edition of our widely-known instruction book. It will contain the new patent laws, with full directions for those who wish to avail themselves of its benefits. We shall be happy to forward copies of this book *gratis* to all who will send us their names with the stamps to pay the postage—four cents.

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HOW MERCURIAL THERMOMETERS ARE MADE.

The word thermometer,as everybody knows,of course,means "heat measurer," and yet the word, in its etymological signification, conveys what is, or, at least, may be, an erroneous notion of the actual results obtained by means of this useful and interesting little instrument. That heat should be accurately measured, implies that we should be able to start from zero, or no heat. The zero upon our ordinary Fahrenheit thermometers is only thirty-two degrees below the freezing point of water, and this temperature,as is demonstrated by the use of instruments capable of indicating a relatively very low degree,is still as evidently heat,and a good deal of heat,though not so much as that of our scorching July days. We have no more authority for saying that the lowest degree registered closely approaches the lowest, in the nature of things possible, than we have for asserting, that the highest degree attained or measured is the highest degree possible. All that the thermometer does, is, assuming that the cause is proportional to the effect, to indicate by a regularly adjusted scale, the expansion and contraction of a certain substance—for instance, alcohol or mercury—and from this expansion and contraction, we infer that the cause or condition of it—that is,the increase or decrease of heat is proportional to the result. It would not be erroneous to say, that the thermometer measures the relative increase or decrease of temperature, but it does not, and can not, measure heat itself. Yet the uses of the instrument are as various and beneficial as if heat were as absolutely measured, as we can measure the pressure of the air by the barometer, or the specific gravities of liquids by means of the hydrometer. All results,dependent exclusively upon heat, will be uniform, for the same degree of heat, and, using this law, we can reason from one result to another, the results, of course, having been first obtained by experiment, and registered for use.

As an illustration, having once discovered and noted the fact, that water boils in the open air when the mercury of a thermometer, immersed in it, has expanded to the point of 212° on the scale, we may always count on the concomitance of these results, the boiling of water, and the registered expansion of the mercury, except under the following circumstances, which, so far as we know, have yet received no explanation. After a thermometer has been exposed for some weeks to the ordinary temperature of the air, if it be suddenly exposed to the temperature of boiling water, its freezing point will often be found to have lowered from one to two degrees. This has been observed in some of the standard thermometers of the Royal Society, London, and by various experimenters. It is sometimes two or three weeks before the freezing point corresponds again with that on the scale.

The determination of the temperature at which different physical results take place is of incalculable advantage to science and the arts, notwithstanding what has already been said, that the thermometer really does not measure heat at all.

It is not intended to discuss here, however, either the history, theory, or uses of the thermometer. Our object is to describe the manufacture of the instrument, the indications of which have so much to do with our physical comfort or discomfort, and which are so important to nearly all processes in the arts.

A mercurial thermometer is a very simple instrument. A small glass tube, with a bulb at one end, containing mercury, and a graduated scale, constitute all that is essential to it, yet in this, as in many other cases, simplicity begets difficulty. To make this simple combination perform its duty accurately, is by no means an easy matter. The first difficulty met with, is the want of uniformity in the diameters of the bores of different tubes,and the varying size of the bore in almost every tube. It is scarcely possible ever to find one the caliber of which is the same throughout its length, and,if so found,it is the result of pure accident. It is obvious, therefore, that unless some means of eliminating the errors which would arise from this source, be adopted, nothing like accuracy can be expected in the indications of the instrument. As the character of the bore cannot be altered, the desired result must be obtained in another way.

The method employed to obviate this difficulty is called "calibration." Tubes are selected tolerably free from imperfections,and a column of mercury,of one inch or less in length is introduced into it. The tube is then attached to the frame of a dividing engine, and put in connection with flexible rubber bags, to which pressure is applied, and regulated by screws. The air pressure in one bag being reduced, while it is increased in the other, the mercury column may be forced to and held at any part of the tube.

