low, the coarser part of what leaves the screen is reconveyed to the mill by an elevator for regrinding; that which is fine enough being first removed by the usual apparatus adopted in milling. A suction blower causes the air to draw strongly into the mill, thereby preventing the escape of dust.

The revolving heads, shown with the parts assembled in Fig. 3 and separated in Fig. 4, are each composed of two parts, one of which, A, a simple hard iron cylinder, called a bushing, is removable, and when worn can be easily taken out and replaced. As soon as the mill has been put in operation, a curious formation is made inside of the head of a conical, cup-like stone lining (Figs. 3 and 5), formed by the caking within the head of the material being ground. This lining is of the utmost importance, as it is a complete shield to these parts of the machine. With the exception of the edges of the bushings, the entire interior of the machine is completely protected from wear by the rock itself.

The elementary parts of the mill are clearly shown in Fig. 5. The end of each shaft carries a head holding a bushing that projects a little way into the case. Within each bushing is shown the hollow stone cone, formed by the packing of the rock. The hopper is filled with rocks that drop into the case between the heads. The arrows on the shafts indicate the direction of revolution of the two shafts. Immediately after starting, the stone cones form themselves, and become as hard as the rock itself. When these stone cones have been formed, it is apparent that the centrifugal force given by their revolution will hurl out all the rocks forced into them, in the general direction indicated by the arrows. The flying rocks are sure to collide with those moving in the opposite direction, as their journey is made through an atmosphere of the same material, for the mill is kept constantly filled. These collisions result in rapid and perfect crushing, and the rocks expend their force upon each other before reaching the iron work of the machine.

The iron screen is of very small diameter, and the ground rock is let out at once. This is a great economy, for to strike rock after it is once reduced to the fineness wanted is a serious waste of power, and, in metal-bearing rock, to leave a particle of free metal in a machine to be churned and pounded over and again many times, and worn away, would be often to suffer a great loss.

These mills are manufactured by the Sturtevant Mill Company, of 89 Mason Building, Boston, Mass. They are made in six sizes, with heads from 4 to 36 inches in diameter.

Some idea of their capacity may be obtained from the fact that the 20 inch mill will discharge from sixteen to twenty tons of hard rock per hour, and the 36 inch mill will reduce 1,500 tons of hard rock per day.

These giant grinders are of small size, and all of the power transmitted by the belts acts directly upon the rocks reducing each other.

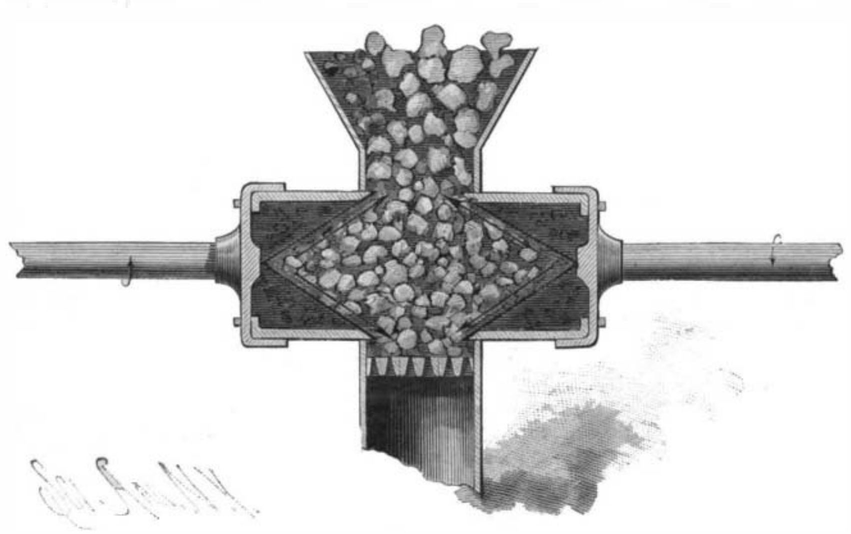
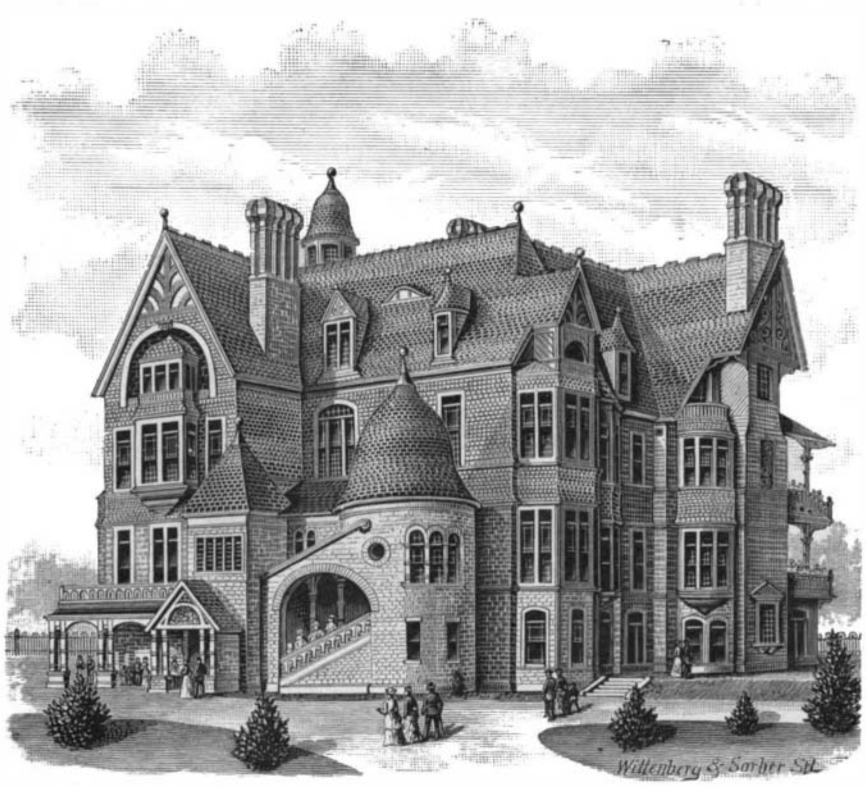


