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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1031.

For the Week Ending October 5, 1895.

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THE LOCOMOTIVE OF THE FUTURE.

Is the electric locomotive to supersede the steam locomotive, as the future tractive power on our railroads? It is popularly supposed that it will, and striking developments are being looked for by the public in the trials that are now being made, both in France and America, with electric locomotives of the same weight and power as the standard up-to-date steam locomotive. From the day that electricity was first used as a tractive force, it has been the fashion to predict the early decline of the steam locomotive, and the substitution of some form of electrical traction in its place. It was confidently predicted that motors of half the bulk and weight of the modern engine would soon be hauling our trains at unprecedented speeds, and with that noiseless energy and cleanly operation that distinguishes electric power.

This swifter and more silent transportation was to be accomplished with less expense than the present method by steam locomotives.

It is now some years since these sweeping prophecies were first made and in the interval electric traction has had an extended trial on trolley and suburban lines. It is to-day being tested on standard gage trunk lines; and it is safe to say that, as the case now stands, there are no indications that the future existence of the steam locomotive is in any way jeopardized.

In judging of the relative efficiency of the steam and electric locomotives there is one ultimate test by which they will be tried and upon which the verdict will be given—the test of economy. Other things being equal, the engine which can haul a given train-load a given number of miles on the smallest consumption of fuel will be the engine of the future.

There is no sentiment in a question such as this. It is judged entirely from the shareholders' point of view. However much we might like to see our lightning expresses sweeping from city to city impelled by the silent force, it is certain we shall never see that sight until the day comes when electric traction can be produced at a consumption of fuel considerably less than the three pounds of coal per horse power per hour that marks the performance of the best locomotive practice of to-day.

As the case now stands, the economy lies with the steam locomotive, for the reason that the power generated in the boiler is transferred as tractive force directly to the rails, and it is subject merely to the loss occasioned by the internal friction of the engine itself.

In the case of the electric locomotive, in addition to this loss by internal friction in the engine at the power house, there is a loss between the engine and the dynamo; there is a loss in the resistance of the wire that transmits the current, and there is another loss in the motor itself. Now this treble loss of power must in some way be compensated for before the two engines stand even on equal terms. What compensation can the electric locomotive offer? It was claimed that it would be lighter, not having to haul a tender loaded with fuel and water. But it is not lighter.

The new Heilman locomotive in France is to weigh over ninety tons; and the Baltimore and Ohio Railway engine weighs ninety-six tons; and these weights, for the work they are to accomplish, are rather over than under the weights of steam locomotives constructed for similar service. Nor can it be claimed that there is any saving in first cost. A ninety ton electric locomotive cannot at present be built for very much less than a steam locomotive of equal power; and what margin there might be in its favor is largely offset by the cost of the expensive installation of boilers, engines and dynamos, that must be erected at stated intervals along the line; and by the cost of the wiring for transmission of the current.

There remains then the question of maintenance and running expenses. In this respect, for the first time in this comparison, we can see a distinct advantage for the electric locomotive; inasmuch as the purely rotary motion of its moving parts is far less conducive to wear and tear than the combined reciprocating and rotary motion of the moving parts of the steam locomotive. As an offset against this, however, there must be placed the deterioration of the system of wiring, and the wear and tear of the engines and boilers at the power house. It is fair to suppose that the wear and tear at the power house—a part of which is justly chargeable to each of the locomotives that it serves—will fully offset any advantage that the electric may have over the steam locomotive in this respect.

At present there are no statistics available by which a comparison of the cost of labor in the two systems can be made. It is probable, however, that the engineer of a first-class electric locomotive would require the services of an assistant, in which case the expense of the power house staff would have to be reckoned against the electric system in a comparison.

There remains then the question of fuel economy. Unless the electric system can show a very marked economy in this respect, it is evident from the foregoing considerations that a strong case is made out in favor of the present system of steam haulage. The best steam locomotive practice of to-day shows that a modern express locomotive will produce one horse power per hour on the consumption of three pounds of coal. It is doubtful if the best electric light installations can show a better result.

