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Contents.

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TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 998.

For the Week Ending February 16, 1895.

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ZERO WEATHER OVER THE UNITED STATES.

Such a drop in temperature as was experienced over the greater portion of the United States, from the Rocky Mountains to the Atlantic, and from the Canada border to the Gulf of Mexico, during the week ending February 9, has hardly had a parallel since the recording of weather changes has become a regular system. Severer weather and heavier snowfalls have been experienced heretofore in limited sections, but the great area and low range of temperature of the storm which had its center in Texas on February 6 was something phenomenal. The temperature was below the freezing point for nearly three days throughout the entire United States, except a small area on the southern extremity of Florida and the California coast up to about Portland. And within the lines which marked the extent of country over which a freezing temperature was being experienced the mercury dropped to the zero point over the greater portion. At New York City, three degrees below zero was experienced, and throughout New England the range was from zero to twenty-six degrees below. It was below the zero temperature also throughout the States of New York and Pennsylvania, in portions of Maryland, Virginia, and the Carolinas, and in the greater part of Georgia, Alabama, and Mississippi, the zero line extending down into the heart of Texas, and thence westerly to the Rocky Mountains, and including the entire territory of the Mississippi Valley and around the great lakes.

In the memorable blizzard of 1888, a much smaller area was affected, the storm being confined mainly to the Middle Atlantic States, and the temperature did not fall so low, although there was a much greater snow fall. The snow fall accompanying the last great cold wave has varied from a few inches in depth, along the coast, to upward of two feet at many points in the interior, and, accompanied as it has been by a high wind, reaching a velocity of seventy miles an hour at Sandy Hook, railroad travel in all directions has been greatly impeded. But perhaps the greatest loss attributable to the cold weather will be that of the Southern fruit crops. The zero point has been reached over a large territory where a freezing temperature has heretofore been but rarely experienced, and the fruit crops of these milder climates cannot but be an almost total loss, it being reported that the Florida orange crop and a great portion of the trees have been entirely destroyed.

A NEW JET-PROPELLED STEAM LIFEBOAT.

The Royal Lifeboat Institution, a benevolent organization supported by subscriptions from the charitable people of Great Britain, maintains many lifeboat stations on the coasts, which are the means of saving hundreds of lives every year. In general, lifeboats are worked by oars and sails. In 1891 the institution caused to be built a steam-propelled lifeboat, worked on the jet principle. That is to say, instead of the ordinary screw propeller, jets of water are used to drive the vessel.

The water jets are produced by means of rotary pumps, and when the jets are discharged from the stern the boat is driven forward. The discharge nozzles are capable of being shifted, so as to direct the jets laterally, in which case the vessel may be turned around or made to move sidewise. The first jet propelled lifeboat proved very useful and successful, and now the institution has added another boat, worked on the same principle. This vessel is named the City of Glasgow. She is 53 feet long, 16 feet beam, 5½ feet deep. Displacement 30 tons. Besides coal, provisions, water and crew, the boat will carry 40 passengers. On each side there are two centrifugal pumps for working the vessel. Engines, 200 horse power. Speed, 8 miles per hour, and capable of towing another boat at same speed. The vessel is propelled and turned with the utmost facility, without the use of the rudder, although, of course, a rudder is provided. Going at full speed the boat may be stopped dead and started astern in 20 seconds.

A somewhat similar jet boat, named the President Van Heel, has been built for the Lifeboat Institution of South Holland, and is operated with much success.

We have on several occasions called the attention of the Navy Department to the importance of having our war vessels fitted with jet pipes and proper connections with the steam pumps, so that in case of need, such as loss of rudder or in an action, this auxiliary means might be employed to steer, swing, or turn the vessel, as circumstances might require. We have also suggested the inquiry whether additional pumps and pipes might not be arranged for connection with the main engines of the ship, so that in case of loss of propeller, or breaking of shaft, the propulsion of the vessel might be still maintained.

These suggestions apply not only to war ships, but also to merchant steamers. The jet system is not capable of yielding so high a rate of speed for a ship as the propeller, but it is a safe and effective method, especially useful for emergencies. It would be a simple and comparatively inexpensive matter on all steamers to arrange jet pipes for steering purposes in case of rudder loss. Such devices should be made compulsory, same as other safety requirements.

