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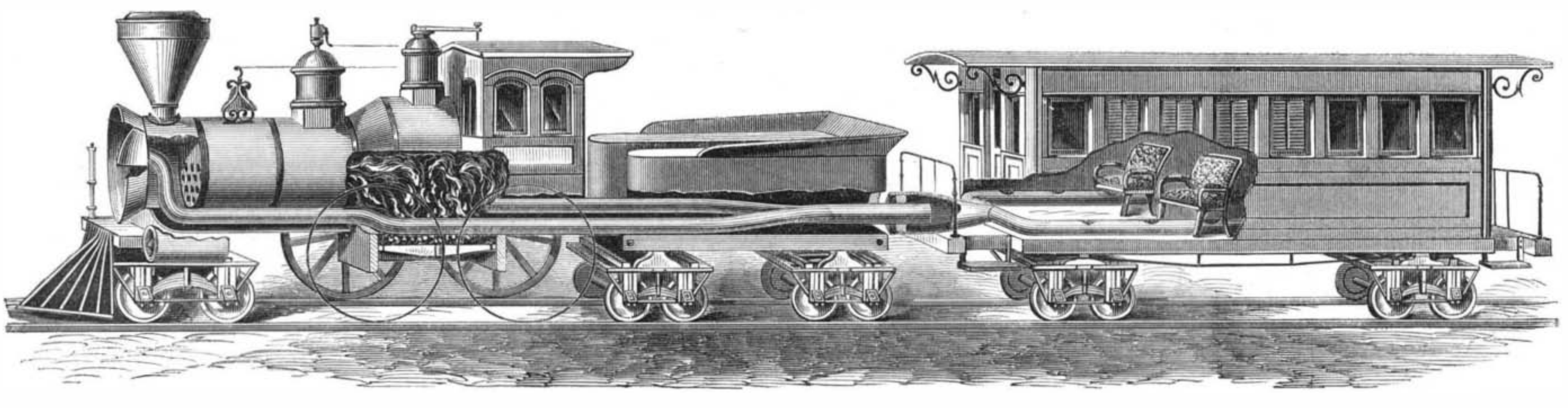
Novel Device for Heating and Ventilating Railroad Cars.

The object of the device seen in the accompanying engraving is to utilize the heat of the boiler and fire box of a railroad locomotive to warm a train of cars in cold weather, and to ventilate the cars with pure air free from dust or cinders in summer. The arrangement is quite simple. The front of the locomotive is provided with a funnel-shaped mouth, from which a pipe leads down under the boiler, and in close contact therewith. At the forward end of the fire box it divides nto two branches; one passing along each side and through the tender, at the rear of which they again unite. Each car is furnished with similar pipes passing along under the seats, and fitted with registers that may be opened and closed at will. The union between the pipes of the different cars is plainly seen in the engraving, a bell mouth containing a packing for the end of the pipe, but sufficiently yielding to allow of lateral motion in rounding curves, etc. The front end of the pipe has a hood inside the funnel mouth, to prevent rain or snow from entering.



FRANCIS' CAR HEATING AND VENTILATING APPARATUS.

It is evident that if the pipes were left exposed to the atmosphere, but little heat could be realized; but to overcome this difficulty the inventor, for winter service, proposes to put a heavy non-conducting jacket entirely around the boiler and fire box, or sufficient to inclose the larger portion of the heating surface and the pipes. The other exposed portions of the pipe are also similarly protected. In the summer the jacketing of the locomotive is removed, and the pipe exposed to the external air.

Patented April 28, 1868, by Dr. Samuel W. Francis, who may be addressed at P. O. Box 240, Newport, R. I. The entire right is for sale.