Unless a system of stationary boilers and engines can be produced that will furnish the electric locomotive with its power for one-half the coal consumption that is necessary for the generation of the same power in the steam locomotive, we may rest assured that George Stephenson's invention will remain among us for years to come as the greatest triumph of the modern mechanical world.

THE WORLD'S PRODUCTION OF TIN.

We have before us an extract from the sixteenth Annual Report of Mr. Charles D. Walcott, Director of the United States Geological Survey, for the year 1894-95. It consists of a printed report on the production of tin in the various parts of the world by Mr. Charles M. Rolker.

In the past ten years the total output has risen from 50,299 tons in 1884 to 83,387 tons in 1894. The subjoined table shows that more than one-half of the world's output for 1894 came from the Straits Settlements in the Malay Peninsula.

WORLD'S OUTPUT OF TIN, 1894.

1.	The Straits to Europe and America	46,724
2.	England	8,800
3.	Australia to Europe and America	5,824
4.	Banca sales to Holland	6,139
5.	Billiton sales to Holland and Java	4,764
6.	Bolivian imports into England	3,482
7.	Straits to India and China	4,655
8.	Sundry countries	642
9.	Germany	896
10.	Austria	65
	Total	83,387

The Straits tin mines are the most prolific, and they are probably the oldest, in the world. Before the Christian era the Ethiopians, and later the Arabians, traded with India and "used the Indian name 'Naak' to designate tin, a fact which would point to farther India as the source of the tin industry in those days."

There was a Roman coin in use in the year 500 B.C. which contained 7·66 per cent of tin; and this antiquity of the use of tin is shown by a coin of Alexander the Great, 335 B.C., which contains 13·14 per cent of tin. Historical records for the past two thousand years speak from time to time of the tin that is brought from the Malay Peninsula. The present tin mines of this district are alluvial. The constituent parts of the alluvium vary, as does the depth; but the characteristic covering that has to be removed is of an average depth of ten to eleven feet, and consists chiefly of clay seams, alternating with sand and gravel. The pay gravel has an average depth of eight feet. The process of recovery is by washing in boxes; and Chinese labor is largely employed.

The well known tin mines of Cornwall, England, vary very little in their yearly output; the amount running from 8,000 to 9,000 tons per annum. The metal is recovered from the lode ores by crushing and by smelting. The Australian mines are rich and full of promise, Tasmania alone being in itself the third largest producer of tin in the world, coming next to Cornwall.

The United States, though such a large consumer of tin, does not at present figure as a producer of the metal. The report states that "no tin is being produced in the United States, and the tin occurrences of this country are so far only of geological or mineralogical interest, with indications of prospective value in a few instances." The most promising indications are those found in the Black Hills of Dakota.

Hardening Steel by Gas.

Consul Monaghan, of Chemnitz, reports (June 16) that the Germans are interested in a new process for hardening steel by means of gas. The invention originated with the famous French steel and iron firm Schneider & Company, of Creusot.

It is a well known fact that gas, under great heat, deposits carbon in solid form. Upon this depends its light effects, and also the formation of the so-called retort graphites, a thick covering of pure carbon on the walls of the gaslight retort. The gas that strikes the retort walls deposits part of its carbon upon them. This is the fact on which Schneider bases his very useful invention—a process for cementing together (uniting) steel armor plates.

It is said to be very important in the production of armor plates to have them comparatively soft inside and hard outside. This hardening is obtainable by the application of carbon. Formerly, the process of hardening consisted in covering the plates with layers of coal and heating them till they glowed. Schneider's process puts two plates into a furnace, one on top of the other, with a hollow space between. This space is made gas tight by means of asbestos packing put on around the edges, and the plates are heated red hot, while a stream of light gas is poured into the hollow space indicated. The carbon thrown out by the gas is greedily taken up by the glowing plates until they are thickly covered. The depth of this carbon covering can be regulated by the amount of gas admitted. In order to secure regular and uniform act-

ion during the process, and to prevent the pipes that carry the gas to the hollow space from absorbing any of the carbon, they are insulated in other pipes through which water is constantly circulating. It is believed that this simple and rapid carbonizing process will soon be applicable to many other branches of the steel industry.

