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Contents:

(Illustrations are indicated by an Asterisk.)

AMERICAN STEAMSHIPS.

Our merchant steam marine has long been celebrated for the speed and economy of magnificent vessels. In point of economy, particularly, we have excelled all other nations, and there are few foreign vessels afloat which can compare with some of our latest steamships. One of the greatest items of expense in steam lines is fuel, and the most lively interest attaches to everything relating to a diminished consumption of it; particularly at this time, when the cost of the article seems to be so well sustained at advanced rates that there is no prospect of its falling.

For the past three years the Pacific Mail Steamship Company have been renewing their fleet of ships, and they have now some vessels which challenge the admiration of every one for their unequalled performances.

These ships are first-class, and full-powered as regards engines; the speed they attain for the amount of coal burned is worthy of special notice. The *Constitution* was the first of these new ships, and the *Golden City* the second; both are essentially the same dimensions and model, being 364 feet long, by 45 feet beam; tunnage (carpenter's measurement) is 4,400 tuns. The engine has a cylinder 105 inches diameter by 12 feet stroke, an adjustable cut-off, and an overhead beam.

The voyages of these vessels are made under different circumstances, as regards the load carried. From San Francisco to Panama, they are light, and average 14 feet draft on an even keel. The log of the *Golden City* is before us, and we make our extracts from it. On the return trip the draft is much greater, and averages 17 feet. The distance run by the *Golden City* on the trip from San Francisco to Panama, averaged 218 miles in 24 hours. During this trip 393 tuns of coal were burned, or one tun of 2,240 pounds, part anthracite and part Cardiff (Welch) per hour. The steam pressure was 12 pounds and the revolutions 13,625 (average) in 24 hours. *The point of cut-off was 14 inches* (average). On the return trip from Panama to San Francisco, the distance run in 24 hours averaged 253 miles, while the coal (anthracite and Cumberland) consumed in doing this duty was 39 tuns, about 3,360 pounds per hour with 15,084 revolutions in 24 hours. The point of cut-off was $32\frac{1}{4}$ inches. Average pressure $17\frac{1}{2}$ pounds. These trips are from Dec. 12th, 1863, to Jan. 4th, 1864, inclusive.

Such a record as this is extraordinary, and no ship but an American one, and no engine but a beam-engine has ever achieved it. The *Golden City* has Sewel's surface condenser and the Martin boiler (so much abused and derided of late), and there is no question at all of its economy for the duty it does. The amount of waste in the fuel is but 12 per cent. Here we have a ship of 4,400 tuns burthen, making 9 miles an hour on 2,240 pounds of coal. Comment is unnecessary. It appears from these figures that the cost of producing a horse-power on the trip from Panama to San Francisco, was about $3\frac{1}{2}$ pounds of coal per hour. This force is not produced so cheaply as it is by some investigators (speculators, perhaps we might say) of the marine steam engine, who make a horse-power for any number of pounds of coal less than four that the fertility of their imaginations can supply, but it is the actual amount of one trip taken at random from the log of a ship doing duty, and making money for her owners. The facts stated will bear investigation.

It is gratifying to us, as a people, that our engine and ship builders are capable of producing machines and models which defy competition. Those persons who mourn over the monopoly of the sea now enjoyed by foreign nations, may be assured that when peace reigns again, we are fully capable, so far as vessels go, of outstripping all others.

A LAW OF COMBUSTION.

Numerous and careful experiments have developed the law that the heat generated by the burning of any substance is pretty nearly in proportion to the weight of oxygen with which the substance combines in burning. For instance, the combustion of one pound of hydrogen gas will raise the temperature of 33,808 lbs. of water one degree of the centigrade scale, while the burning of a pound of tin will raise the temperature of only 1,144 lbs. of water one degree. But the pound of hydrogen in burning combines with 8 lbs. of oxygen, while the pound of tin combines with only about one-fourth ($\frac{19}{30}$ths) of a pound of oxygen. A simple calculation will show that the quantity of heat generated by the combination of a pound of oxygen is very nearly the same in both cases. A pound of oxygen in burning hydrogen will raise the temperature of 4,226 lbs. of water one degree, while in burning tin it will raise the temperature of 4,230 lbs. of water one degree.

This law does not hold, however, in cases where the combustible in burning undergoes a change of form, from the gaseous to the solid, or from the solid to the gaseous state. For instance carbon in burning to carbonic oxide is changed from the solid to the gaseous form, and in this case a pound of oxygen generates only 2,962 units of heat, while in burning this carbonic oxide into carbonic acid, where no change of form takes place, a pound of oxygen generates 4,258 units of heat. In burning zinc the oxygen is changed from the gaseous to the solid state, and in this case a pound of oxygen generates 5,285 units of heat.

