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Contents:

(Illustrated articles are marked with an asterisk.)

LAND AND WATER—ARE EARTHQUAKES LAND MAKERS?

A writer in a late number of *Chambers' Journal*, under the caption, "The Usefulness of Earthquakes," attempts the theory that these phenomena, combined with volcanic eruptions, are the means of repairing the waste made by the action of the sea on shores and of rainfall on interiors. He assumes that "*If* the solid substance of the earth formed a perfect sphere in ante-geologic times—that is in ages preceding those to which our present geologic studies extend—there can be no doubt that there was then no visible land above the surface of the water; the ocean must have formed a uniformly deep covering to the submerged surface of the solid globe. In this state of things, nothing but the earth's subterranean forces should tend to the production of continents and islands."

The *if* which we have italicized is the best reply to his doubtful assumption; there is no evidence that the earth was ever a perfect sphere; in fact, not only astronomy but geology witnesses the contrary. The earth is an oblate spheroid, and, so far as our means of ascertaining extends, was always of this form. If the earth was ever, for any geologic period, submerged with water, some evidences would have remained in every portion of its surface. By a "geologic period," we mean the duration of time between one great natural condition, as determined by geologists, and its successor; periods counted by a lapse of time compared to which our historical period is as the dust in the balance. Any one who carefully reads the records of geological investigation will see that the probabilities are strongly in favor of a condition of the earth's surface as regards protuberances and depressions—mountains and valleys, elevated plateaus and depressed plains, land and water—in ancient times very similar to that which now exists. To be sure, it is evident that portions, now dry land, formed once the bottom of seas, and mountains were but islands, but there is no reason for doubting that the present seas might have been dry land; our means for determining this fact, however, are meager compared with those afforded for an examination of dry land. We cannot traverse the ocean's bottom as we can the valleys of the habitable earth. It may be possible that a larger proportion of the earth's surface was once covered by water than at present; but while this opinion may be entertained, it is morally certain that where seas now roll their unobstructed waves dry land in many instances existed. Why could not the peninsula of Yucatan with Cuba, Hayti, Jamaica, and the group of Caribbean islands once have inclosed as an inland lake what is known now as the Caribbean Sea? And why not the peninsulas of Florida and Yucatan with western Cuba have similarly inclosed the Gulf of Mexico? So at the Straits of Dover, there is evidence, from recent soundings and examinations, that England and France were once physically united as they subsequently were politically.

The writer makes this statement: "At first sight it may seem paradoxical to assert that earthquakes, fearfully destructive as they have so often proved, are yet essentially preservative and restorative phenomena; yet this is strictly the case. Had no earthquakes taken place in old times, man would not now be living on the face of the earth; if no earthquakes were to take place in future, the term of man's existence would be limited within a range of time far less than that to which it seems likely, in all human probability, to be extended."

This *does* seem paradoxical, because, for every case of the permanent upheaval of barren rock by earthquakes there can be brought the record of permanent disappearance of fertile lands. Indeed, the destruction caused by earthquakes in the sinking or ingulfing of tracts of land and producing in their place lakes of noxious waters, or allowing the inroads of the sea has been so great and so much more frequent than the gift of solid land, that earthquakes are, the world over, and in all times, regarded with dread as the most destructive agent in nature. From the time that (as the "New England Primer," published in 1770, has it),

Proud Korah's troop
Was swallowed up,

down to the recent destruction of Arequipa and other cities on the western coast of South America, the earthquake has been a destroyer and not a restorer. From the disappearance of the island, Atlantis, mentioned by Plato in his *Timæus* to the recent reports of similar disappearances, the earthquake has diminished rather than increased the amount of habitable land.

IMPORTANCE OF ACCURACY IN THE USE OF MECHANICAL AND SCIENTIFIC TERMS.

The general employment of technical terms and phrases among scientists and mechanics, and the necessity for their use to avoid inconvenient paraphrases and involved sentences, make a thorough understanding and a discriminate use of these terms a duty to all who employ them. In our descriptions of machinery and processes we have always studiously avoided those terms, which, not being commonly used, were either generally unfamiliar or not self-defining. It may be that at times the article as published appeared to be too elementary in character, but it is better to use language understood by all than a *patois* intelligible to the initiated only. There are in use many technical terms, however, that of themselves are far more expressive than any phrase in common use, and these should be employed in preference to an explanatory sentence which reaches its point only by seeming to aim at another. In such cases the technicals are the proper terms. Many of them are not laid down in the dictionaries, and different ones are used in different sections of the country by men engaged in the same business; but some are so apparently demonstrative and in their sound so well convey the idea that they are always understood. For instance, if a smith speaks of a "suant" heat, every one knows at once that it means a soft, even heat, permeating the mass of iron—the very sound of the word conveying the idea. The "bite" of an acid or file, the "hang" of a hammer, the "rake" of a turning tool, and many others beside those which show their applicability by their derivation, are better than any phrase that is simply descriptive or definitive.