William O. Grover.

The death of William O. Grover removes from our midst the last of the original inventors and promoters of sewing machines. A man of ingenious mind, genial disposition, kind hearted, liberal, he will be greatly missed by all who knew him.

He died at his summer residence, in Beverly, Mass., September 5, aged 71.

When the business of the Grover & Baker Sewing Machine Company was sold to the Domestic Sewing Machine Company, in 1876, Mr. Grover retired from commercial activity, and has since lived in Boston, enjoying his large fortune realized from the sewing machine business.

He was a native of Mansfield, Mass., his family being among the oldest of the State.

The Sewing Machine Times says: "William O. Grover and William E. Baker were the original inventors and patentees of the sewing machine that bore their name and for some years was among the foremost in the market. These patents were issued in 1851–52 and the machine placed on the market about 1853. It was built in Boston, where the inventors lived. Mr. Grover was a tailor before turning his attention to the sewing machine.

"The gist of the joint invention of Messrs. Grover & Baker was in making the double loop stitch, which was new, by the circular under-needle and in the so-called 'four-motion' feed. These were two of the most important, in a commercial sense, of all known to the trade, the stitch-forming mechanism being the foundation of the Grover & Baker business, and the feed becoming a necessary element for all successful sewing machines for general purposes, even to this day. After these joint inventions Mr. Grover made many others in the development of the early machines, and from 1856 to 1879 took out seventeen such additional patents. He was not known as an inventor in other lines.

"The four-motion feed patent was one of the most important of those by which the old combination controlled the market, and was the one on which they usually brought suit against infringers. It was reissued to broaden its claims and was extended for seven years, expiring in 1873, after which time the Bachelder patent was the bulwark of the combination.

"An interesting fact revealed by the Patent Office records is the simultaneous invention of the four-motion feed by Grover & Baker and by Allen B. Wilson, of Wheeler & Wilson. Both had applications before the office claiming the four-motion feed, as we have always known and used it. It had never been used commercially. Wilson had, in the previous year, 1851, patented the yielding-pressure feeder, but with only two motions. While the four-motion invention was clearly subsidiary to Wilson's patent, the latter needed the four-motion improvement to make it successful. Of course the struggle was a hard one to obtain control of so valuable a feature. The result of the investigation was in favor of Grover & Baker, who had been able to show that their invention was in patentable shape a few days earlier than Wilson's, and the two patents issued in June, 1852, showed and described the disputed invention, but only one of them claimed it."

The Gum Benjamin Industry in Siam.*

The Gum Benjamin tree is large and tall, and has a heart similar to that of the "teng-rang" (a species of Shorea) and "phayom" (a kind of mahogany). In its general character and in the form of its leaves it resembles the "takieu" tree (a forest tree of hard wood used for making dug-out boats). The Gum Benjamin tree is propagated from the original fruit. This, when fallen and lying upon the ground, takes root and sprouts after the fashion of the "phayom" and "gang" trees. As regards the trunk of the Gum Benjamin tree, there is no one who uses it. Gum Benjamin trees are generally found on elevated ground, and do not like the plains country. They grow in isolated patches like the forests of "teng-rang" and teak. A forest patch of Gum Benjamin usually contains from 50 to 60 trees and upward, and the tree is found generally in large numbers along the high hills in the extensive forest region of Slua Phan, Tangslok and the borders of Muang Theng, in the province of Luang Prabang. It is rarely met with in other countries, except those outside the provinces immediately contiguous to Siam. The Siamese Thai, Annamites and Tongsoos, who have settled in the above-mentioned provinces, have worked out and traded in the Gum Benjamin from an early period for successive generations, and these are scattered among the neighboring people, as well as being frequently found in Siam also. The season for working the Gum Benjamin is from the eighth or ninth months (July and August) to the tenth and twelfth months (September and November), when the season ends.