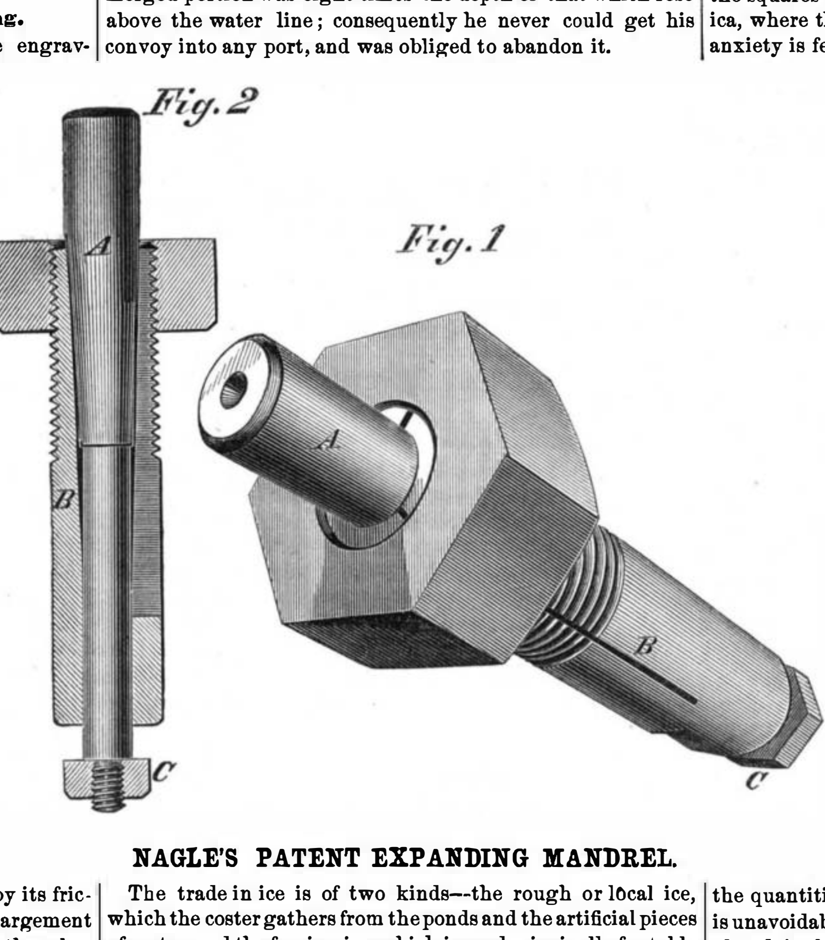
Improvement in Mandrels for Turning.

The mandrel, one form of which is shown in the engravings, we have lately seen in use in one of the best machine shops in Connecticut, and was struck with its simplicity, ease of operation and evident handiness. It may be threaded to receive a nut for facing up and chamfering, or left plain to receive a gear, pulley, coupling, or anything that requires turning and facing.

Fig. 1 is a perspective view of the mandrel with a nut screwed on ready for facing, and Fig. 2 is a longitudinal section. The arbor, B, is bored through from end to end, the hole, for a portion of the length, being slightly tapering, as seen plainly in the section. From the open end of the taper the mandrel is sawed lengthwise into three equal parts, the slots extending back a distance adapted to the work to be done. A plug, A, fits the hole in the mandrel, and when driven in, it slightly expands the mandrel, holding whatever is seated on it very firmly, the expansion being equable, as the taper of the plug and of the conical hole exactly coincide. A slight tap on the other end of the plug releases the bearing by allowing the parts of the mandrel to resume their former position, a small nut, C, on the end preventing the plug form falling out and getting bruised or lost.

The ordinary smooth mandrel used for turning pulleys, etc., upon, must be turned slightly tapering, while the hole it is intended to fit should be perfectly straight. The mandrel must be driven through until its surface engages sufficiently to hold the object to be turned by its friction on the interior surface of the hole. A slight enlargement of the hole will change the position of the article on the arbor or mandrel, which, especially in turning a taper, as in facing a pulley(which is highest in the middle), is a great annoyance. With this expanding arbor, however, the pulley may be placed at any point on the mandrel and held evenly and firmly.

But in squaring up nuts its advantages are still more apparent. In addition to those already mentioned, the nut may be placed, as seen in the engravings, so that the face shall project beyond the end of the arbor, and neither the arbor itself nor the point of the tool be injured, while the cut will reach to the bottom of the thread. Beside this, the face of the nut will be always at right angles, or square with the thread, a result not always practicable with the ordinary method of squaring up nuts. Patented August 4, 1868. The mandrels are made of all sizes to the standard gages by the inventor and manufacturer, A. F. Nagle, who may be addressed Box 347, Providence, R. I.



