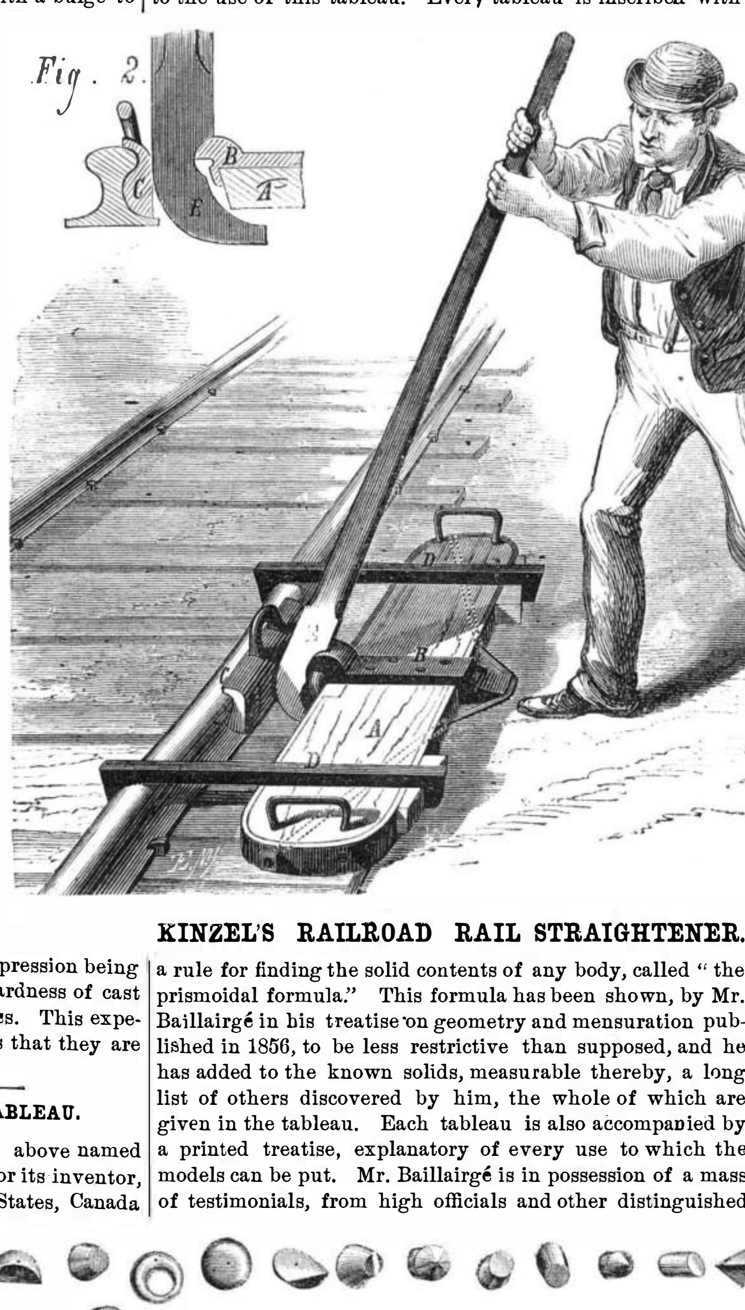
SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE. MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXVI.--No. 23. [NEW SERIES.] NEW YORK. JUNE 1, 1872. $3 per Annum. [IN ADVANCE.]

Railroad Rail Straightener.

Our engraving illustrates what appears to be a useful invention for straightening railroad rails without taking them up or drawing the spikes. A is a truss bearing bound round with a metal band, through which passes a truss rod, the course of which is partly shown and partly indicated by dotted lines. The curved center of this truss rod bears against the rear end of the bearing, B, which is firmly secured to the truss bearing, A. C is a bearing made with a bulge to fit the rail. D D are clamps, which are placed the required distance apart, and wedged so as to hold the truss bearing to the rail. E is a lever with a cam shaped end. The whole operation will readily be understood from Fig. 2, which represents, in section, the relative positions of the working parts and the rail, just before the lever is depressed to straighten it. The inventor states that four or five men will take a crook out of a rail, with this machine, in one minute; to take it up, straighten, and replace it, would occupy them twenty-five or thirty minutes. Its efficiency was proved by straightening a portion of a rail on which rested the driving wheel of a thirty tun engine. Patented through the Scientific American Patent Agency, March 26, 1872. Further information may be obtained of the patentee, G. I. Kinzel, Knoxville, Tenn.