But all technical terms to be useful should be definite. Though a "stringer" may be a "beam," it does not follow that a beam is a stringer. A railroad "sleeper" may not be also a railroad "tie." A "bit" may be a plane iron or an instrument for boring wood. "Force" and "power" are not synonymous, neither are "weight" and "pressure." So we might go on indefinitely, and give examples of the indiscriminate and improper use of technical terms. We have a letter before us in which the writer, speaking of his steam boiler, uses the terms "fire surface" and "heating surface" as synonymous. Another speaks of the "force" of steam and the "pressure" of steam, also as synonymous or interchangeable terms. It is sometimes difficult, under such circumstances, to really understand what is meant. In such cases it would be better to use language of a less concise but more explanatory character.

Yet there is a pedantry affected by many in the use of technicals that is as annoying as it is pretentious. It is seen in the use of geometrical terms in defining well-known and familiar forms, and of algebraic formulas to state simple arithmetical problems. There are occasions when this is not only proper, but absolutely necessary for the defining of the subject. As to those who air their superficialties by a malapropos employment of all the technical terms they have been able to pick up, they do not deserve notice; such are beneath criticism and beyond improvement.

But even our professional teachers, the compilers of manuals designed to aid the beginner, are open to the charge of pedantry, and not unfrequently to that of writing about what it is evident they do not themselves understand. It would be unkind and harsh, perhaps, to refer by title to such works, but we have been several times much surprised to note the ingenuity of two, at least, of these authors in concealing their own ignorance while assuming to teach others. Nystrom, in his "Technological Education" says: "We frequently find most valuable formulas given by scientific men in such a shape that it requires to know more than the author in order to employ them; they are not only not trimmed to a practical shape, but even the meaning of letters is rarely explained in proper technical language."

We are convinced that the reason why our mechanics do not generally take kindly to scientific education applicable to their department, is not because of a dislike to the subject, but because of the needless obstructions in the way of ambiguous and involved statements that seem to be made or presented in a form purposely designed to annoy, or carelessly calculated to mislead.

HOLLOW vs. SOLID SHAFTING.

Hollow shafting, where large diameter is not objectionable, has long been in use, made generally of cast iron, and frequently used as a drum or continuous pulley for the reception of belts. Such a shaft was used in the "pistol shop" of Colt's factory before the destruction of the building by fire about four years ago, and a similar line may now be in use in the reconstructed building. This shaft was five hundred feet long and fifteen inches diameter, made of hollow cast-iron cylinders, connected with each other by a solid shaft or bearing at each end, resting in a box as a journal. The result was an almost continuous drum, of five hundred feet in length, from which belts led to the counter shafts of the machines, the speed of each machine being regulated by the diameter of the pulleys on the countershafts. We have heard also of wrought iron pipes of only two inches diameter being used as shafting successfully.

Tredgold says that a round tube whose internal and external diameters are as seven to ten, respectively, has twice the lateral strength of a solid cylinder containing the same amount of material. A cylinder (solid) of cast iron, five inches diameter, has a transverse strength of 21,104 pounds, while one of eight inches diameter, containing the same cross sectional area of metal, has a transverse strength of no less than 45,416 pounds.

These facts would seem to show plainly the possibility of reducing the weight, materially, of shafting without a diminution of its strength. The weight of shafting is a mass the inertia of which must be overcome by the driving power, and in some cases the amount of power, otherwise useful, that is thus absorbed, is not less than twenty per cent. If by the use of lighter shafting this could be reduced only five per cent, the saving would be worth an effort. Shafting must be of sufficient diameter to sustain the weight of pulleys and the strain of belts without springing, but if the requisite stiffness—resistance to torsion and springing—can be obtained by hollow shafts of much less weight, not only is money saved in the first cost (shafting being furnished by the pound), but the continual expense in the absorption of unnecessary power in driving the unnecessary weight would also be prevented. That hollow shafting of wrought iron can be made cheaply is sufficiently apparent when we examine specimens of pipe used for various purposes. And not only would the first cost be less, but the ease of handling, owing to reduction in weight, would lessen the cost of turning, etc. Such shafting could also be easily oiled from the inside which would seem to be the proper method.

