universal application.

He found, in the first place, that the diameters of elementary molecules had a limited range of variation throughout the compounds into which they enter, and that their tendency to vary is directly as their basicity or electro-positive attitude toward the elements with which they are associated. In the different varieties of common salt, for instance, the sodium diameter will vary, while that of the chlorine remains constant. Stolba's variety is represented by

$$\left(\underset{23}{\mathrm{Na}}\ \underset{24}{\mathrm{Na}}\right) \cdot 2\underset{24}{\mathrm{Cl}} = 2{\cdot}181.$$

Hydrogen, the most electro-positive element, has a range of 16 to 28, while oxygen, the most electro-negative of all, *never varies,* but always has the fixed volume 5,184, which is not an even cube, but curiously enough 3×12^3.

The diameters of some of the other common substances are: Chlorine in chlorates 20, in chlorides 24 or 28; sulphur in most metallic sulphides 20 in sulphates 24; carbon in hydrocarbons and carbonates 20; nitrogen 20, in cyanogen 24; silicon 20.

It the case of allotropes like the two varieties of common salt whose formulas have been given, and of organic homologues—that is, of series whose members differ in composition by the successive addition of the same elements—the tendency of the added molecule is to assume a diameter already present, or a diameter next above or below one already present. To understand this more fully compare the following volumic formulas for some members of the alcohol series:

$$\text{Wood spirit,}\quad 2\underset{27}{\mathrm{H}d} \cdot 2\underset{27}{\mathrm{Hm}}$$

$$\text{Spirit of wine,}\quad 2\underset{27}{\mathrm{H}d} \cdot 2\underset{27}{\mathrm{Hm}} \cdot 2\underset{26}{\mathrm{Hm}}$$

$$\text{Propionic alcohol,}\quad 2\underset{27}{\mathrm{H}d}\ \ 2\underset{27}{\mathrm{Hm}} \cdot 2\underset{26}{\mathrm{Hm}} \cdot \left(\underset{25}{\mathrm{Hm}}\ \underset{26}{\mathrm{Hm}}\right)$$

In these formulas H*d* stands for H_2O with the ice diameter, and Hm for H_2C. In the former Wurtz gives the name of hydor and to the latter that of homologen. Observe that the diameter of each additional molecule shows the tendency just mentioned. It was at first supposed that this tendency, to which the name of engymmetry was given, applied also to other classes of compounds; but it afterward turned out that they exhibited a remarkable regularity of a different kind. Before taking up this subject it will be expedient to learn Wurtz's views with regard to the nature of the components designated by him as H*d* and Hm. In constructing his volumic formulas he found very numerous instances in which the calculated densities could not be made to agree with those obtained experimentally, except on the theory that in these bodies certain ones of the elements were more intimately combined with each other than with the other constituents, and that they formed groups expanding and contracting *as a whole.* Of such groups, or radicals as he calls them, he at first found only four, viz., cyanogen, ammonium, Hm and H*d*; but he now holds that others may be formed from the last two by substitution. Such a view, of course, sweeps away a great army of hypothetical radicals in organic chemistry—a proceeding which chemists will be very loth to permit.

When the formulas of organic bodies are examined according to the method just indicated, and the volumes of Hm and H*d* have been subtracted, there will be found remaining a carbon nucleus consisting of C in alcohols, ethers, and fatty acids, of 3C in aldehydes, of 4C in benzoles and olefines, of 4C in sugars and starches, etc. The variations in diameter of these carbon molecules appear to be connected with the liquidity and solidity of a body, and also with its boiling point. Thus, in the paraffine series we have:

Butane,	$\underset{24}{\mathrm{C}}\ \ 3\underset{24}{\mathrm{Hm}} \cdot 4\underset{22}{\mathrm{H}}$ = Density ·593.	Observed density	·600
Pentane,	$\underset{24}{\mathrm{C}}\ \ 4\underset{24}{\mathrm{Hm}} \cdot 4\underset{22}{\mathrm{H}}$ = " ·6445.	" "	·6413
Solid paraffine,	$\underset{20}{\mathrm{C}} \cdot 19\underset{24}{\mathrm{Hm}}\ \ 4\underset{22}{\mathrm{H}}$ = " ·9002.	" "	89

The first two are liquids and have C = 24; in the third, which is solid, C = 20. Between them there are 14 members of the series which furnish concordant formulas.