The mercury being thus brought to the portion of the tube where the graduation is proposed to commence,the exact position of one end of the column is marked upon the tube, a microscope with cross wires being employed to aid the eye of the operator in performing the operation with exactness. By means of the rubber bags, the mercury is again forced along until the end of the column, where the first mark is made, is brought under the microscope cross wires, placed at the other end, and so on throughout the entire length intended to be graduated. The varying lengths of the column which are accurately measured in the different positions are recorded,and indicate the variations in the caliber of the tubes. A permanent mark is made at the end, as at the beginning of the calibration.

It will be seen, that if the spaces successively occupied by the mercury be divided into an equal number of equal parts, anyone of these parts will indicate a corresponding increase of volume, although the bore of the tube may vary in its diameter.

The required dimensions of the bulb are found, aproximately, by weighing a measured length of the mercurial column, and computing the capacity of the bulb from the known expansion of mercury and its specific gravity.

The bulb may be formed upon the tube previous to the calibration, or afterwards attached. In the former case, however, the thermometers have their scale divided after the determination of the freezing and boiling points, and no tubes can be used except such as are found to be approximately perfect. In the latter case, the arbitrary scale, as marked from the calibration, may be reduced after the determination of the freezing and boiling points into the Fahrenheit scale, by the application of a simple algebraic formula.

The freezing point is determined by placing the bulb in finely pounded ice, from which the water is drained away as it melts. The boiling point is obtained by placing the bulb in steam having the same elasticity as the atmosphere, a peculiar apparatus, devised by Regnault, being generally employed for the purpose.

In putting in the mercury, a small reservoir of paper or glass is fixed upon the upper end of the tube. Heat is then applied to the bulb, which, driving out the air through the mercury, the latter, as soon as the bulb is allowed to cool, descends through the tube, being forced by the pressure of the external atmosphere. The upper end of the tube is then heated and drawn out, ready to be sealed hermetically. The mercury is then boiled in the bulb, to expel all trace of air, and, while it is in a state of ebullition, the tube is sealed by directing the flame of a blowpipe against the upper end,which fuses the glass and closes the aperture.

The reader must not imagine that all the manipulations we have described are performed on all thermometers in a perfect and accurate manner. A very large majority of these instruments, in common use, are entirely worthless for any scientific investigation, although they furnish, perhaps, sufficiently accurate indications for the regulation of the temperature of apartments, and for other ordinary purposes.

IS THE KNOWLEDGE OF ENGLISH GRAMMAR NECESSARY TO THE WRITING OF GOOD ENGLISH?

A correspondent writes us that the practical working men of this country need a practical grammar in order to enable them to attain that facility and accuracy of expression, essential to a lucid communication of their ideas. The present works upon the subject, he thinks, are overburdened with rules, observations, and quotations, and are not adapted to the use of such as wish to learn to write and speak correctly in the shortest possible time, and without the aid of a living teacher.

As this bugbear of grammar is, we know, preventing many valuable ideas and suggestions from receiving the publicity they deserve, we propose to devote a brief space to its demolition.

First, then, we say that the use of correct and forcible language, either in writing or speaking, is purely a matter of habit. No one in writing can afford to stop and apply grammatical rules to every word and phrase he employs, and no writer does this. If he had these rules all at his tongue's end, they would not enable him to use good language, unless good language is the daily habit of his life. Many of these rules are of extremely doubtful character, so far as the English language is concerned, and more are so loaded down with exceptions that they are practically useful only to critics in defining and pointing out errors of style and construction in such literary productions as depend for their merit more upon their style than anything else. The use of good language cannot be put on and off like a coat. He who accustoms himself to loose forms of expression to-day will to-morrow speak loosely when he perhaps desires to be accurate.

Many of our most able writers and speakers know little or nothing of grammar as a science, and one of the most forcible writers among the contributors to our present magazine literature has recently written a series of articles for the *Galaxy*, in which he has sought to prove that most of the definitions and so-called rules of English grammar are shams; even going so far as to entitle one of his articles "The Grammarless Tongue," meaning by the expression, grammarless tongue, our vernacular. It must be confessed, too, that he made out a pretty strong case.