KINZEL'S RAILROAD RAIL STRAIGHTENER.

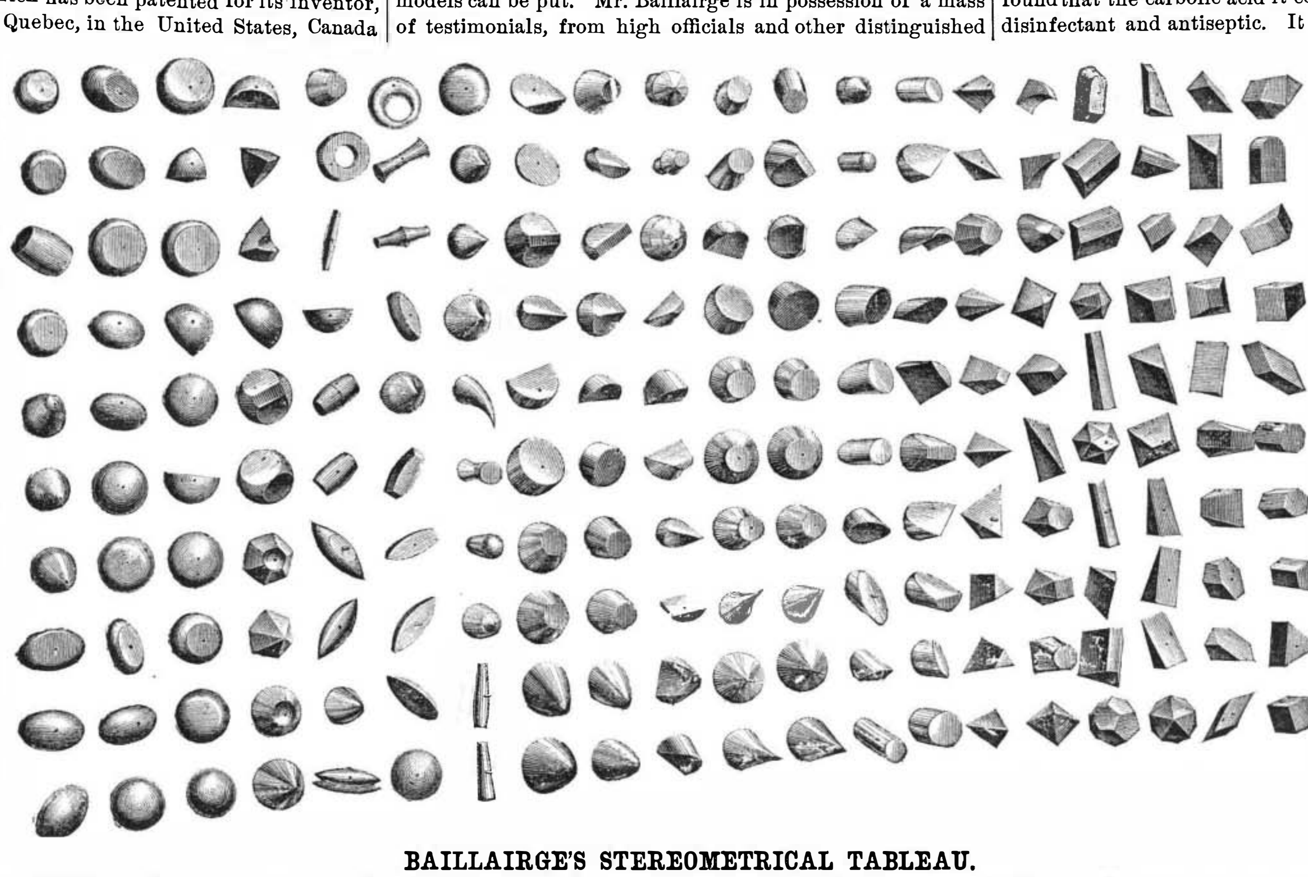
The Effect of Cold on Iron.