The 16 specimens of butyric alcohol, $C_8H_{20}O_2$, whose densities have been determined by different chemists, may be divided into four varieties or isomeres, boiling respectively at 116°, 108°, 98°, and 82·5°. Their volumic formulas would be as follows:

1. ${}^{C}_{20}\ 7^{Hm}_{24}\cdot 2^{Hd}_{24}\cdot {}^{H}_{28}{}^{H}_{29}$ = Density ·8279. Observed mean of 6 = 8235

2. ${}^{C}_{24}\cdot 7^{Hm}_{24}\cdot 2^{Hd}_{24}\cdot 2^{H}_{28}$ = " ·8125. " " " 6 = ·8161

3 ${}^{C}_{28}\cdot 7^{Hm}_{24}\cdot 2^{Hd}_{24}\cdot 2^{H}_{25}$ = " ·8333. " " " 2 = ·8385

4. ${}^{C}_{28}\ 7^{Hm}_{24}\ 2^{Hd}_{24}\cdot {}^{H}_{26}{}^{H}_{27}$ = " ·806 " (solid) 1 = ·8 75

${}^{C}_{32}\ 7^{Hm}_{24}\cdot 2^{Hd}_{24}\cdot 2^{H}_{25}$ = " ·7854 " (melted) 2 = 7849

Here the carbon varies through the series 20, 24, 28, 32, and in the last example it expands from 28 to 32 when the body changes from the solid to the liquid state.

Upon examining the above examples and those which are to follow, it will be observed that *there is a tendency to assume diameters divisible by four*. The second butyric alcohol is a perfect example. It must be remembered, however, that these and other volumic formulas are constructed to represent the *means* of all available density determinations of any given body There is every probability that there exists in every case an isomere whose density will lead to a perfectly normal formula in which all the diameters are multiples of four, while other specimens of the body exhibit only more or less perfect approximations. This probability has the support of hundreds upon hundreds of instances. We can only give a few to show the different phases of this tendency.

Where inorganic compounds are found with varying densities this variation is caused by the most positive or basylic constituent.

Sulphate of potash, $O_4\cdot {}^{S}_{24}\cdot 2^{K}_{23}$ = 2·888. Maximum observed D.= 2·88

" " " $O_4\ {}^{S}_{24}\ {}^{K}_{26}{}^{K}_{27}$ = 2·423. Minimum " D.= 2·407

The potassium alone varies, and the variation is here nearly 4 diameters. This is often the case between maxima and minima, while the intermediate isomeres differ by half or whole diameters. The densest carbon, diamond = ${}^{C}_{15}$ = 3·556, while the lightest, lampblack = ${}^{C}_{19}$ = 1·75; difference = 4 diameters. Again, we have.

Quartz, = $O_2\cdot {}^{Si}_{23}$ = 2·662. Observed density, 2·663

Lightest silica known = $O_2\cdot {}^{Si}_{27}$ = 1·83. " " 1·815

The latter is obtained by the ignition of opal.

When an electro-negative unites with different positives of the same group, the positives increase by 4 or 4*n* diameters.

Chloride of lithium, $2^{Cl}_{24}\ {}^{Li}_{19}\ {}^{Li}_{20}$ = 1·999. Observed D., 1·998

Chloride of sodium, $2^{Cl}_{24}\ {}^{Na}_{23}\ {}^{Na}_{24}$ = 2·181. " D., 2·172

Here the negative chlorine remains the same, while Na is greater by 4 diameters than Li.