Fig. 5.—ELEMENTARY PARTS OF THE STURTEVANT MILL.

The Inventor of the Postage Stamp System.

Mr. Patrick Chalmers, of Wimbledon, has issued a pamphlet claiming that his father, James Chalmers, bookseller, Dundee, was the inventor, in the month of August, 1834, of the adhesive postage stamp. It appears that evidence has come to light, from papers bequeathed to the South Kensington Museum Library by the late Sir Henry Cole, of the original plan by James Chalmers of the adhesive postage stamp, to be printed from a die of various values, for use according to weight of letters, on sheets of paper specially prepared for the purpose and afterward gummed over with an adhesive substance, to be sold in sheets, in lesser quantities, or singly, as required, at post offices or by stationers—all as subsequently adopted by Mr. Rowland Hill, and in use to this day.

Mr. Chalmers makes out a case that is practically impregnable.



ST. LOUIS JOCKEY CLUB—SOUTHEAST VIEW OF CLUB HOUSE.

NEW CLUB HOUSE OF THE ST. LOUIS JOCKEY CLUB.*

The three illustrations herewith bring at once before the mind a good idea of the general plan and principal details of a new club house now being erected by the St. Louis Jockey Club, which it is expected will cost $50,000. Externally, the outline of the building, as presented in the view from the southeast, is broken into many projections—towers, gables, galleries, and porches being combined in such way as to present a most attractive appearance; but on the opposite side, that which looks toward the race course, there are to be two lines of galleries, 16 feet wide, running the entire length of the building, the ends shown at the right in the first engraving indicating their position.