The effect of cold on iron, concerning which much diversity of opinion exists, is illustrated pretty forcibly by the experience of the Grand Trunk Railway of Canada, which is exposed to severe cold and a great deal of it. At the recent half yearly meeting of the company, in London, the President said that 3,500 to 4,000 rails on the line break every winter! But he found comfort in the fact that, in about 110 miles of steel track, only eight or ten rails have broken. It was feared when Bessemer rails were first introduced that their resistance to wear would be counterbalanced by unusual liability to break, and that they would be especially dangerous in severe climates, the impression being apparently that, having something of the hardness of cast iron, they had also something of its brittleness. This experience of the Grand Trunk, however, indicates that they are especially fitted for such climates.

BAILLAIRGE'S STEREOMETRICAL TABLEAU.

Our engraving is a perspective view of the above named educational device, which has been patented for its inventor, Mr. C. Baillairgé, of Quebec, in the United States, Canada and Europe. It consists of a board, about six feet long and four feet wide, with some two hundred wooden models, comprising, so to say, all the elementary forms, their segments, and sections, and numerous other solids, simple and compound.

The tableau is set in an appropriate frame, with glass covering, so as to exhibit the models while excluding the dust. The front can be opened at pleasure so as to afford access to the models, each of which is merely supported on the board by a round nail or wire, which admits of its easy removal and replacement by teacher or pupil. The instruction conveyed by this tableau, appealing, as it does, to the uneducated eye and mind, is, the inventor thinks, destined to be of great use in developing the intelligence of the untaught masses of mankind. He expects to introduce it into all the educational institutions of the United States and elsewhere, as it is now being disseminated in Canada; and he has no doubt that the tableau will also find its place in the studio of the engineer and architect, to whom the models will be suggestive of various forms and relative proportions which cannot fail to aid them in their pursuits. The rapid success attained by a school in Quebec, in mensuration of all kinds of surfaces and yet higher mathematics, including conic sections, was attributed to the use of this tableau. Every tableau is inscribed with a rule for finding the solid contents of any body, called "the prismoidal formula." This formula has been shown, by Mr. Baillairgé in his treatise on geometry and mensuration published in 1856, to be less restrictive than supposed, and he has added to the known solids, measurable thereby, a long list of others discovered by him, the whole of which are given in the tableau. Each tableau is also accompanied by a printed treatise, explanatory of every use to which the models can be put. Mr. Baillairgé is in possession of a mass of testimonials, from high officials and other distinguished men, both in Canada and Europe, together with reports of various educational and other institutions, all highly complimentary to him and his invention.



BAILLAIRGE'S STEREOMETRICAL TABLEAU.

Dr. Wilkie, of Quebec, thinks "the government would confer a boon on schools of the middle and higher classes by affording access to so suggestive a collection;" and Professor Newton, of Yale College, considers the tableau "of great use for showing the variety and extent of applications of the prismoidal formula."

Aniline Colors.

Professor C. F. Chandler recently delivered an interesting lecture on the above, before the Polytechnic Association of the American Institute, from which we take the following:

It is well understood that coal is an element of our national wealth, and that we derive from it our power. The combustion of 300 lbs. of coal under a steam boiler will produce a power equal to the mechanical force exerted by a man for a year. Another important application of bituminous coal is to the manufacture of illuminating gas. In this manufacture there are certain residual products, which were at first thrown away; and it is of these that I propose to speak to-night.

Coal tar is produced at the rate of about ten gallons to the tun of coal. Thousands of barrels of coal tar were at first thrown away; but the chemist turned his attention to this substance, and discovered so many products useful in the arts, which could be made from it, that coal tar now finds a ready market at $1·50 per barrel. When coal tar is subjected to distillation, the liquid portion passes off, and there remains the heavy black pitch which is used for roofing and for pavements. The liquid portion, which comprises about one fourth of the original coal tar, produces first a light fluid called naphtha, and then a heavy liquid which is called dead oil. The light liquid is a mixture of carbon and hydrogen, of which benzole is the type. It is C_{12} H_6, that is, taking into account the difference of weight, 72 parts of carbon to 6 parts of hydrogen. Other substances are produced from this, differing by two atoms of each, making C_{14} H_8, C_{16} H_{10}, C_{18} H_{12}, C_{20} H_{14}, etc.; but, until recently only the first two have had any practical importance in the arts. They were used simply as fuel, and as antiseptics, for preserving timber from decay. But lately one of them is claimed to be a specific for the small pox.