Charles W. Copeland.

Charles W. Copeland, one of the best known marine and mechanical engineers in the country, died at his Brooklyn home February 5. Mr. Copeland was born in Coventry, Conn., in 1815. Daniel Copeland, his father, was a builder of steam engines and boilers in Hartford, Conn. The plant was established on the premises afterward occupied by the extensive concern of the Woodruff & Beach Iron Works of that city. Charles Copeland was carefully trained by his father in designing and draughting steam vessels. He also received practical instructions in the shops in pattern making, founding, machine fitting, boiler making, and later became the superintendent of his father's establishment. He designed at this time a number of steamers for use on the Connecticut and Southern rivers. Under the guidance of Professor Hackley, of Columbia College, he became an adept in mathematics. In 1836 he accepted a position as designing and constructing engineer in the West Point Foundry of New York, then one of the largest plants of the kind in the country. While connected with this concern he designed and built many marine engines, including those for the United States naval steamer Fulton, the steamboats Utica, Rochester, Swallow, Milwaukee, and Cleveland, and the ferryboats Gold Hunter, Jamaica, Bunker Hill, and Lexington. He built the first iron hull in the United States for a boat which was put in service on Lake Pontchartrain.

In the year 1839 he was appointed constructing engineer to the United States navy, an office similar to that now occupied by the chief of the Bureau of Steam Engineering. During the Mexican war he fitted out what was called the "Mosquito Fleet," consisting of the Spitfire, Scorpion, Scourge, Vixen, etc. At a later period he designed the engines and boilers of the naval steamers Missouri, Mississippi, and the Michigan, for Lake Erie, which was the first iron steamer ever used for naval service. Subsequently he designed the machinery for the naval steamers Saranac and Susquehanna. He then became superintending engineer of the Allaire Works of New York, where he designed and built the machinery for the steamers Pacific and Baltic of the Collins Line, the Panama, the Bay State, the Empire State, the Traveler, and others. In 1852 Mr. Copeland's opinion was called for on the "Steamboat Bill," and he was appointed the first supervising inspector under the new law for the New York district. He held this position for nine years. During the civil war he was engaged in altering and refitting vessels for the Southern rivers, and he introduced double-enders for navigating the intricate channels of the rivers. Since the war, Mr. Copeland has been engaged as consulting and superintending engineer for United States Lighthouse Board and by private individuals and corporations. He designed the steamers City of New York, City of Worcester, and City of Boston during this period. These are only a few of the many works which came under Mr. Copeland's care. He was a man of the strictest integrity, and his reports were always models of accuracy and reliability.

A Water Pipe Trouble.

The way in which pipes sometimes become mysteriously clogged is illustrated by the following from the Sanitary Plumber:

"Arriving at the dwelling containing the trouble-some closet, I went in and uncoupled the supply coupling at the valve, and with the water off blowed through the pipe. Judging from the ease with which the air passed through the pipe, it seemed that the supply was not at fault, and the plumber assured me that he had blown through it himself, long before. Nevertheless, I produced a small pocket mirror and directed a light to the interior of the coupling and pipe; there in an instant's glance I detected the cause of the failure. In making the joint which joined the valve coupling to the supply pipe, solder had run through and half filled the bore of the pipe. As the couplings for these valves are large, this would not ordinarily have caused the great reduction in the supply experienced in this case. The bulk of the solder which had run through hung free in the shape of a large lima bean. At the coupling end of the bean it was effectually hinged to the solder of the joint where it run through. One could blow through the pipe easily from the coupling end, but scarcely at all from the supply side, as the air or water would catch the solder bean and throw it across the waterway of the pipe, stopping its egress almost as effectually as would the clack of a check valve put on wrong side to.

"We pinched the solder out of the pipe and the closet worked charmingly. The plumber and his boss looked very crestfallen when the cause of the trouble became known, and did all they could to make amends."

THE Book of Job, written about 1520 B.C., describes very accurately several processes of smelting different metals.

India Rubber.