When a positive unites with several negatives of the same group, the resulting series will show a variation of the positive through 4 or 4*n* diameters.

Chloride of sodium, $2^{Cl}_{24}\ {}^{Na}_{23}\ {}^{Na}_{24}$ = 2·181. Observed density, 2·172

Bromide of sodium, $2^{Br}_{24}\ {}^{Na}_{27}\ {}^{Na}_{28}$ = 2·973. " " 2·952

Changes from solidity to liquidity and from color to blackness are accompanied by variations of 4 or 4*n* diameters. Examples of organic bodies illustrating the first of these changes have already been given.

Tin chloride, solid = $2^{Cl}_{24}\ 2^{Hd}_{24}\ {}^{Sn}_{29}$ = 2·82. Observed D. = 2·76

" " fused = $2^{Cl}_{28}\cdot 2^{Hd}_{24}\cdot {}^{Sn}_{25}$ = 2·581. " " = 2·588

Elements uncombined change only through half or whole diameters instead of 4*n*:

Solid potassium = ${}^{K}_{35}\ {}^{K}_{36}$ = ·871. Observed D. = ·87

Melted " = ${}^{K}_{36}$ = ·836. " " = ·842

To illustrate the change from color to blackness, we have:

Cinnabar red cryst., $2^{S}_{24}\cdot {}^{Hg}_{24}\ {}^{Hg}_{25}$ = 8·127. Observed D. = 8·124

Meta-cinnabar black cryst., $2^{S}_{20}\cdot 2^{Hg}_{28}$ = 7·746. " " = 7·748

Such are, in brief, the results of this latest and most extensive of the researches into molecular volumes. It is not the writer's purpose at present to discuss the reasoning or the methods pursued by the different investigators, but simply to present for the first time their work and their views in a connected form, with the hope that a knowledge of the subject may thus be promoted among those who are sufficiently interested in theoretical chemistry to give it their careful attention.

C. F. K.

Is it Education or Accident?

Technical education supposes that a child must be educated for the sphere he is expected to occupy in life. Advocates of a purely technical education use frequently such phrases as "laboring classes," "station in life," "educated classes," "cultured society," "upper classes." Whether this is wise in republican America as in monarchical Europe remains to be seen. Experience has shown that it is exceedingly unwise to suppose that a certain boy is to make a Congressman, while another will peg boots. The issue usually shows that the young lawmaker makes a cobbler, while the predestinated bootmaker becomes a foreign minister. Some of our very best and most learned men were not intended by their parents to occupy very high stations in life. It is dangerous to "suppose" very much in reference to any boy, continues *Barnes' Educational Monthly*, in this enlightened age.

ENGINEERING INVENTIONS.

Mr. Joseph R. Winters, of Chambersburg, Pa, has patented in this country, also in England, Canada, France, Germany, and Belgium, an improved fire escape ladder and hose conductor, which may be easily raised to any required height within the limits of the capacity of the machine, and it may be inclined at any desired angle. It carries the hose up with it, and is arranged so that it may be used in lowering timid or infirm persons, or articles of furniture. The invention consists in a novel and ingenious arrangement of devices, which cannot be readily described without an engraving.

An improvement in the class of car couplings, whose engaging devices are pivoted hooks or draw bars, has been patented by Mr William W Scott, of Sumner, Iowa It consists in the employment of coupling hooks or draw bars, having pivoted heads to adapt them for engagement with bumpers having slotted heads, which are inclined, the object being to enable cars of different heights to be coupled

An improved car coupling, designed to obviate the necessity and its attendant danger of going between the cars, is the invention of Mr. Charles Ahrenbeck, of Navasota, Texas. The improvement consists in the particular means applied to an ordinary draw bar for holding and centering the ordinary form of link, and elevating the same so as to enter the opposite draw bar.