If, then, the use of good English is not to be learned from "English grammars," how is it to be learned? We answer, by familiarizing ourselves with good language, by studying the meaning and derivation of words, by the habitual reading of such authors as are accepted authorities in the use of language, and whose writings have established its usage. This will not avail, however, if an attempt is not made to shake off bad habits, and acquire good ones.

But it is not necessary to possess the most happy style of expression to communicate important facts. An old professor used to remark that most people of moderate education can write and speak forcibly if they *have something to say*, meaning that they must possess some complete idea, well thought out, before they attempt to utter it. A man having an idea thus mentally wrought out, may misplace capitals and misspell words, but he can scarcely fail to make himself understood; for his thinking has been done in language, and the natural expression of the idea must be nearly or quite as clear as his thinking. But if he try to assume an artificial style quite foreign to that which he is accustomed to use, ten to one he will fail to make himself understood.

We trust no correspondent or reader will hesitate to communicate anything he deems of value to us for fear of making grammatical or orthographical errors. Let the aim be merely to express the ideas clearly, and we will be responsible for all the rest.

DEPRECIATION OF AMERICAN VITALITY.

Dear reader, during this terribly exhausting devitalizing weather, we have steadily kept to a pre-adopted resolution that we would leave the discussion of the "heated term" entirely to the dailies and health journals; and, although the above heading might at first sight lead to the belief that our stock of subjects is so far exhausted that we are compelled to resort to a rehearsal of the oft-repeated platitudes which annually appear at this season, about the heat, and the dust, and the way to avoid sun-stroke, and how to keep cool, and how to get a good sleep in hot weather, etc., etc.; we assure you that we have something more weighty to discuss.

We Americans are charged with a "decrease in vitality;" not at this particular season, but in general. We plead "not guilty to the charge."

What is the evidence of our decreasing vitality? The report of a life insurance company, which shows that out of forty-four deaths occurring during the past year among its insured, eighteen had been insured only three years.

This a cotemporary takes as ample evidence of the decrease of "American vitality," and gives us a column-and-a-half homily upon our sins of omission and commission, which in its opinion are fast bringing the nation into a state of physical degradation.

In defense of our plea, we call attention to the following facts. First, that the present competition among life insurance companies, and the methods in which many of them transact business, are such that we wonder the proportion of deaths occurring among their insured is not greater than it is. Second, the fact that we, as a people, bear and endure more than formerly, is an evidence of increasing rather than decreasing vitality.

Only consider for a moment the burdens of dress which our increasing civilization imposes. Think of the bunion-breeding boots, the chest-compressing corsets, the fashionable, black silk, headachy hats for males, and the almost entire absence of hat for females. Think of the horrible heaps of hair bundled upon the heads of our women, and the merciless exposure of the necks and legs of American children.

Think of the indiscriminate way in which we bolt our food at all hours, and how that food is adulterated, and how abominably it is cooked. Think of the gallons of tepid enervating drinks we swallow, and the annual consumption of alcohol and tobacco.

Think of the system of tasking and cramming from books, which we call education, and how our daughters graduating at eighteen from seminaries of learning, are expected to have mastered, or done their best to master, all the dead and living languages, the sciences, literature, and metaphysics.

Think of what frightful drafts upon the hours of natural rest are made by the balls, routs, and parties of fashionable society.

Think of how our young men plunge either up to the neck in dissipation, or rush without stint into business in the mad race for riches.

Think of how all this rush and bustle, this highly seasoned mental and bodily food feeds the passions, and begets a craving for the excitement which in turn, instead of satisfying, feeds the craving.

Think of our swift journeys by land and sea. Think how the telegraph brings all countries near, and how events, the news of which thirty years since would have scarce reached us in months, are now retailed by the news mongers next morning before we get down to breakfast, demanding increased activity of brain, and keeping the mind constantly at work.