At a recent meeting of the London section of the Society of Chemical Industry, Mr. T. Christy exhibited specimens of different sorts of rubber, specially with the view of showing that rubber can be extracted by water. In the first instance the Landolphia was shown with the roots and boughs as cut from the living tree, next the stems after they had been boiled. The next stage was the debris of the bark and the rubber still hanging on to one end of a twig which otherwise was perfectly clean and free from any succus; then there was the mass as it fell into the pan with the bark mixed with the gum. It was then shown in different stages of treatment up to the Landolphia rubber as sent into commerce. Another Landolphia was shown from the Congo; this had been wound off direct from the tree into a ball and dried in the course of winding.

Another exhibit was Almadina, so called from the man who discovered it and worked it out in West Africa; it also goes by the name of potato gum. This gum has most interesting properties, which have been fully explained in the scientific papers, especially by Mr. Lascelles Scott. From a series of experiments lasting over four years, it was found that by placing in a box, open to the sun and rain, some of the very best India rubber and gutta percha, some pure Almadina, and also Almadina mixed with India rubber and gutta percha, at the end of the experiment the best rubber had almost disappeared and was quite worthless, whereas the India rubber and gutta percha mixed with Almadina remained perfectly sound and with full elastic properties. He obtained some tons of Almadina, melted it, and added to it a considerable quantity of water and some tannic acid. This was well stirred and it took up a large quantity of water. When the mass was sufficiently kneaded it was put into bags and allowed to cool, and then sent down to some large India rubber works, and the proprietor was so pleased with it that he offered to take any quantity at 1s. 6d. to 1s. 10d. per pound. This rubber, of course, had a quantity of water in it; allowance had to be made in charging the weight when it was handed to the railway of at least 20 per cent. As practical manufacturers on a large scale had now admitted its great value, he then met them and told them that he could no longer continue to manufacture this gum, and that he was prepared, if they gave him a sufficient order for the raw material, to give them all the information. Suffice it to say that they gave the order, but the foreman resented it very much and did all he could not to use this rubber, until his place was handed over to another man who thoroughly understood the valuable properties of Almadina. The consequence was that a very much higher class of goods was turned out of these works and large contracts made. This shows how difficult it is to overcome prejudices.

Another gum, also obtained by being boiled, was chicle gum. This came from Mexico, and was known to Americans as the base for their chewing gum. Small pieces were prepared for those who desired to experiment with it. He had sent a sample to one of his friends, who was certainly one of the most advanced men in the rubber trade, and explained to him the most simple manner of testing it, viz., chewing it; he did so, and he wrote back saying that he was delighted with the material and wanted a quantity for experiment, and, if it went down to a certain price, to put his name down for the first supplies. This gum was also found useful in plaster making and pills.

In conclusion, there were many other gums which he believed would advantageously yield to the treatment of cutting down the boughs and boiling them in water, finally extracting the rubber as the mass cooled. He had sent a request to several places where the rubber trees were growing wild, suggesting that this plan should be tried.

The Future of the Earth and of Man.

One of the most immediate effects of the progress of sidereal evolution is the impoverishment of the fluid reservoirs that surround the planets. Such a discovery is, of course, very threatening for us, and it may be asked whether our oceans and our atmosphere are rich enough to answer the needs of the rocks that will consolidate hereafter. It is easy to make a calculation on this point. The crust of the earth is at present so thin that a hen's egg has relatively thicker walls than our globe. If we suppose the consolidation pushed to its center, such a consolidation would require many times the amount of water which all our seas can furnish. Our satellite, the moon, which, by reason of its smaller volume, has reached the advanced degrees of refrigeration much more quickly than the earth, is now precisely at that phase in which all that was absorbable is engulfed in the voids of its crust. The day will come, then, when the earth, after having lost its atmosphere and its oceans after having had enormous rifts opened all over its surface, will be broken into meteoric fragments. Long before this time, all living beings, and especially human beings, deprived of the conditions necessary for existence, will have been extinguished. Let me note, moreover, that as the law of sidereal evolution is equally applicable to the sun, there will come a time when that radiant star will cease to vivify the planets. If they shall not already have been broken into pieces, they will become, by the extinction of the heat of the sun, unfit to be the dwelling place of living beings.