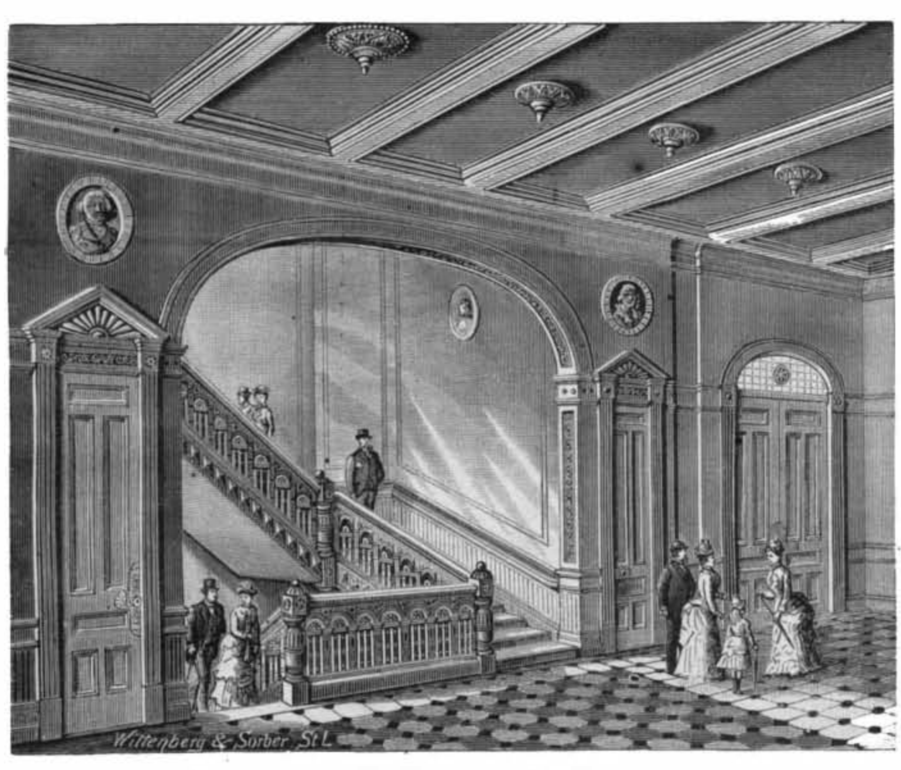
The second line of balcony and porch will have its floor stepped from the face of the porch back to the wall of the building, as with a grand stand, to give the occupants a better view of the races. The interior of the edifice will be handsomely finished and tastily furnished, after the designs shown in the engravings, for the use of members of the association and their families. Bowling alleys, a billiard room, and gymnasium are to be included in the arrangement.

The floors will be of polished yellow pine and the basement and first and second stories will be finished in hard wood. The walls of the ladies' reception room are rough cast and to be finished with gold bronze. The second story is to be devoted to private parlors and dining rooms. The main hall has the principal staircase recessed in it, inclosed by arches and lighted by a skylight.

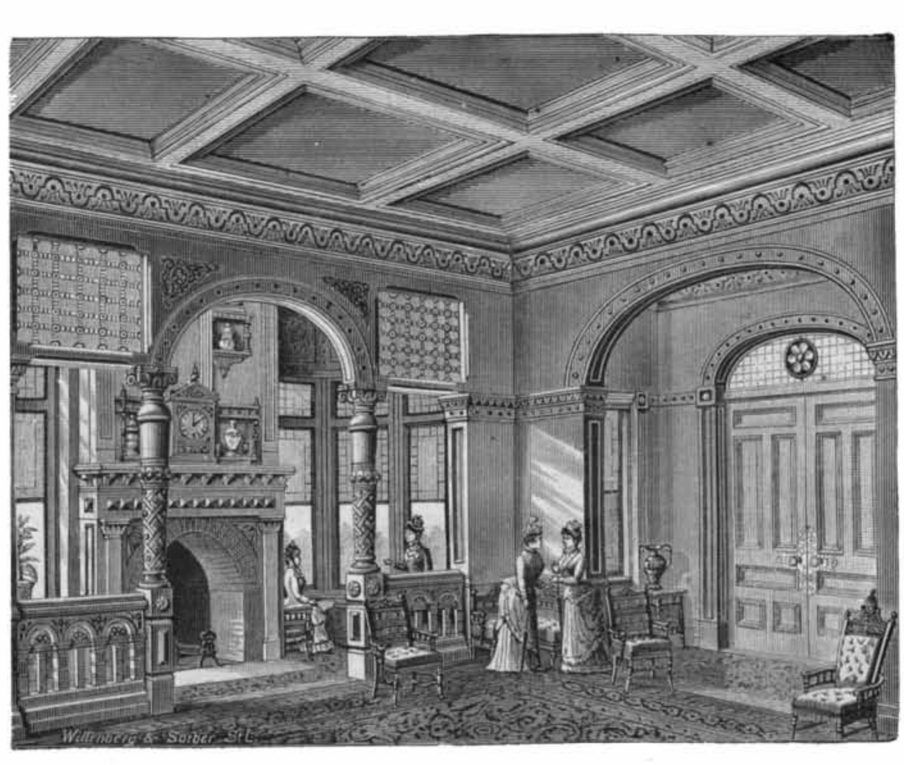
Manufacturers Must be on the Alert.