After the volatile portions have been removed, there remains this dead oil, which is heavier than water. This was for a long time used as a fuel in glass houses. It was then found that the carbolic acid it contains was a most powerful disinfectant and antiseptic. It was found that it would prevent the spread of the cattle disease, that cattle having the disease in its worst form might be placed with others with safety, if they were protected by this acid. It was found, too, that the durability of timber was increased four or five fold by its application.

But I wish to-night to invite your special attention to the beautiful colors which have recently been obtained from refuse coal tar. They are naturally subdivided into three groups, the aniline colors, those derived from naphthaline, and the carbolic acid colors. I shall confine my attention wholly to the chemical phase of the subject.

Benzole is a hydrocarbon. Bringing that in contact with nitric acid, an atom of nitrogen carries off an atom of hydrogen; and we have nitro-benzole, which is a very fragrant oil, an artificial oil of bitter almonds, used instead of that substance in the manufacture of soaps. When the nitro-benzole is made to give up its oxygen and take up hydrogen, it becomes aniline. Nitrogen is a protean element which gives rise to a great variety of compounds. Ammonia is NH_3; and these three atoms of hydrogen can be replaced by a great variety of substances. Aniline is a similar substance. It is ammonia, replacing one atom of hydrogen by phenyl, which is $C_{12}H_5$. There is no limit to the number of compounds that may be developed on this type; and it opens one of the most important fields of chemical investigation at the present day. All the aniline colors are derived from N_3H_9, converted by the process of substitution into new compounds. The first investigation in this direction, which, however, did not result in any practical product, was that of a German chemist, who found that by treating aniline with chloride of lime, he produced a violet or purple tint. Perkins, who was the first successful manufacturer of color from coal tar, manufactured a substance to which he gave the name of mauve. Then came the discovery of the rose aniline, which is produced from commercial aniline, pure aniline not answering the purpose. Subjecting commercial aniline to the action of nitric acid, and then to the action of nascent hydrogen, we obtain rose aniline, which is $C_{40}H_{19}N_3$. The chloride, hydrochlorate, arseniate, acetate, nitrate, and other salts of this substance produce the beautiful tints of which I have specimens here. Hoffmann found that he could change this beautiful red tint of the rose aniline to various shades of violet, by simply boiling it with more aniline. This introduced more phenyl in the place of hydrogen. One atom made it purple, another more bluish, and a third atom of phenyl made it the most beautiful blue that has ever been manufactured.

Replacing the hydrogen with ethyl, C_4H_5, or with methyl, C_2H_3, we obtain still further colors. In every case the beautiful rose red becomes more and more purple, until the substitution of the last atom of hydrogen converts it into a deep and perfect blue. On carrying the investigation further, it was found that by proper treatment the blue color could be converted into a green, by using ethyl and methyl. Subsequent treatment developed an entirely different base, having the form $C_{40}H_{17}N_3$, with yellow tints; and further treatment produced a brown and finally a black; so that the most durable black for calico printing is now obtained from aniline.

From the coal tar obtained from a tun of coal, three fourths of a pound of this beautiful color are produced. The coal, which is worth about $6, produces the gas, the coke, the ammoniacal water, largely used for agricultural purposes, the carbolic acid, used for the preservation of timber and as a disinfectant, and finally this beautiful color, which alone is worth nearly as much as the coal originally cost. The amount of this industry has become so enormous that at present five tuns of this raw aniline oil are manufactured daily on the continent alone, and 90,000 lbs. of iodine are used in effecting the substitution; and yet it is an industry which has started since 1860.