It is safe to say that an average American of to-day lives more in one year than he could have done in ten, a half century ago.

And yet he stands it pretty well. To be sure, his nerves are rather sensitive, and he finds it hard to sit still. You will nearly always see him dancing his cane, or drumming on the table, twitching his legs, whistling, or humming a tune. But even these additional drafts upon his vitality are honored by his constitution in a way that shows that although he may, and often does overdraw the account, that account must be a large one at the outset of his career.

No! American lives may be shorter than formerly, although we think there is not good evidence of even this; but vitality must be on the increase, or the drains made upon it would make us all bankrupt.

We rest our case. What say you, gentlemen of the jury?

SCIENTIFIC INTELLIGENCE.

CURE FOR LEAD POISONING.

In some of the large establishments of France the best antidote for lead poisoning was found to be a lemonade made of weak sulphuric acid, but after a while the workmen became disgusted with the taste of this liquor, and refused to drink it. It was observed that two workmen in one of the factories were entirely exempt from lead colic, and, upon inquiry, it transpired that they made free use of milk. The director of the works at once ordered enough milk every morning and evening for all of the workmen, and from that time all symptoms of lead poisoning disappeared. The suggestion is worthy of attention on the part of all persons who are exposed to the poisonous action of lead, to make free use of milk. It is at once an agreeable and easily attainable remedy.

USE OF ELECTRICITY IN CAUTERIZATION.

The old method of cauterization by fire is to be replaced by the electro-thermic or galvano-caustic apparatus. The latter process is safer and more certain in its operation. It is possible at will to vary the degree of heat, to raise it instantly to the highest intensity, to diminish or suppress it, to render it intermittent or continued, to direct it into deep cavities, and to destroy all the tissues by contact. It is said that the wounds produced by electricity are less liable to contagion and miasmatic infections than those caused by sharp instruments.

The apparatus can be made of any desired shape so as to be applicable to all parts of the body, and it is known that important cures have been effected by the introduction of platinum wires and the cauterization by the battery of parts of the body inaccessible in any other way. Electricity has already been tried in cases of bad tumors, in amputations, in excisions of cancers, in destruction of wens, for opening cysts, for removing internal tumors, upon wounds by fire, and in numerous other cases. And a recent article in *Cosmos* claims for it the following advantages: The electro-thermic cautery suppresses all pain after the operation; avoids loss of blood; prevents the retention and alteration of the liquids; avoids all putrid and purulent infections; facilitates the organic reconstruction and healing of the parts; affords a method universally applicable, strong or weak, continuous or intermittent; capable of sloughing the tissues, of carbonizing them, of destroying them, of converting them into gas, and must be regarded as one of the most important contributions to modern surgery."

PRESERVED BREAD.

This bread is proposed as a substitute for the biscuit and "hard tack" used at sea. It is easily prepared though the process is somewhat tedious. The bread is baked in the usual way, it is then subjected to desiccation for eight to fourteen days, until it is thoroughly dry; it is then exposed for a short time to the action of steam, and afterwards squeezed into tablets under an hydraulic press for twenty-four hours. The tablets can be preserved for years in hermetically-sealed packages.

Bread thus prepared retains a vitreous fracture, can be easily masticated by the teeth, is admirable for bouillon and soup, and experience has shown that 200 pounds of good flour will afford 188 pounds of compressed tablets. An army provided with this bread and Liebig's extract of meat would be prepared for any emergency that might arise. A soldier could easily carry several days' rations in his knapsack.

DISINFECTING SOLUTION.

According to *Cosmos* the medical authorities of Paris ordain phenic (carbolic) acid for the disinfecting of the bodies of patients who have died of small-pox. For this purpose they takes 12 grammes of crystallized phenic acid to one liter of water. Hitherto chloride of calcium has been employed, but never with satisfactory results, whereas phenic acid has been found to be entirely effective, and its application is unattended with inconveniences of any sort.