A coupling for cars that will automatically couple them at all times, whether the latch is up or down, and which is arranged so that the draught at no time falls upon the pin or pivot of the latch, but is borne directly by the draw head, has been patented by Mr. Patrick M. Bracelin, of Davenport, Iowa. This invention obviates the necessity of going between the cars either to uncouple or couple them.

Mr Robert Hay, of Mineral Point, Wis, has invented an improved draw bar, which consists of a frame adapted to be connected with the tender, and provided with a coupling bar carrying cross heads and a spiral spring within the frame, so that when drawn or pushed it is cushioned by the spring, and thus relieves the shock and strain on the engine

Messrs. Robert M. Pringle and William D. Robb, of Elizabethtown, Ky., have patented an improvement in safety valves, which consists in changing the form of valve in common use, so as to make it extremely sensitive to any variations in steam pressure, and so that the escaping steam shall assist in closing as well as in opening the valve, and in inclosing it in a case provided with a set screw and jam nut, in order to adjust and secure the valve at will.

Mr. Charles A. Mentry, of Newhall Station, Cal., has invented an expanding reamer for increasing the bore of oil and other deep wells, that can be let down through the tube and expanded when it reaches the proper point for the reaming to begin. It consists of a forked reamer incasing an expanding spring plunger projecting through its head, where it is provided with a needle controlled by a trigger, from which a halyard leads up to the surface.

An improvement in the class of coupling devices which consist of pivoted hooks, has been patented by Messrs Seth S. Watrous and William Gerber, of Fremont Center, Mich. The improvement consists in the combination of the two cams projecting in opposite directions, with the coupling hooks pivoted within the draw head on vertical pins, but in different horizontal planes, the cams being arranged in relation to the hooks, so that the latter may be spread when the cams are turned.

A Runaway Railway Wheel.

A most singular railroad accident lately occurred on the Erie Railway at Middletown, N. Y. The train known as the steamboat express, one of the fastest on the road, had just left the station and attained its full speed, when the forward wheel of the front truck of the locomotive became detached and started down the track by itself. Such was its impetus that it ran fully a hundred yards, then left the track and ran through the brick wall of Bunnell's lumber yard before it came to a standstill. The cause of the accident was a heated and worn out journal. Travel was delayed on the eastward bound track nearly four hours in consequence.

Foreign Fruit Trade of New York.

According to the annual report of the inspector of customs the value of the green fruit imported at this port during 1878 was as follows:

Varieties of fruit.	Per centum duty.	Value. Dollars.	Amount of duty. Dollars.
Oranges and lemons	20	2,802,966	560,593.20
Grapes	20	232,004	46,400.80
Pineapples	20	87,666	17,533.20
Bananas	10	395,619	39,561.90
Limes	10	3,564	356.40
Grapefruit, shaddocks, mangoes, plantains, watermelons, cantaloupe melons, and a few other varieties of green fruit not named	10	15,711	1,567.60
Cocoanuts	Free.	197,520	
Total, 1878		$3,735,050	$666,016.60
Total, 1877		$3,148,992	$564,140.30
Increase of value and duty for 1878		$586,058	$101,876 30

There was a large increase in the quantity of fruit imported from the West Indies, except in the case of oranges and pineapples. The falling off in pineapples is supposed to be due to the establishment of large canning factories in the West Indies. An extraordinary increase, amounting to two and a quarter millions, occurred in the importation of cocoanuts. Of Mediterranean fruit, the importations in 1878 were lightly in excess of those of the preceding year. Of grapes, the number of packages was largely in excess of those of any previous year, namely, 45,000 barrels and 12,000 half barrels. The pomegranates numbered 200 cases. The Mediterranean oranges and lemons number 1,254,802 boxes and cases. The average loss on oranges was 36 per centum, and on lemons 20 per centum.

From the West Indies, 12,942,675 oranges were imported, with an average loss of 45 per cent. Of bananas there were 560,837 bunches imported—an increase of 157,916 bunches over 1877. Twenty-three per cent of the 2,704,773 pineapples perished on the voyage. Nearly 10,000,000 cocoanuts were imported, with an average loss of 9 per cent.