The manufacturer who hopes to hold his own in the fierce competition which characterizes modern industry must of necessity keep a sharp lookout for valuable improvements in machinery, and must introduce them promptly when they are presented. The movement of the industries is always forward. Thousands of ingenious minds are continually studying out methods for making processes easier and more economical. Every month some kind of a device for bettering the way of doing a thing, or for saving a little labor, is patented. The manufacturer who simply ignores these things and runs along heedlessly in the old way, with the old devices, will be left behind and beaten as surely as the earth rolls around the sun. A mill built and filled with machinery twenty years ago, and left unimproved, could not begin to compete with a modern mill containing all the new mechanical improvements. And the way to keep a mill property from deteriorating is to add in every important improvement as is it put on the market. The most successful mills are the mills that do this very thing; and they succeed because they do it.—*Textile Record.*

* We are indebted for our illustrations on this page to the *Illustrated Graphic News*, of Chicago, a recently established pictorial weekly newspaper, which presents many interesting features, and will obtain, without doubt, a large circulation in the West.



THE MAIN HALL AND STAIRWAY.



LADIES' PARLOR.

A Cheap Concrete.

A kind of concrete made without cement is said to be coming into favor with Parisian architects. It is composed of 8 parts of sand, gravel, and pebbles, 1 part of burnt and powdered common earth, 1 part of pulverized clinkers and cinders, and 1½ parts of unslaked hydraulic lime. These materials are thoroughly incorporated while dry into a homogeneous mixture, which is then wetted up and well beaten. The result of this is a hard and solid mass, which sets almost immediately, becoming exceedingly strong after a few days. It may be made still stronger by the addition of a small proportion—say 1 part—of cement. Among other constructions to which this material has been appplied is named as an example a house 65 feet by 45 feet, three stories high, standing on a terrace which has a retaining wall 200 feet long and 20 feet high. Every part of this structure was made of the hard, economical concrete, including foundations, cellar vaulting, retaining wall, and all exterior and internal walls, together with their cornices, mouldings, string courses, balustrades, and parapets. No bond iron was used in the walls, and no wood lintels, beams, or posts were required. It is claimed for this material that it is not liable to crack or scale, and is extremely cheap, as it can be made almost wholly from materials to be found everywhere. Doubtless a further economy could be realized by employing simple machinery for mixing the materials in both the dry and wet stages.

Properties of Fluids and Solid Metals.

Professor W. C. Roberts-Austen, F.R.S., Chemist of the Mint, lectured recently at the Royal Institution upon "Certain Properties Common to Fluids and Solid Metals."

He began by drawing attention to the early memoir of Reaumur to the French Academy of Sciences on the ductility and malleability of metals, in which he clearly defined the conditions under which colloid metals would actually flow. The resemblances, said the speaker, between metals and fluids have long been known, and present the following eight prominent points: 1. Rejection of impurities on solidification. 2. Surfusion. 3. Flow under pressure. 4. Changes due to compression. 5. Absorption of gases. 6. Absorption of liquids. 7. Vaporization. 8. Surface tension.

In passing from the solid to the liquid state, the metals sometimes present the same phenomena as water; for instance, water distinctly rejects impurity to a considerable extent when it solidifies into ice; an alloy of lead, antimony, and copper on solidifying will reject much of the lead, and take up the remainder. Water may be cooled down to —8 degrees without actual solidification, but agitation then determines the immediate formation of ice, and the rising of the temperature of the mass to zero is indicated by a thermometer. Faraday stated that sulphur and phosphorus exhibit in their degree the same effects. The master of the Netherlands Mint has proved that gold and silver behave in just the same way. The lecturer here placed a small cup filled with molten gold upon the table in the dark; the metal cooled to dull red, scarcely visible, then at the moment of solidification flashed up brightly, and rose to the temperature of its solidifying point. Gold fuses at 1,020 degrees, but the slightest trace of silicon will lower the point at which it softens to the melting point of zinc.