CURE OF CONSTIPATION BY ELECTRICTY.

Dr. A. Cabe, of Lyons, France, had in his practice a very obstinate case of constipation in a female subject 80 years of age, who for sixty years had suffered in consequence of a severe attack of dysentery encountered in her youth. The patient having had no passage for forty days, the doctor tried to induce a contraction of the intestines by the application of electricity. He inserted the negative pole of a Gaiffe battery into the rectum, and applied the positive to the navel, and in the course of two minutes the results were completely satisfactory.

SOLUBILITY OF CLAY IN WATER.

M. Schloessing has shown that clay is soluble in distilled water. There appears to be a colloidal solution that will remain for months, but if a drop of chloride of lime be introduced the liquid becomes instantly clear. The water of the Mississippi always contains more or less alumina in suspension, which can be removed by adding a few drops of a solution of chloride of calcium, or of sulphate of lime. In this manner the Egyptians clarify the water of the Nile, which is always turbid.

A SPONTANEOUS COMBUSTIBLE GAS.

The bi-bromide of ethylene, when mixed with oxygen gas, takes fire spontaneously in the sunlight. The bromine appears to combine with the hydrogen in a manner analogous to the union of chlorine with hydrogen in the sunlight.

HOW OUR WHEAT CROPS ARE HANDLED.

The facts given in the following account of the mode of handling our grain crops at the west, from a Milwaukee correspondent of the New York *Tribune*, will convey to many of our readers at home, as well as abroad, some conception of the immensity of the grain business in this country:

The city of Milwaukee, with its 100,000 inhabitants, and Chicago, 3½ times larger, are what they are because they handle such vast amounts of the raw material of food. On an average, as Mr. Fisk remarked in his wonderful story of the gold panic, it takes one bushel of grain to bring the other to its market. When a farmer raises 200 bushels, the value of 100 is divided among railroads, elevators, schooners, and operators, who are thus paid for delivering the other 100 to the consumers. In this view the facilities for handling grain become as important as the art by which it is produced. In the descriptions that follow, the accounts of marvelous quantities and vast warehousing apparatus, the farmer will see how stupendous is the system to which he contributes, and warm-hearted Americans may see somewhat in all this to remind them of the marvelous resources and material grandeur of this nation.

As a general mart for the sale of all grains Chicago is quite in advance of this city and of all our cities; but for wheat as the special crop of the West, the grand cereal, Milwaukee is the place for learning how it is treated after it leaves the bins of the farmers. The reason why this place thus bears off the palm and gives law in the wheat market is simply because she has had several far-seeing and enterprising citizens who were duly impressed with the importance of drawing the crops for the great grain region north and west of here to this point for shipment to Eastern cities. The railroads built, Milwaukee has laid her hands on a lion's share of the wheat crops of the Northwest by certain business virtues and by prompt and liberal expenditures at the right time and place. In this respect her example is a pattern, and is profitable for young business places and young business men to study. For it is by no means a matter of course that Milwaukee should receive and ship twenty odd million bushels of wheat. This is not the only outlet. In fact, Chicago is reaching out for this same 20,000,000 bushels, and she would have drawn it had not Milwaukee made it for the interest of all shippers of spring wheat to send their trains here rather than to her vigorous, vigilant, daring, and imperial rival.

WHAT IS AN ELEVATOR?