A word with regard to the carbolic acid colors. The carbolic acid is obtained by treating the dead oil with an alkali. This furnishes a number of coloring matters. Carbolic acid is $C_{12}H_6O_2$, or it is the oxide of benzole, which is $C_{12}H_6$. Treating carbolic acid with nitric acid, we produce $C_{12}H_3(NO_4)3O_2$. Picric acid is a substantive dye for silk and wool, uniting with them without any mordant. Treating picric acid with the cyanide of potassium, an acid is produced which gives beautiful garnet colors on silk and wool. By treating carbolic acid with soda and the oxide of mercury, it is converted into rosolic acid, which produces various shades of orange, and is used for coloring house paper. Treating this with ammonia, it produces a scarlet tint. The intimate connection, existing between the rosolic acid and the aniline colors, is shown by the fact that, by treating rose aniline in anhydrous acid, the same result is obtained. From this orange red of rosolic acid, can be produced a deep blue color by the action of aniline.

There is a series of naphthaline colors, but they are not found to be fast, and I will therefore pass them by.

When coal oil is distilled, and 25 or 30 per cent of volatile products are removed, the result is solid, and is called anthracene. Recently, from this, there has been artificially produced the coloring matter of madder. The colors from aniline had proved brilliant and durable for silk and wool, but not for cotton fabrics. It is now a question whether the colors from anthracene will supply this want, and whether they will be found to be permanent.

QUICK STEAM LAUNCHES.

BY F. J. BRAMWELL, ESQ., C. E.

For some little time past, the interest of naval architects and engineers has been excited by the reports which have from time to time been given in the newspapers of the performances of steam launches built by Mr. Thorneycroft, of Chiswick. From these reports, it has appeared that steam launches of about 50 ft. in length have attained speeds varying from seventeen to nineteen statute miles per hour, or 14 4-7 to 16 2-7 knots per hour speeds which even in this day would be considered very good for the finest sea going steamers, and speeds which have hitherto been regarded as impossible unless the vessel were at least 200 feet in length. The writer, having been much struck with these statements and with those made to him by engineers who had witnessed the performances of the launches, thought it might be interesting for the Institution to have a short paper upon the subject. He, therefore put himself in communication with Mr. Thorneycroft, who kindly allowed him to make what experiments he thought fit. These experiments, which have taken place within the last few days, have been made on the *Miranda*. The length of the *Miranda* over all is 50 feet: ditto, on water line, 45 feet 6 inches: the beam 6 feet 6 inches; ditto, on water line, 5 feet 9½ inches; the draft of water in running trim with six persons on board, and with 3 cwt. of coals, is 2 feet 6 inches, taking the extreme depth of the screw. She is built of steel, the general thickness of the plates being 1-8 inch to 1-16 inch. She has a pair of inverted direct acting engines having cylinders of 6 inches diameter by 8 inch stroke. These engines make up to as many as 600 revolutions or 800 feet of the piston per minute: their ordinary working speed, however is less than this. They drive a two bladed screw of 2 feet 6½ inches diameter and 3 feet 4 inches pitch. This screw is abaft the rudder, which is made in an upper and lower part joined by a bow, so as to pass the shaft which is placed out of the horizontal line to the extent of 1 in 28, the after end of course being the lower. The boiler is of steel, of the locomotive type, and has a total heating surface of 116 feet, and a total fire grate surface of 41¼ feet; the barrel plates are 5-16 inch thick, the fire box external plates also 5-16 inch; and the internal, which are copper plates, are ⅜ inches thick; the stays of the fire box are ⅜ inch, and 4 inches apart. The fuel is coal. The boiler is fed by a three millimeter Giffard injector. The whole weight of the engines and boiler with water in it up to the working level, and of the propeller, is about 40 cwt. to 41 cwt., or 4,448 lbs. to 4,560 lbs.