THE WICKEDNESS OF WASTE—VALUE OF BONES.

If persons who carelessly and thoughtlessly throw away what they consider useless to themselves, understood the intrinsic value of these discarded trifles or this unpleasant rubbish, we are certain some little trouble would be taken to preserve and direct them to their real use. We will, from the thousand and one of these unconsidered trifles, select but one—bones—as a text for a few words in regard to their waste; and we will not refer even to their use in the arts as material for manufacture into various forms of use and beauty in which they reappear on our persons and in our dwellings, but confine our remarks to the value of bones as a fertilizing agent.

Let us see, first, of what bones are composed. Take ox bones, which comprise the larger part of household bone waste. Berzelius gives the following as the constituents of the dry bones:

Phosphate of lime with a little fluoride of calcium	57·35
Bone gelatin	33·30
Carbonate of lime	3·85
Phosphate of magnesia	2·05
Soda and common salt	3·45
	100·00

Every intelligent farmer knows that these are just the elements for combining with inorganic matter to make a fertile soil. It is, however, maintained by some that the nitrogen—contained in the gelatin—is not beneficial as a fertilizing element, from the fact that calcined bones deprived of their nitrogen, are still very valuable as a manure. But we believe that the nitrogenous element is really a valuable ingredient in fertilizers, for nitrate of soda, NaO, NO_5 is known to be a valuable fertilizer, and where found in natural beds as on the west coast of South America, it is exported for agricultural use as well as for the manufacture of nitric acid. The necessary amount of soda to form this combination exists in bones, and as the oxygen of the atmosphere readily combines with it, the objections against it as being unfit for fertilization do not seem to be tenable.

Prof. Johnston (than whom no better authority can be quoted) says that one hundred pounds of dry bone-dust add to the soil as much organic animal matter as three hundred or four hundred pounds of blood or flesh, and also, at the same time, two-thirds of their weight of inorganic matter—lime, magnesia, common salt, soda, phosphoric acid—all of which should be present in a fertile soil. From this it will be seen that even if the usefulness of bones was limited to their application to the soil, their value is sufficient to induce care in their saving and preparation. The superphosphate of lime so favorably known to our farmers is simply bones treated with one-third their weight of sulphuric acid and an equal quantity of water. The farmers of England understand the value of bones. Beside those gathered in their own country, they import them from the pampas of South America, the feeding and slaughtering grounds of millions of semi-wild cattle, and prepare them for their soil.

VEGETABLE OILS USED IN PAINTING.

There are two kinds of oils found in plants, called respectively *volatile*, or essential oils, and *fixed* oils. The former are those of which essences and extracts are made, and are called volatile because when exposed to the air they will, like ether or alcohol, entirely evaporate. The fixed oils, on the contrary, will not evaporate, hence their name. The latter are divided into two classes, *unctuous*, or *greasy* oils, and *siccative*, or *drying* oils. The drying oils are of great value in the arts, their principal application being in the art of painting. They are the vehicles for the distribution of colors over the surfaces of materials which it is desirable to ornament or to protect from the chemical action of external substances. Thus used they perform a two-fold office, as beside enabling the colors to be uniformly spread upon any surface, they form of themselves a protective coat owing to their siccative properties.

The sources of the siccative oils are numerous. They exist in the seeds of the order of plants, called by botanists Linaceae, commonly known as the flaxes. Of these a species is grown in the East Indies, and large quantities of the seed are imported to this country from that source. The plant is also largely cultivated in Ireland, Holland, America, and other places, not only for its fiber, but the seed. The oil obtained from flaxseed, commonly known as linseed oil, is an important and valuable article of commerce, and is sold in two states, called *raw* and *boiled*.

Beside the flaxes numerous other plants produce seeds containing siccative oils. Of these the hemp, poppy, sunflower, and many nut-bearing trees may be mentioned. Indeed good nut-oil, according to some authorities, possesses the siccative property to a greater extent than any other.

The fixed vegetable oils are either cold or hot expressed. The former are the best oils, but the latter are much used, as a better yield can be obtained by the use of heat, and consequently they are cheaper; while if too high a degree of heat is not used, their quality is not very seriously impaired.