A distinguished professor whom science lost prematurely, M. Trouessart, whose mind had been much occupied with these questions, explained thus the future which awaits us, and at the same time made known his own preferences among the possible different destinies of the human race:

"Some day," he said, "that brilliant torch which is for us the source of light, of heat, of movement, and of life, will be extinguished, and we poor mortals (for how can we be indifferent to the destiny of our posterity ?) —what will become of us? After dragging out the remnant of a dying life; after leading the sad existence of the Laps, the Esquimaux, the Samocides; after having retraced all the steps of our development, physical, intellectual, and moral, we shall end with exhaustion, misery, hunger and cold! A thousand times better for the earth to close its career with a mighty catastrophe, which would make an end of human beings while in full civilization, which would permit humanity to say to the universe which was crushing it, to use the fine expression of Pascal, that it is nobler than the universe; yes, anything rather than such a miserable end, in which thought itself will doubtless be extinguished before the wretched remains of the material life! Yet such a catastrophe science does not foresee, while it foresees the extinction of the sun."

The theory of sidereal evolution dissipates this sad perspective. Since we have the certainty that neither the reason nor the sense nor the heart which has been bestowed on us is an illusion, let us also have confidence that the reality which is before humanity is worth far more than all that we, in our profound ignorance, can conceive of as the best.—Stanislas Meunier.

Liquid Fuel.

It has so often been said that one ton of oil fuel will make as much steam as two tons of good coal, that the statement has met with tolerably general acceptance; and very imposing structures have been built upon it. It is, however, like many other assertions, one that will not bear the test of careful scrutiny. It originated, there is reason to believe, with more or less sanguine inventors; and it may be true when certain qualities of coal and of oil are compared; and, again, petroleum may be better adapted for burning to advantage under special circumstances than coal. But it is well known that the precise merits of petroleum have not been advocated on such a practical basis as this. It has been maintained that petroleum, when burned in a suitable furnace, will give out twice as many heat units as a pound of coal; and no doubt the announcement that "Russoline," as used in oil engines at the Cambridge Show, is little more than one-fourth better than coal, came as a startling surprise to many people. It is just as well, however, that the precise truth should be known, and its proper value assigned to oil fuel. There is little difficulty in doing this, as soon as the composition of the oil is known.

The so-called hydrocarbons are of multifarious and most complex composition. There are hundreds of them, between the highly volatile benzines and the dense tar-like stuff known as astaki, and all may be obtained by fractional distillation from almost every sample of crude mineral oil. With the details of the chemical construction of rock or mineral oil we need not now concern ourselves. There are only two "fuels" properly so called in petroleum. The one is hydrogen, the other carbon, and these exist in varied proportions in different samples. The complete combustion of one pound of hydrogen to water will develop 62,000 British thermal units, and one pound of carbon will develop in like manner 14,500 thermal units. The average specific gravity of crude petroleum is probably somewhere about 0·87, and its composition about 85 per cent carbon, 13 per cent hydrogen, and 2 per cent oxygen. The evaporative efficiency of one pound of this fuel is thus: $14,500 \times 0·85 = 12,325$ units for the carbon; $62,000 \times 0·13 = 8,600$ for the hydrogen; and $12,325 + 8,600 = 20,925$, say 21,000 units for the whole. It will be seen that this is a long way from the 29,000 units needed to be equal to double the value of good coal.