A point which the writer thought it would be interesting to note was the gross indicated horse power at each of the speeds. So far as the writer has ever heard, no one has attempted to indicate engines at anything like 500 revolutions per minute. At 300 revolutions the horse power was 11·05, at 600 revolutions, 71·61, 400 revolutions, 23·45, and 500, 42·31. The next thing to be ascertained was what was the speed of the boat at these varying revolutions. For this purpose, it was determined to take the ordnance measurement from Barnes railway bridge to Putney old bridge; this appears by measurement to be three and a half statute miles and eighty-eight yards. A counter was kept in gear; the total number of revolutions was 6,131, giving a mean of 530 a minute. It was clear a greater speed could have been maintained so far as the engine and boiler were concerned; but it was feared that the injector was hardly large enough to supply the required quantity of feed water, and therefore the link was notched back.

The total number of revolutions was 6756, giving just under 580 revolutions as the mean per minute. At the very last of the run, the engines were making 600 revolutions per minute, Mr. Thorneycroft having found that he had water enough in his boiler, and being thereby enabled to give the engines full steam without risk. The mean speed was 18·36 miles per hour. Runs were then made upon the measured mile at varying revolutions; 555 revolutions give 18·65 speed; 500 give 16·15 speed; 400, 11·82 speed; 300, 11·05 speed; 200, 4·02 speed; 100 revolutions could not be taken, as it would not have given a rate sufficient to have stemmed the tide.

The slip of the screw was for 500 revolutions 14·7 per cent; for 400 hundred revolutions, 21 9 per cent; for 300 revolutions, 12·9 per cent; and 200, 7.1 per cent. The highest point of observation on which any measurement was taken was 555 revolutions, at which point the slip of the screw was 11·3. The displacement of the boat at the draft at which she was tried was 3·73 tuns. If the speeds at the varying revolutions be reduced from statute miles into knots, and then the formula $V^3 \times D^{\frac{2}{3}} \div 1$ H. P., be employed to ascertain the coefficient of steamship performance, the following results will be obtained: At 500 revolutions, the coefficient will be 150; at 400 revolutions, the coefficient will be 106; at 300 revolutions, the coefficient will be 131, etc.

In conclusion, the writer has to thank Mr. Thorneycroft, and he thinks the Institution will also thank him, for the readiness with which he has allowed these experiments to be carried out; and more than that, for having made that which the writer believes to be a real step in the science of steam propulsion. And he trusts that these unusual and wholly unexpected results of speed will call the attention of naval architects and engineers to the subject of improving the velocity of large sea going steamers.—*Engineer*.

The Star Depths.

Mr. Richard Proctor recently delivered, at the Royal Institution, a lecture on star depths. He dwelt on the contrast between the ideas which we form from the aspect of the starry heavens, on a calm clear night

> When all the stars shine
> And the heavens break open to their highest,

and the scene disclosed to the mind's eye of the astronomer. Each star, amid the solemn depths, is in reality a sun, instinct with fiery energy and urging its way with inconceivable velocity through space. Nor are these suns exempt from mutation. Several among them are losing year by year a portion of their light and heat, equal to the requirements of our earth, or of the whole solar system even for hundreds of years; others are growing brighter; new stars have appeared, and stars known to the ancients have vanished. Thus the question arises whether our sun, a star like the rest, may not also be subject to changes. If so, the question is one of extreme interest to ourselves, not as directly affecting our wants, but as involving the very existence of more or less remote generations. To obtain a direct answer to the question would require observations of the sun continued with unflagging patience for many years. But indirectly the question may be answered by comparing the present aspect of the heavens with the scene presented to those who first studied the stars. The lecturer then proceeded to inquire whether any traces remain of those features of resemblance which first led the ancients to call certain star groups by certain names. He showed that, though the constellations of the Great Bear and the Lion as at present figured do not in the least remind us of the animals they are supposed to represent, yet the figures of these animals may be fairly traced if we include larger regions of the heavens than the present constellation boundaries permit. For instance, if *Canes Venatici* be included with *Ursa Major* and the three stars at present regarded as the tail (of a tailless animal) be regarded as forming an outline of a part of the back, then we have a figure not unlike a bear. Again, if we regard the group of stars forming the northern claw of *Cancer* as marking the place of the lion's head, the stars in *Leo Minor* as forming the mane, and *Coma Berenices* as the tufted tail of the animal, then the space thus indicated will be found to include a very fair representation of a lion. In like manner the stern of the ship *Argo* is very fairly indicated if the stars forming the hind legs of *Canis Major* are included in the configuration. Hence the lecturer arrived at two conclusions—1st, that the ancients were not solicitous to occupy the heavens with constellations fitted in like the countries in a geographical map; and 2ndly, that the stars exhibit at present the same general configuration which existed when the most ancient constellations were formed. From the second of these conclusions, we may infer that probabilities are on the whole in favor of a satisfactory degree of steadfastness in the sun's luster.