In extracting these oils, the seeds are ground under heavy stone rollers, revolving upon an axis which passes through an upright shaft. As the outside of the rollers must travel faster than the sides nearer the upright shaft, a rubbing as well as crushing effect is obtained. The meal thus produced is subjected to enormous pressure, and the oil is squeezed out. This is the raw oil of commerce. The siccative property of this oil, as of all other drying oils, depends upon the effects of oxygen upon it. When exposed to the air, it absorbs oxygen and becomes resinous in its character. This is drying in one sense, but not, as is often supposed, drying by evaporation. The latter takes place when any substance parts with its liquid portions, or that which holds its solid ingredients in solution. Oils, on the contrary, dry by absorbing oxygen and combining with it to form resinous substances nearly allied to the well-known resin obtained from pine. Cold solidifies linseed oil, and most other drying oils. They therefore spread better in a warm temperature. The siccative property of linseed oil is increased by heating it with litharge. It was formerly thought that the increased drying property of linseed oil, when heated with litharge, depended solely upon its combination with the oxygen contained in that substance, and it would dry quicker when exposed to atmospheric action. But, according to Liebig, the principal use of the lead oxide is to precipitate the mucilaginous and albuminous matters contained in oils, which, when present, interfere with the action of oxygen.

Linseed oil is used not only in painting but in the manufacture of printers' ink, varnishes, oilcloths, etc. When adulterated with fish oil, the presence of the latter may be detected by rubbing a small quantity in the palm of the hand; the smell of the fish oil can then be detected. It is also used in the manufacture of linoleum, which is a combination of the oxidized oil with resinous gums and other substances, possessing the appearance and many properties of india-rubber. This substance can be vulcanized like rubber, and is applicable to very many purposes in the arts.

Many painters suppose that it is necessary to use "dryers" in paint, as litharge, dissolved usually in linseed oil by the aid of heat. It has, however, been demonstrated by Chevreul that these substances are not essential to make paint dry. He performed the following experiments:

Four oak strips were painted, each on one side, with a paint composed of white lead and linseed oil, and on the other side with a paint composed of white zinc and linseed oil. The strip No. 1 was exposed to the air to dry; No. 2 was put into a bottle of the capacity of two liters (3·52 pints) and closed; No. 3 was put into a similar bottle, containing dry oxygen gas; No. 4 was put into a similar bottle, containing dry carbonic acid gas. The results as to drying were examined after twenty-four hours, and again after 72 hours:

After twenty-four hours the lead paint on No. 1 was almost dry; the zinc paint had set, but was not dry. On No. 2, the lead paint was almost dry; the zinc paint had set, but was not dry. On No. 3, both the lead and the zinc paints were perfectly dry. On No. 4, both paints were still wet and fresh, and had undergone no change.

After seventy-two hours the paints on Nos. 1 and 2 were perfectly dry. The lead paint on No. 4 had almost set, but it had no adhesion to the wood, and could be easily removed by friction; the zinc paint had undergone no change, but stuck to the finger like fresh paint.

These paints contained none of the so-called dryers, yet when they came in contact with free oxygen they dried perfectly. But while it is thus shown that dryers are not absolutely essential, it is none the less true that their use greatly facilitates the setting and drying of paint, a very desirable thing under many circumstances.

Any admixture of non-drying, or unctuous oils, in the oils used for painting renders them "tacky" when spread upon any surface. A good test of their presence is, therefore, their behavior in this respect when their layers are exposed to the atmosphere or oxygen in a closed vessel.

It is the affinity which such oils possess for oxygen that renders them liable to take fire spontaneously when spread over the fibers of wool or cotton waste, by the heat resulting from the slow combustion which takes place under such circumstances. Even animal oils, similarly treated, are liable to spontaneous combustion.

BULLETIN OF THE NATIONAL ASSOCIATION OF WOOL MANUFACTURERS.

The first number of the above publication is received and contains much interesting and valuable information. It is distributed gratuitously among the members of the Association from the commencement of the year in which they are admitted. Whether it is to be obtained by outsiders upon the payment of a subscription price, or otherwise, does not appear, so far as we can see, from the number before us.