But this is not all. There are on the market petroleum oils which contain much less than 13 per cent of hydrogen. Thus there are samples which have 11 per cent hydrogen and 87 carbon; the value of these is only 19,400 units. D. K. Clark finds the average value of a number of samples to be 20,420 units. The number 20,000 is easily remembered, and if we assign that to petroleum as its calorific value in units, we shall do it no injustice. When we come to consider the petroleum oils obtained by distillation from the crude liquid the case is apparently very much better for the oil, for specimens may be had with as much as 28 per cent of hydrogen and an efficiency of about 27,000 units, or very close to twice that of coal. But oils of this character cannot be used for raising steam. In the first place, they are too dear; but even if this difficulty were got over, we should not be better off, because the specific gravity is little more than 0·7, and it ignites at about 86°. Such fuel would be much too dangerous for use, partaking, as it does, of the nature of a benzine. It may be quite possible, however, to use it in an oil engine, and attempts to do this have been attended with varying measures of success; but for boiler work its use is out of the question. The form of the oil best adapted for raising steam is no doubt astaki. This has not been made the subject of much chemical investigation; it is the residue left in the stills when the lighter benzines and paraffines have been driven off. It boils at high temperatures, as much as 490° indeed. What its chemical composition is we are unable to say with any certainty; probably no two samples are quite alike. There is reason to believe, however, that it is deficient in hydrogen, and that its value in units does not exceed, if it equals, 20,000 units. That is to say, it is, weight for weight, about one-half better than coal. If a given quantity of coal will evaporate 14,500 pounds of water, then an equal weight of astaki will evaporate 20,000 pounds of water. The drawback to its use is that, ton for ton, it costs about twice as much as coal; consequently it is a very expensive fuel.

We see then that the startling claims advanced by inventors of various systems of burning petroleum have no real foundation in fact, and they tend to retard the use of oil fuel rather than promote it. The right spirit in which to approach the subject is, while not expecting too much in the way of evaporative efficiency, to bear in mind that it is unfair to compare its price with that of coal in England only, and to remember that it is a superbly convenient fuel, involving the least possible trouble in burning it. As to cost, we compare petroleum here at say 25s. a ton with coal at 10s. or 12s.; but steamers trading through the Mediterranean and into the Black Sea will have to pay £2 10s. per ton for their coal, while petroleum may be put on board for less than the cost of coal in England, and astaki can be had almost for the cost of putting it into the tanks. To utilize oil fuel, then, properly, it appears that marine boilers should be so constructed that they will, like Mr. Holden's locomotives, burn either fuel indiscriminately, so that as the cargo steamer moves from port to port, she will always be able to provide herself with that form of fuel which can be had at the lowest price.

Hundreds of patents have been secured for different methods of spraying and burning liquid fuel. The great secret of success seems to lie in so arranging matters that the flame will not put itself out and prevent the oil from being properly consumed. If we put a bit of flaming paper over the chimney of a lighted lamp, the paper will be extinguished by the uprush of carbonic acid from the lamp flame. In the same way, when petroleum spray is directed into a furnace high up, it cannot burn, because the upper part of the fire box contains little or no free oxygen, the spray is driven unconsumed through the flame, strikes the bridge or fire stone, and runs down it to be burned—usually badly—below. The jet of oil should enter near the grate bars, but the precise height is a matter of adjustment, involving special knowledge not to be imparted by letterpress. As regards the spraying, that is usually effected by steam, but the practice is very objectionable, because the quantity used is very considerable, and represents great waste of fresh water, which must be made up again for the sake of the boilers, at least in the case of sea-going steamers. The use of compressed air appears to be better, but it is worth while to consider whether either air or steam is needed. It might be found practicable to get rid of both by driving the oil in through very fine nozzles—needled if desirable—under heavy pressure. This device has been employed in oil engines with much success, and we do not see why it should not be made to answer for furnaces. If it can be used, it disposes at a stroke of several serious objections to the use of liquid fuel at sea, and a very moderate sum would suffice to test the value of the idea. The principle involved cannot be made the subject of a patent, but the experimenter might secure himself an adequate reward by patenting the details of the apparatus by which it was carried into practice. —The Engineer.

Increasing and Varied Uses of Aluminum.

The Aluminum World gives the following table showing the quantity, price, and total value of manufactured aluminum for each year from 1884 till 1893:

Date.	Pounds.	Price per pound.	Value (total).
1884	150	$9.00	$1,350.00
1885	283	9.00	2.550.00
1886	3,000	9.00	27,000.00
1887	18 000	3.27	59,000.00
1888	19,000	3.42	65,000.00
1889	47,468	2.04	97,335.00
1890	61,281	1.55	61,281.00
1891	150,000	.66	100,000.00
1892	259,885	.66	172 834.00
1893	339,629	.75	266,903.00

The decrease in price in 1891 and 1892 was due to an infringement contest which produced competition among the manufacturers.