The remainder of the lecture was occupied by an explanation of the general principles on which the determination of stellar distances depends. This introduced the consideration of the enormous extension of the stellar universe when, with distances from star to star so enormous as have been proved to exist, the number of stars is so vast as to be practically infinite. Amongst the illustrations of this part of the lecture was an illuminated diagram showing 324,198 stars; but the lecturer mentioned that the Herschels' 18 in. telescope would show 530 times as many stars and the great Rosse telescope, more than 2,000 times as many.—*Mechanics' Magazine.*

Liebig on Lager.

A correspondent has interviewed Baron Liebig, the celebrated German chemist, at his home in Munich, and gleaned his views upon the lager question. "Beer," said the Baron, "is better than brandy. Man must have a stimulant of some sort. Brandy is a great evil. We find that the consumption of beer is making great headway even in wine districts—for instance, in Stuttgart. As a nourishment, beer takes a very subordinate place, not higher indeed, than potatoes; and we find that in no city is there such an amount of meat consumed as in Munich, where the greatest quantity of beer is also consumed. Beer must have meat or albumen. Before every beer cellar in Munich, you will find a cheese stand. Why? Because in cheese you will find that albumen which in beer is lacking. Therefore you see that beer and cheese go together by a law of Nature! But as an article of nourishment, beer is very subordinate. Schnapps is a great misfortune, and destroys the working power. Through our late war, we have won great respect for tobacco, tea, coffee, and extract of meat. A physician told me that, when the wounded would take nothing else, they have grasped at cigars; their eyes glistening—they felt a lifting up of the sinking nerves. Tobacco must have this effect. We could not do our wounded, frequently, a greater service than by giving them cigars. And we came to the conclusion that tobacco was valuable to us." Baron Liebig evidently looks to America for an improvement in beer and the perfection of beer drinking. Said he: "It is a peculiarity of Americans that they make everything better than we do. I am convinced that American beer will, in time, be better than German. With us everything remains as it was. The worst beer brewers are in Bavaria—though it was earlier the best. And why? Look into our brewery system. The brewers are only ignorant people, who brew good beer from routine alone. They are incapable of helping themselves. But as soon as the Americans get any thing from us they improve upon it, and we get it back again as an American discovery."

Arabian Mode of Perfuming.

How the Arab ladies perfume themselves is thus described by Sir Samuel Baker in his work on the Nile: "In the floor of the hut or tent, as it may chance to be, a small hole is excavated sufficiently large to contain a champagne bottle. A fire of charcoal or simply glowing embers is made within the hole, into which the woman about to be scented throws a handful of drugs. She then takes off the clothes, or robe which forms her dress, and crouches over the fumes, while she arranges her robe to fall as a mantle from her neck to the ground like a tent. She now begins to perspire freely in the hot air bath, and the pores of the skin being open and moist, the volatile oil from the smoke of the burning perfumes is immediately absorbed. By the time the fire has expired, the scenting process is completed, and both her person and her robe are redolent with incense, with which they are so thoroughly impregnated that I have frequently smelt a party of women strongly at full a hundred yards distance, when the wind has been blowing from their direction. The scent, which is supposed to be very attractive to gentlemen, is composed of ginger, cloves, cinnamon, frankincense, and myrrh, a species of sea weed brought from the Red Sea, and lastly the horny disc which covers the aperture when the shell fish withdraws itself within its shell. The proportions of these ingredients in this mixture are according to taste."

THE support of one of the large tuns of ale in Coolidge, Pratt & Co.'s brewery, containing from 400 to 500 barrels of boiling beer, recently gave way all of a sudden, letting the vat fall and spilling the beer. Loss, $4,000.