In 1726 it was discovered by Louis Lemery that under certain conditions lead exhibits a remarkable property. It is common experience that a spurious silver coin has no "ring," and when a metal is not sonorous, the remark is sometimes made, "It is as dull as lead." In an ancient and perhaps now generally forgotten experiment, it was discovered that if lead be cast into the form of a segment of a sphere, that is to say, into the form of a plano-convex lens, it will emit quite a sharp note when struck. The speaker illustrated this by experiment, the lead giving a clear tinkling sound. A piece of lead beaten into the same shape with a hammer gave no ring when struck. It was true, he said, that the presence of a trace of impurity conduced to the sonorousness of the cast lead, but he would now strike a piece of chemically pure cast lead, and they would hear that it was sufficiently sonorous to illustrate his point. The conclusion in 1726 was that the phenomenon was due to the way in which the constituent grains of lead touch each other, also to their shape and size. In the recent discoveries on dilatation by Professor Osborne Reynolds, there seemed to be something of the same kind; in the case of the lead there was a true flow, and a passage of small particles of matter from one position to another under the hammer. A solid may be very brittle, and yet it will flow; a horizontal stick of sealing wax, supported only at its two ends, will in course of time bend at the normal temperature of the atmosphere, in which phenomenon there is a slow flow of particles; yet let an attempt be made to similarly bend the same stick of wax suddenly, it will snap. M. Tresca, of Paris, by bringing great pressure to bear upon disks of cold lead, forced the lead to flow through a small hole, from which it emerged with a rounded end; when a segment of the issuing jet was cut, the lines of flow could be seen. In the pressing of iron and steel there are lines of flow. Mr. Roberts-Austen illustrated this by means of a crosshead sent to him by Mr. Webb, of the Crewe Works. The lines were made visible by etching. Ruskin had once made the remark that as men stamped the cow upon the butter, why not stamp the bee upon the honey? It simply was not practicable, because honey flows at the normal temperature. The lecturer continued that the most important application in industry with which he was acquainted, connected with the flow of metals under pressure, was suggested by Mr. Baker for the preparation of the steel for the Forth Bridge. He then illustrated the flow of pewter, by pressing a disk of it in a lathe, and showed how Sir Henry Bessemer had made cold-spun ornamental articles from disks of mild steel, 11 inches in diameter. On applying tension, he said, to steel or iron, the metal will extend to a certain point, then there is a permanent set, after which it will begin to flow, and continue to flow until it breaks. Standard gold will do the same, but the presence of a "trace" of lead will prevent the "flow" entirely.

Professor Roberts-Austen next drew attention to the experiments of Professor Walter Spring, of Liege, in the submission of cold and powdered metals to immense presssure. The apparatus (which was shown) used consisted of a ponderous lever press, with heavy weights at the end farthest from the fulcrum, as well as the means of applying screw pressure. The little piston which gave the pressure to the powder passed through a gun metal cap, which had a tap wherewith it was connected to an air pump, so that the air was withdrawn from the interstices of the metallic grains. In 1882 he (Mr. Roberts-Austen) had repeated and verified M. Spring's experiments and results, some of which are set forth in the following table:

Results obtained by M. W. Spring by the Compression of Finely Divided Metals.

Lead	welds at a	pressure of	13	tons	per square inch.
Zinc	"	"	19	"	"
Tin	"	"	32	"	"
Antimony	"	"	38	"	"
Aluminum	"	"	38	"	"
Bismuth	"	"	38	"	"
Copper	"	"	38	"	"
Lead flows at		"	33	"	"
Tin "		"	47	"	"

When more pressure than fifty tons to the inch is given by the machine, the metals submitted to its action begin to flow through the fine cracks of the compressing chamber, just as if the metals were so much treacle; for instance, when tin filings are made perfectly clean, the interstitial air removed, and then submitted to pressure, they form a solid little cylinder with wings where the metal has streamed into the cracks, as exemplified by the result which he then exhibited. He also exhibited a wire of lead which had been pressed into that form from fine powder, which wire had a breaking strain very little less than if it had been formed by a melting process. M. Spring has proved that it is possible to press powdered crystalline metals into masses of another crystalline structure, just the same as by fusion; also, that it is possible to actually build up alloys by pressure. Were the old alchemists, then, right in the idea that bodies never combine except when in solution? Experiment proved that solution is not necessary. Chloride of mercury and iodide of potassium are both anhydrous salts. He would triturate them together by means of a mortar and pestle, and they would see that a red colored iodide of mercury would be produced. The lecturer then took a little pressed bar, made originally from a mixture of powdered tin, bismuth, cadmium, and lead, in suitable proportions, and proved by experiment that those metals had been compressed into a true alloy, which would melt below the temperature of 100 degrees, or far lower than the melting point of the most fusible constituent of the alloy. He applied the heat by means of melted paraffine, since the bubbles in boiling water would not have permitted a clear image of the experiment to be projected upon the screen by the electric lantern. It may be argued, he said, that the heat of the compression of the metals sets up incipient fusion. M. Spring had pointed out that the pressure was applied with extreme slowness, and that if all the work were translated into heat, that heat would not be sufficient to account for the result. M. Spring had also by direct experiment given evidence that the heat was below 28 degrees, and he had asked, Is the union of the metals due to regelation? Faraday discovered in 1850 the regelation of ice, which had enabled Dr. Tyndall to render splendid service to science by furnishing the key to the explanation of the nature of the movements of vast masses of ice, for glaciers owe their motion, not to viscosity, but to regelation. Bismuth is a metal which exhibits the phenomenon of regelation. It is difficult to believe, said M. Spring, that ice alone possesses the property of regelation; give other bodies the same relative conditions—give them the necessary pressure, temperatures, and times, will not the same results be evolved? The grains of powdered nitrate of soda or phosphate of soda in a bottle will slowly unite. May there not, however, said the lecturer, be in the compression of gases an analogy to the liquefaction of gases? In gases the molecules are free, but by pressure they are condensed into liquid form by being brought into spheres of mutual action, and metal, by being powdered, may be said to be coarsely gasified. He regretted that the time allotted for lectures would not permit him to enter into all the particulars he desired to give, but he would add that metals, like liquids, could not only be vaporized, and would absorb gases, but exhibited something like surface tension. He here took a thick horizontal wire of an alloy of gold and silver, resting upon its two ends, and merely touched its center with a soluble chloride; after the lapse of a minute or two the surfaces of the thick wire cracked, and in such a manner as to suggest surface tension. Mr. Fletcher, he said, had first pointed this out to him. Professor Roberts-Austen then concluded by pointing to the influence of the facts they had considered on art, on science, and on industry.