Thenceforward is the period during which the Gum Benjamin is bought and sold. The Gum Benjamin is worked after the following methods. So many trees are notched so as to form a girdle round the stem. An interval of three months is allowed to elapse between the period of notching and that of picking the Gum Benjamin dammar, which wells out of the trunk and collects in the notches. By means of a sharpened stick or the point of a knife this is picked out, bark and all, and gathered at once in baskets. It is then sorted and divided into different classes, according to choice. Picking cannot commence before the interval of three months has elapsed, as the dammar that has trickled out into the notches would not have had time to harden. It would still be soft and sticky, and if picked at the time would become dirty, owing to the bark coming off with it; nor would it be of such value either, as, being sticky, it would cling to other things, and the full benefit would not be derived, such as would be the case if it were properly dry. For this reason, the Gum Benjamin must be left for three months after the notching, in order that all the gum possible may well out, and it may become dry and hard.

Among the people above mentioned the picking and sale of Gum Benjamin is generally considered as one way of obtaining a livelihood, for the gum has a value, and is reckoned as a marketable commodity. And even if the people have no other occupation but selling Gum Benjamin, that by itself is sufficient as a means of livelihood. The period during which the Gum Benjamin is sold is not necessarily confined to the eighth or ninth months. The reason for selecting that season is because the people of those parts have many other things to do; for instance, they have to plow the fields and reap their rice harvest. In the eighth and ninth months their work on the paddy fields is finished, and they can therefore turn their attention to Gum Benjamin. For this reason there is a special season. Their paddy fields are their first care, and then the Gum Benjamin trade. Those who have no business with plowing paddy fields and planting rice can, if they wish, work continuously at Gum Benjamin at all seasons, and during every month of the year.

The Gum Benjamin trade requires no very great outlay of capital. All the implements required are one large ax, a rice basket, and an open woven basket. If a person wishes to work alone without servants to assist him, he can do so; for in the first stages there is nothing much that requires to be lifted or carried. The only labor necessary would be when the Gum Benjamin is being picked and placed in baskets, and has to be carried to the temporary or permanent home of picker. The profits gained on any one particular occasion or another can hardly be gaged accurately. Those who work out much sell at a large profit, those who work out little sell at smaller profit. One catty (133⅓ pounds) and upward would be considered a large output.

Picked Gum Benjamin is sorted into three classes. The best class, and that which fetches a high price, is called "slua," and is that which is sold in large lumps, and is not dirtied by the presence of bark. The second class is that left over from the first class, and is in somewhat smaller lumps than the latter, and has some, but not much, bark attached to it. This is inferior in quality to Class I, and is half the value. That is to say if Class I is sold at 75 ticals, Class II would sell at 37½ ticals. The third class is that left over from Class II. This class has bark attached to it, is soiled with dust and dirt, and is in fine, small pieces. It is called "mun," and is half the value of Class II. The price of Gum Benjamin as sold in the jungle districts where the gum is worked is as follows: Class I. One Chinese catty (66⅔ pounds), 100 or about 75 ticals. Class II. Half the price of Class I. Class III. Half the price of Class II. The price in Bangkok is: Class I. One Chinese catty, 260 ticals, as it has always been.

The Gum Benjamin trees that grow in the jungle districts referred to are not the subject of disputed ownership by one person more than another. Any one who wishes to work Gum Benjamin has merely to go into the jungle, search for and notch as many trees as he pleases, like people, for example, who go into the jungle to cut posts for their houses. Nor is there any tax or other emolument accruing to the country from either the trunk or the gum of the Gum Benjamin tree; nor is the Gum Benjamin trade one in the prosecution of which much thieving or fighting arises, whether it is because there are many people together at a time, or because, being in the jungle where there are fierce tigers, one man cannot steal along alone by himself, but is obliged to travel with parties, and so robbery and theft are rendered impossible, is uncertain. This gum is sweet scented, and is much used in mixing either with medicines or scents of various kinds. For whichever of these purposes it is sold, it always fetches a high price like other valuable commodities, and for that reason Gum Benjamin is an article of commerce which merchants have bought and sold from time immemorial to the present day.