Among other interesting statistics we find it stated that the number of sets of machinery or series of cards—a set forming the unit for calculation in woolen machinery—employed in the United States, reported to the National Association of Wool Manufacturers, on the 25th of October, 1865, was 4,100. The estimated number in the United States, as all were not reported at that time, was 5,000. From a carefully prepared table we find that Massachusetts consumes more wool in her factories than any other four States in the Union, her weekly consumption being 857,496 pounds of scoured wool. Of this aggregate 560,396 pounds are domestic wool and the balance is of foreign production. Connecticut stands next to Massachusetts in her consumption of wool, using weekly 252,880 pounds of scoured wool. New York uses 236,510 pounds, and New Hampshire, 217,110 pounds. The total amount used weekly in the United States is, according to the table, 2,252,545 pounds. It will thus be seen that Massachusetts manufactures more than one-third of all the wool consumed in the woolen mills of this country. The smallest consumption of any given in this table, is that of Minnesota, which is only 1,200 pounds per week. Some of the States and Territories consuming little wool are not, however, reported; but they will not vary the statement to any noticeable extent. In New York there are 124 mills that have not been heard from. In Massachusetts 74 have not reported. In all the States there are 624 mills not reported, against 917 which have forwarded their statements. From this it will be seen that the large aggregate weekly consumption, as above stated, falls much below the reality. It is fair to suppose, however, that many of those not heard from are small establishments; but, granting that, the weekly consumption will not fall far below 3,000,000 pounds.

The value of the wool manufacture as given in the report of the United States Commissioner of Revenue, is $121,868,250·33.

The effect of the establishment of mills in California and Oregon has been greatly beneficial to the wool growers of those States; previous to their erection they were at the mercy of speculating monopolists from the Atlantic States. This is another illustration of the value of home markets.

Returns of woolen machinery constructed by the principal manufacturers of cards and jacks in the country show that *two thousand and eighty-six sets* have been made since January 1865. These facts show that the wool industry of the United States is already not only a large and important, but a vigorously growing one.

The *Bulletin* contains much other matter of interest to which we cannot at present allude. Communications should be addressed to John L. Hayes, Editor, and Secretary of the Association, 75 Sumner street, Boston, Mass.

CONSERVING OF FRUIT.

This may seem to the general reader a more inviting topic than the conservation of force, of which we are frequently called to speak. To our lady readers—for we are well aware there are plenty of them—who look weekly over our columns to find something to help them in their housekeeping duties, we are sure the topic will be interesting, although it may appear a little out of season to them. But they will remember when we put them in mind of it, that the putting up and conserving of fruit has got to be a business of very large proportions throughout the civilized world; and although the bulk of it is put up in the summer and autumn, it is eaten throughout the entire year. Nay, it may be eaten for several years after it is put up, provided proper pains are taken. It is quite possible that the advice we shall give, if followed, may save much loss in the value of fruit already put up, and stored for sale.

"Forewarned is forearmed" and to wait until the very time when information is wanted before attempting to obtain it, is something like death-bed repentance—mostly too late. We recently had something to say on the subject of confectionary, which has called forth considerable correspondence, asking for an extension of the subject so that it should embrace the conserving of fruit. In complying with this request, we shall first call attention to the chemical composition of fruits. To intelligently conserve anything, we should know what it is we wish to conserve.

In all organic substances, the chemical elements which are essential to their existence exist in a state of combination. Destructive distillation or destructive fermentation resolves these, either into their ultimate elements or transforms them into new compounds. Any of the different kinds of fermentations is the partial or entire decomposition of the natural combinations (proximate principles), and their recombination into other and distinct combinations, during which some portions of the proximate principles escape as gaseous products, while oxygen is taken up from the atmosphere or from other sources. The first step toward the total breaking up and destruction of any organic compound is some kind of fermentation. It follows, therefore, that if fermentation be prevented, the keeping of any organic substance for any length of time is possible.

The proximate principles of plants, including fruits, are divided into two classes, those which contain nitrogen and those which do not contain it.

The most important proximate principles not containing nitrogen are starch, gum, fructose or fruit sugar, glucose or grape sugar, pectose or vegetable jelly, cellulose or cellular tissue, lignine or wood substance found in the skins of fruits as well as their stems, and cane sugar, or the sugar in common use for confections and domestic purposes.

The important nitrogenized substances found in plants, are vegetable albumen vegetable casein and gluten. This class of proximate principles owing to the feeble affinities of nitrogen are, under favorable circumstances, particularly liable to decompose.