An elevator, in these grain cities, means an enormous building usually more than 200 feet long and over 100 high, with an equipment of powerful belts and buckets for raising grain, and rows of gigantic bins for storing it. I have just returned from a visit to Elevator A, that stands at the termination of the La Crosse division of the Milwaukee and St. Paul Railroad. This structure is 280 feet long and 80 wide. The total length of the great driving belt, urged by a 200-horse power engine, is 280 feet, that is, the half extending from cellar to comb is 140 feet, and the down half is of course equal to it. This belt is thirty-six inches wide and three-quarters of an inch thick, and is made of six-ply or thicknesses of canvas, with sheets of india-rubber passed between and into them. But such immense strength will not seem excessive when we see the Titan work it has to do. It drives nine receiving elevators or belts set with buckets; each of these is as long as the main belt; that is to say, they lift the grain 140 feet. The buckets are made of thick tin bound with hoop iron, and are well riveted to the belt at intervals of fourteen inches. In shape they are like the buckets in a common grist mill, but very much larger, for these are six inches across the mouth and eighteen inches long. When full one contains a peck. They do not usually go up quite full, but, allowing for this, there are 100 pecks, twenty-five bushels, loaded on one side of one of these belts whenever it is at work. If all nine are running at once, as is often the case, the quantity of wheat lifted on these swift-running belts is 225 bushels. The established weight of a bushel of No. 2 Milwaukee Spring is fifty-five pounds. This would make the total lift of the receiving elevators, every moment they are at work, over 12,000 lbs. Discharging upon each of these nine is a hopper-shaped bin beneath the railroad track. A car load of wheat is rolled over the bin, the doors lifted, and six stout men step in with big, bright, grain shovels. Each knows his place, and they work like so many engines, with a stroke steady and true and effective. In four minutes from the time these six step into the car there is nothing left but a quart or two of sweepings on the floor. A car carries from 250 to 300 bushels, and the swift-running belt that rushes by them in its tireless industry has carried the 300 bushels 140 feet in the air, as fast as those six stout Teutons could shovel it out. I was pleased to note a manly and candid expression on the faces of all who were at work in wheat. They did not look like men who spent their earnings on bad whiskey or smoked them away over lager and pretzels, coming home late to pound a hard-working woman and curse their children.

When carried aloft the receiver throws the grain into a hopper-bottomed bin fixed on scales, and the weight is accurately given. Before the wheat is rolled into the warehouse it is carefully inspected and graded. Nineteen out of every twenty bushels coming here is spring wheat, and thirty-eight per cent of all that arrives this year is graded No. 2. The inspector gives his memorandum to the weigher, and he turns the spout over the bin containing No. 1, No. 2, or No. 3, as directed by the marks on the inspector's book. Very much depends on the care and honesty of this inspector, and the laws of the Milwaukee Chamber of Commerce require that he be sworn, that he give heavy bond, and be himself in no sense a buyer or a seller of wheat. Here let me remark wheat is often graded No. 2, not so much because it lacks plumpness and weight as because you let oats get in with it. And this neglect is rather on the increase. Farmers do not appear to be as particular as they were about their seed wheat. For instance, Mr. Langston, the secretary of the Board, showed me his tables, and from them it appears that in 1865 seventy-seven per cent of the wheat was No. 1. The next year we had that bad fall when it rained all August, and everybody's grain sprouted. There was but ten per cent of No. 1 in 1866. In 1867 it was sixty per cent. In 1868 and 1869 the harvest has been nothing to complain of, but Milwaukee saw but thirty-eight per cent of No. 1 wheat.

The bins in which this wheat is poured are of great size, being 60 feet deep, 20 wide, and 10 across, containing 12,000 cubic feet. The total receiving and storing capacity of this establishment is 1,500,000 bushels. Of the crop of 1869 it has received 7,000,000 bushels. About 10,000 bushels are taken into a train of the average length. So 2,100 trains have rolled into this elevator and discharged.

HOW WHEAT IS SHIPPED.

Milwaukee has an admirable harbor. Two rivers run into the lake, and at the junction is a wide spread of marsh grown up with bulrushes and green with aquatic rankness. But the mud is soft, and canals are easily cut, so that a hundred of these warehouses could be so stationed that while cars rolled up on one side, ships drawing ten feet of water might anchor on the other. As soon as a grain ship is anchored beside an elevator the hatches are removed, and great spouts extend over them from the bottom of one of the enormous bins I have described. The gate is raised and a torrent of wheat pours down. The loading power of these spouts is 12,000 bushels an hour. The *Orient*, for Oswego, was loaded the other day in an hour and a half, and her capacity is 18,000 bushels. The Oswego and Ogdensburg schooners and vessels destined for the Welland Canal usually take on from 12,000 to 20,000 bushels. The Buffalo vessels are larger, often receiving 30,000 and in a few cases 45,000 bushels.