Overland Boating.

The proposed construction of a ship railway across the Isthmus of Panama has called to mind the similar though smaller portage system formerly employed by the State of Pennsylvania. For many years the system was used in transporting canal-boats (built in sections) from the canal between Conemaugh (near Johnstown, Penn.) on the western side of the Allegheny Mountains, and Hollidaysburg on the eastern side. By this arrangement boats without breaking bulk were passed between Pittsburg and Philadelphia via Columbia. The portage of the mountains was made by means of inclined planes, at the top of which were stationary engines to draw up or let down the cars or trucks, using a heavy hemp rope running over pulleys between the rails to keep it from the ground. After reaching the top of the plane a small locomotive was used along the "levels," as they were called, until the next plane was reached. By this means transit was quick, and the expense of handling the cargo twice was avoided. After the construction of the Pennsylvania Railroad, and the introduction of locomotives that could draw loads up grades that years before were only capable of ascent by means of ropes and stationary engines, the old portage road of the State, becoming the property of the Pennsylvania Railroad Company by purchase, was abandoned; and now the traveler can see, as he is whirled along in a palace car, only the ruins of what was forty years ago one of the most wonderful public improvements of the age.

A similar system is still employed in New Jersey for changing canal-boats laden with coal from one canal system to another.

The Export Trade in Staves, Shooks, and Hoops.

"The great majority of the sugar and molasses hogsheads which are emptied of their contents in this city," says the Boston *Commercial Bulletin*, "find their way back to the West Indies again. The hogsheads are purchased from the refiners by an enterprising firm, who take them apart, clean the staves and bundle them up into shooks, and export them, together with their heads, to Cuba. This firm have one yard in South Boston in which they thus prepare 2,000 hogsheads per week for export. The export trade in new shooks to the West Indies is also an important one, these last selling at from $1 to $1.75, while the second-hand shooks bring but 50 to 75 cents. The stave trade of Boston is nearly all in the hands of one firm; and as more than $300,000 worth of cooperage stock of various kinds are exported, in addition to what is used in this vicinity, their business is a large one. The staves, which are so largely exported from Boston to the Mediterranean and to England, are white oak. Sugar barrels are also made from elm, and in New York are being made of a single piece, cut out for the purpose. The oak staves come from the West, largely from Michigan. Staves are usually exported in the rough or unfinished state, and range all the way from $60 to $150 per thousand for hogshead staves, and $80 to $200 per thousand for pipe staves."

Another Railway Bridge for Niagara River.

In 1849 the Lewiston Suspension Bridge Company and the Queenston Suspension Bridge Company were organized, the first on this side and the second on the Canada side of the Niagara River. They built a highway suspension bridge at Lewiston, and maintained it for some time. It blew over one day and was never repaired. The ruins of the structure still remain in the form of masonry on each side of the river, and one cable still suspended. The Oswego *Palladium* says that the Rome, Watertown and Ogdensburg and the Great Western (Canada) railway companies have bought the stock of the old companies above named and formed a company with $1,000,000 capital to build a bridge at Lewiston. The work will be begun immediately. The bridge will be one of the finest of the kind in the world. The river at the point to be crossed is 600 feet wide. The bridge will be a steel truss structure of one span, and will be a railroad and highway bridge. The object of the parties in interest is to accommodate the local trade of the Rome, Watertown and Ogdensburg road and that of Northern New England and the West.

Coupe Cars for London.

An order for fifty two-horse cars for use in South London, England, was recently completed by a firm of car builders in this city. The same company are now building for the same market a number of one-horse cars of the "bob-tail" pattern. In London they will be known as coupés. These cars are provided with pay boxes, have horse guards at the dashboard, and life guards in front of the wheels, and are hung on Mr. Stephenson's new method, which makes the riding easy. They are finished in hard woods, and the seats are upholstered in fancy carpets. American cars are preferred in England for their superior strength and lightness.