How to Avoid Premature Old Age.

The following good advice is given by Dr. Benjamin Ward Richardson: The rules for the prevention of senile disease are all personal. They should begin in youth. It should be a rule among grown-up persons never to subject children to mental shocks and unnecessary griefs. When, in the surrounding of the child life, some grave calamity has occurred, it is best to make the event as light as possible to the child, and certainly to avoid thrilling it with sights and details which stir it to the utmost, and in the end only leave upon the mind and heart incurable wounds and oppressions. Children should never be taken to funerals, nor to sights that cause a sense of fear and dread combined with great grief, nor to sights which call forth pain and agony in man or in the lower animals.

To avoid premature old age in mature life, the following are important points to remember:

Grief anticipates age. Dwelling on the inevitable past, forming vain hypotheses as to what might have been if this or that had or had not been, acquiring a craze for recounting what has occurred—these acts do more harm to future health and effort than many things connected with real calamity. Occupation and new pursuits are the best preventives for mental shock and bereavement.

Hate anticipates age. Hate keeps the heart always at full tension. It gives rise to oppression of the brain and senses. It confuses the whole man. It robs the stomach of nervous power, and, digestion being impaired, the failure of life begins at once. Those, therefore, who are born with this passion—and a good many, I fear, are—should give it up.

Jealousy anticipates age. The facial expression of jealousy is old age, in however young a face it may be cast. Jealousy preys upon and kills the heart. So, jealous men are not only unhappy, but broken hearted, and live short lives. I have never known a man of jealous nature live anything like a long life or a useful life. The prevention of jealousy is diversion of mind toward useful and unselfish work.

Unchastity anticipates age. Everything that interferes with chastity favors vital deterioration, while the grosser departures from chastity, leading to specific and hereditary disease, are certain causes of organic degeneration and premature old age. Thus chastity is preventive of senile decay.

Intemperance anticipates age. The more the social causes of mental and physical organic diseases are investigated, the more closely the origin of degenerative organic changes leading to premature deterioration and decay are questioned, the more closely does it come out that intemperance, often not suspected by the person himself who is implicated in it, so subtile is its influence, is at the root of the evil.

When old age has really commenced, its march toward final decay is best delayed by attention to those rules of conservation by which life is sustained with the least friction and the least waste.

The prime rules for this purpose are:

To subsist on light but nutritious diet, with milk as the standard food, but varied according to season.

To take food, in moderate quantity, four times in the day, including a light meal before going to bed.

To clothe warmly but lightly, so as that the body may, in all seasons, maintain its equal temperature.

To keep the body in fair exercise, and the mind active and cheerful.

To maintain an interest in what is going on in the world, and to take part in reasonable labors and pleasures, as though old age were not present.

To take plenty of sleep during sleeping hours. To spend nine hours in bed at the least, and to take care during cold weather that the temperature of the bedroom is maintained at 60° Fah.

To avoid passion, excitement, luxury.