It must not be supposed that one of these bins of wheat stands week after week without further care. It is the business of a good warehouseman to watch his wheat, and see that none of it is heating. If he thinks it needs air he can, by lifting a gate, throw it all in a cascade on the floor, and lift it back with the elevator.

Milwaukee has seven such elevators as I have described, but this is the largest. They vary in receiving capacity from 500,000 to 1,500,000 bushels. During the year past more than 14,000,000 bushels have been shipped to the lake cities. Of this Buffalo takes one half, Oswego the rise of 3,000,000 bushels, Kingston 1,500,000 bushels, and the rest goes in driblets to Erie, Cleveland, Toledo, and Dunkirk.

ACTIVITY IN WHEAT.

Napoleon's war, though it brings quaking and ashes to those Rhenish provinces which he proposes to conquer, adds millions and millions to the pockets of Northwestern farmers. The large dealers say they expected nothing but a decline; one large buyer, the largest in the Northwest, says he expected to see No. 2 Milwaukee Spring at ninety cents, and falling by this time. But by a curious coincidence wheat sells to-day at just the figure it held on the 18th July, 1869—that is, $1·30.

I see large crowds in the Chicago Board of Trade, a confused blending of shouts, men reeking with perspiration making swift entries in little books, and bantering each other and betting in words and figures which I do not wholly understand; and the telegraph wires are loaded with messages about wheat, ordering, countermanding, and again confirming the first order. The language in which the business is conducted is very much condensed, but it is easy to see that the fever in Europe brings tossing and tumult to us, but on the whole it benefits the farmer greatly. Milwaukee No. 2 often commands five and sometimes ten cents more than Chicago No. 2. That is, a farmer or a country merchant has a lot, and sends half to one city and half to the other; that which goes to Milwaukee will sell the best. Why? First, because the more northern wheat is generally better and plumper than that which grows in a hotter sun. Secondly, because the men who handle and inspect wheat in Milwaukee are more careful and honest, and those who have charge of the elevator do not let it heat. Thirdly, these circumstances have given Milwaukee wheat repute and a good position in market, and everywhere "a good name is better than rubies."

Boiler Incrustation.

Incrustation is injurious in three distinct ways: It increases the consumption of fuel, injures the boiler, and may even compromise its safety. Incrustation less than one eighth of an inch thick allows the passage of only one quarter of the heat it would if the plate were clean.

One way in which incrustation injures the boiler is by its requiring the fires to be forced, thereby furthering the oxidation, diminishing the strength, and tending to tear away the plates of the boiler. The very cleaning of the boiler tends to injure the plates and structure. At the same time, there is no doubt that a thin incrustation protects the surfaces of the plates against corrosion, and that it often closes up the joints and prevents escapes.

To prevent evil effects from incrustation, the water can be purified before being fed in, or different apparatus, applied inside the boiler, can be used for the purpose. Before feeding it in, water can thus be purified by chemical reactions; by heating it; or it can be distilled by using the condensed steam as feed-water. In the case of the presence in the water of carbonate of lime, held slightly in solution in the form of bicarbonate, the state of solution being aided by the presence of a slight excess of carbonic acid, by saturating, by means of a sufficient quantity of lime, the excess of carbonic acid, the greater portion of the neutral carbonate will be deposited on account of the very slight solubility of that salt.

The processes employed within the boiler consist in blowing out; mixing the water with substances modifying the incrustations either chemically or mechanically; employing the circulation of the water for extracting the matters in suspension, and applying electricity against the incrustations. Marine boilers are continually blown out. In France very good results in preventing solidification have been obtained by the use of logwood shavings. The steam, though the boiler does not prime, is of a violet color; no doubt from its taking up a little water.