* From the Kew Bulletin.

The Reagan Water Circulating and Shaking Grate.

Any one who has had to do with the care of boilers knows that clinkers in the grate and scale in the boilers are two of the worst obstacles to rapid and continuous steam raising. The Reagan water-tube grate is a well-tested and very successful device for meeting this difficulty.

The grate consists essentially of a series of longitudinal two-inch water pipes, between and alternating with which are a series of oscillating rockers or "choppers." These "choppers" are arranged on bars which run transversely to the waterpipes and beneath them; the surface of the "choppers" being level with the axis of the pipes.

The water pipes are fitted at their ends into water boxes; each box taking two pipes, and each box being separate from its neighbor. This arrangement allows the system to expand and contract with the variations of temperature.

The "choppers" keep the bottom of the fire clean, and continuously loosen up and carry away the ash and dirt, which, in the ordinary grate, accumulate and necessitate the opening and keeping open of the fire doors during the operation of cleaning. The continuous inrush of cold air during a cleaning cools off the boiler, and rapidly reduces the steam pressure. The water tubes serve a three-fold purpose:

1. They heat the feed water.
2. In doing so they protect the grate by taking up heat that would otherwise destroy the bars.
3. By the system of circulation through these tubes the boiler is kept clean and free from scale. The makers claim that in cases where these tubes have been in use many years, and using very bad water, they have never been troubled with a tube choking up with sediment or scale.

A series of tests of this grate were made last May by the firm of John Brown & Company, of Sheffield, England. In competition with an ordinary grate this showed an evaporation of no less than 43 per cent more water; and it also showed 14·23 per cent more economy. This was certainly a very creditable result.

The results in the testing laboratory are borne out in actual working tests. The Bridgeport Traction Company state that their monthly coal bill has been reduced by the use of this grate from $1,547 to $919.65, a saving of $627.35. The grate is manufactured by the Water Circulating Grate Company, 126 to 128 Filbert Street, Philadelphia, Pa.

Another Sea Serpent.

A great sea serpent was seen off the Jersey coast at Spring Lake, on Sunday afternoon, September 22, at 1:40 P. M. The testimony concerning the monster is well corroborated. It was seen by Lawyer Willard P. Shaw, a resident of Paterson, N. J., with offices in New York City. With him at the time was his wife, three children, and Miss Ella B. D. Salter, of Paterson. The serpent was also seen by Mr. Philip N. Jackson, another cottager at Spring Lake, who is secretary of the Newark Electric Light Company.

An excellent view was had through binoculars while it was passing directly opposite at a distance of not more than half a mile. The head was of a peculiar shape, quite unlike that of any creature Mr. Shaw had ever seen, and was as large around as a flour barrel, but longer. The nose and mouth resembled those of an alligator. There were no tentacles to be seen. The body was smooth and round, of dark color, and apparently destitute of fins. The monster was making its way to the south and skirting along the shore. Its movements seemed to be effected by a vertical undulation of the body. In the course of its progress it would throw itself out at full length on the surface and then sink its body beneath the water, while the head would be uplifted several feet above the waves. Many ships and schooners frequently pass on the ocean where the serpent was seen. From a knowledge of the size and speed of these, Mr. Shaw makes a conservative estimate of its length at 100 feet, and says that its speed certainly exceeded that of any vessel, and was in the neighborhood of 40 or 50 miles an hour. The serpent was followed with the glasses for six or seven minutes, when it disappeared in the distance to the south. The head was the last part that remained visible.

Owing to the lateness of the season, all the hotels along the coast are closed, and, as the afternoon was hot and sultry, few of the remaining cottagers were stirring. For these reasons, and owing to the short time that the monster remained in sight, there was no opportunity to call other witnesses.

A GOOD engine in charge of a good man rarely requires to be stopped in working hours. When one is stopped frequently, adds the Safety Valve, it would be a good plan to find out whether it is the engine that is out of order, or the man in charge of it.