Starch is acted upon by acids, and converted into glucose (grape sugar). This takes place in the ripening of fruits, as is shown by their greater sweetness when ripe, and also in the mellowing of fruits after they are plucked, which is neither more nor less than partial decomposition. From this it may at once be concluded that fruits which have become mellow to any considerable extent, are more or less unfitted for conserves, as they are already partly decomposed. It does not follow, however, that they are unfitted for food after becoming mellow—as has been asserted by some—unless the mellowing has proceeded too far. When merely mellowed so as to become palatable, the partial decomposition is, in some respects, analogous to that produced by cooking, and renders the fruit more digestible and wholesome. This mellowing will take place in the process of conserving, and in the jars, also, sufficiently to render the fruit tender and palatable, unless the fruit be immature, which is an extreme, also, to be avoided. Gum, although included in the list of non-nitrogenized proximate principles, has but little to do with the subject. Fructose and glucose will be considered in connection with cane sugar. Pectose is an important substance in its relations to the conservation of fruits. It is the proximate principle which becomes jelly when the juices of fruits are boiled. It is insoluble in water, until its characters are changed by the acids contained in the fruits aided by heat, which converts it into pectine which is soluble. It contains the same elements as sugar, but in a very different proportion. By continued boiling it loses its glutinous consistency, an important point as will be seen further on. The so-called "candying" of conserved fruits consists partly in the crystallization of the sugar employed, and the formation of jelly on account of *over-boiling*

Cellulose is only important as it forms the walls of the cells which inclose the proximate principles, and also of its intimate association with the pectose above alluded to. Lignine (wood substance) forms a portion of the rinds or skins of fruits. It is insoluble in water and, as found in the rinds of fruits, has little effect upon their preservation except to protect the more unstable interior compounds from the action of atmospheric oxygen. But all fruits contain more or less air in their interior, which, in the process of conservation, ought to be expelled and replaced by the substance used as a conserving agent. To avoid a too protracted heating of fruits, which is frequently injurious, they should either be deprived of their skins or the latter should be punctured.

The sugars are the most important substances in this class. The elements of the sugars and their proportions by weight in the different sugars, are as follows:

	CARBON.	HYDROGEN.	OXYGEN.	WATER.
Cane Sugar..................	72	9	72	18
Grape Sugar (Glucose)....	72	12	96	18
Fruit Sugar (Fructose)....	72	12	96	00

As water is composed of one part by weight of hydrogen and eight parts of oxygen, it will be seen that only three elements are found in the sugars, and that the variations in their proportions are very slight. The natural change which cane and grape sugars first undergo when incipient decomposition sets in, is combination with water, they thus becoming transformed into grape sugar. Alcoholic fermentation then sets in, followed by the acetic and destructive fermentation and total decay. It is unnecessary, for our present purpose, to follow out the two latter fermentations, as when the alcoholic fermentation takes place the fruit, considered as a conserve, is already spoiled. It is true that the fermentation may be arrested by boiling, but the latter process so greatly deteriorates the appearance and flavor of the fruit that it is not too much to call it spoiled.

Albumen is particularly liable to decay, but as little of it occurs in the pulp of fruit, and that contained in the stems is coagulated by heat during the usual processes of conservation, it need not be considered here. The same is true of caseine and gluten, except the remark upon coagulation. Thus it will be seen that the chemistry of fruit conservation is chiefly confined to the non-nitrogenized substances contained in fruits.

Beside the proximate principles above enumerated, there are over two hundred distinct acids of vegetable origin which are isolated by chemists. But few of them, however, exist in a free state, they being for the most part combined with alkalies or vegetable alkaloids to form salts. Malic acid, which exists in the apple and its kindred fruits, citric acid which is found in lemons and kindred fruits, tartaric acid found in grapes in the form of tartar or bitartrate of potassa, oxalic acid, the acid of the sorrel and rhubarb, or "pie-plant," etc., may be mentioned. A minute description of them is unnecessary. They all contain the same elements as sugar, in different proportions, and their action upon starch is, as above described, to change it into grape sugar.

Having thus reviewed the principal substances found in fruits, let us next trace some of their more important reactions when decomposition takes place. First, the starch becomes more or less converted, first into dextrine, and subsequently into grape sugar which, being soluble, dissolves in the juice; thus the solid portions of the fruit become liquid and it becomes mellow. Vinous or alcoholic fermentation supervenes and the grape sugar is decomposed, alcohol being formed and carbonic acid being