When either the combustible or the oxygen is changed from the solid to the gaseous form, a portion of the heat is absorbed, and the amount of sensible heat is dimished, but when the change is the opposite way the sensible heat is increased.

Even where no change of form occurs in either of the combining elements, the amount of sensible heat developed may be modified by a change of volume; an increase of volume diminishing the sensible heat, and a contraction of volume adding to the heat set free.

There are indications also that the law is further modified by influences which are not fully understood. On another page we give a table of the heat produced in burning a number of substances as ascertained by the best observers; an inspection of this table will prove both the general truth of the law and the numerous variations from it.

PRESERVING FRUIT.

Nearly every one is fond of preserved fruits, but as generally made they are extremely unwholesome; at the present price of sugar "sweetmeats" made in the ordinary way are too expensive to be thought of by persons of ordinary means. Fruit demands—like the Jew in the *Merchant of Venice*—pound for pound, or as much sugar as fruit, and only the best and most costly kinds of the sugar should be used. It is very generally understood that the process of preserving fruit in air-tight cans is not only cheaper but far better than the old-fashioned way. By this method one-fourth the usual quantity of sugar is required, and instead of being a thick agglutinated mass when done, the cherries, plums, or what not, retain their natural color and flavor when properly put up. They not only appeal to the palate but please the eye, which is not the least important point gained in preparing food.

All that is necessary to succeed in preserving fruits in this way is to exclude the air from the jar. This is cheaply effected by boiling. The jars should be of glass, for through it the condition of the fruit can be seen perfectly and detected if it ferments, whereas with other material no warning is given until the vessel bursts and the material is wasted, if it has not been well prepared. Some of our contemporaries prefer corks and cement for closing the mouths of the bottles or jars, but we regard this method as infinitely more troublesome, more costly, and less reliable in the hands of inexperienced persons than those cans which have an india-rubber gasket in the mouth, which is compressed by a screw stop or its equivalent.

With these jars any one can make a tight joint if they screw it up properly. A very great defect with cans of this kind is that the gaskets or rubber rings are too thin and the mouths of the jars are uneven. If the bottom of the stopper is uneven as it generally is, it bears upon the gasket in some places while it is open in others. This is a very annoying fault, and makers of such jars would consult their own interests by testing each can and its cover before it leaves their hands. This is easily done with water. If the jar when capped is not water-tight it certainly will not be air-tight. Another fault is in leaving great cavities inside the glass tops where they are made lighter. These cavities should be filled with plaster by the purchaser, for they hold air and tend to the very evil they should prevent. A cheap and convenient way is to take a piece of stout fine linen and cover it thickly inside and out with a cement made of beeswax and rosin. This latter article is very dear at present, and there is a good substitute for it in a pitch made from coal tar, which may be had in large cities by going down on wharves where vessels are being calked, or in ship chandlery stores. The fruit should be put in a pot surrounded by boiling water, and the jar filled within an inch of the top. If it is fuller the air below, as it rises, causes the contents to overflow and wet the top of the jar, so that the cement does not stick. When the fruit rises to the mouth of the jar then is the time to apply the cover. Clap on the linen, covered thickly with cement, and tie it tightly. When the fruit is cold the cover will be depressed an inch or more if there is no air beneath. If the cover lies flat the air is not expelled and the fruit will spoil.

Another way to test the vacuum is by suddenly turning the jar upside down when cold. If there is much air within, it will be seen escaping in bubbles through the mass to the top (in this case the bottom) of the jar. There will be some air at any rate; it is impossible to get a perfect vacuum in any vessel whatever. If the first trial fails the cemented cover should not be pulled off. Place the jar in warm water again and bring it to a boil. If there is air below, the cover will rise like a light biscuit. Take a pin and make a small hole in the top and it will fall; then just at the moment the juice rises to the opening (or a little before) have ready a lump of cement and clap it over the pin hole. If this is done dexterously the operation cannot fail, and when cold the cover will show for itself whether it is tight or not. The necessity for waxing the cloth thoroughly and tying it tightly will be apparent when the pressure it has to sustain is born in mind; that upon a jar two inches in diameter at the mouth being forty-five pounds. Fruit preserved in this way is much cheaper, more economical and healthier. So far as the palate is concerned there is no comparison with the old-fashioned plans.

THE London Gutta-percha Company assert that the gutta-percha used to insulate the telegraph cable between Dover and Calais, which has been laid thirteen years, exhibits no deterioration in its insulating properties. They also publish a certificate of William Thomson, of Glasgow College, stating that his tests show that the loss of electricity from imperfect insulation in a circuit of 2,000 or 3,000 miles would be insignificant.