NAGLE'S PATENT EXPANDING MANDREL.

THE ICE TRADE.

During the late tropical weather, ice represented a real power in the community, just as in winter coal is an absolute necessity. No doubt if a few hot summers were to succeed each other we should speedily find as bountiful supplies of ice as we now do of fuel. The polar circle would be our mines, or we should lie in wait for the magnificent procession of icebergs which, according to Captain Scoresby, issue from their breeding places in Davis's Straits, and proceed southward until they touch the warm waters of the Gulf Stream, where they are a constant source of danger to passing vessels. A story is told of an American skipper who sailed upon an expedition in search of one of these bergs, grappled it, and promised himself a splendid reward. In tugging the glittering mass into harbor, however, he forgot that its submerged portion was eight times the depth of that which rose above the water line; consequently he never could get his convoy into any port, and was obliged to abandon it.

The trade in ice is of two kinds--the rough or local ice, which the coster gathers from the ponds and the artificial pieces of water, and the foreign ice, which is used principally for table purposes. The glittering cubes of pure crystal we are accustomed to see on the fishmongers' slabs and in the windows of the Wenham Lake Ice Company are all procured from Norway. A few years since this company procured their supply from Wenham Lake, near Boston, but the expense of freight rendered it so costly that they were obliged to seek for sources nearer home. In the hills situated a few miles from Dröbäk in Christiania Fjord there is a very pure lake fed entirely by springs belonging to this company, and from this source all the pure table ice is now supplied. There is a notion that water while in the act of congelation is purged from all foreign matter. This is only partially true. All its mineral salts and any coloring matter it may contain are removed from it, but no organic matter is eliminated in the process. For this reason the clearness of the ice is no test of its purity; many a glittering lump when it dissolves absolutely smells. We state this by way of caution to those who think that the eye is the most perfect test of the purity of this grateful addition to the table. The Wenham Lake Ice Company, when they had satisfied themselves that the piece of water from which they secure their supplies was free from any impurity, not only purchased the lake but the farms surrounding it, in order to keep it in their own hands and secure it from any deleterious local drainage; and it is from this crystal cup that their translucent crops are gathered year by year. The process of reaping the ice crop is the same in Norway as in America. By the aid of a sharp ice plow the surface is ruled with parallel lines 21 inches apart; when the whole surface is marked in one direction the plow is set to work at right angles. In this manner the whole surface is divided like a chess board into squares 22 inches square and about a foot in depth; the ice saw divides these parallel lines, and, by the aid of the spade, a sharp wedge like implement, the squares are split apart with the utmost rapidity. In America, where the weather is at times changeable, the greatest anxiety is felt while the process of reaping is being carried on, lest a thaw should come on and spoil the harvest. It is gathered in as fast as possible into the ice houses, which are, in fact, enormous refrigerators, built of pine wood, with double walls two feet apart, the intervening spaces being filled in with sawdust, which is one of the cheapest and most readily procurable non-conductors. In Norway, where the cold weather is not so liable to be broken up as in America, the harvest is gathered more at leisure; it is secured in the same manner, however, and the ice stores are on a very large scale, sufficient to afford a supply for two or sometimes three years. It seems absurd to talk of ice two years old: to keep the hand of Time from such a perishable article seems an absurdity, but as a fact, much of the table ice now supplied to us was reaped in the latter end of the year 1866. There is scarcely a fjord in Norway in which some trading vessel is not frozen in during the winter months, during which they ship a cargo and run over to England with the first favorable wind. The voyage with a fair wind is not more than four days, hence this island imports nearly the whole of the crop. Thus, in 1865, out of 44,823 tuns exported, this island received 43,359 tuns. The block ice is filled in with rough ice, and during its transport to the ice stores loses ten per cent. These blocks of ice are treated just like blocks of stone; the tools they are lifted with are similar. Considering the quantities that are dealt with, a certain rough handling is unavoidable. When hoisted out of the ship's side they are placed in barges, and conveyed up to the storehouses, protected from the sun only by a tarpauling, and that a black one. It is, therefore, extraordinary that the loss by melting is not more than it is during transport The loss is at least 50 per cent before it is vended to the purchasers.

When the ice-blocks are stored sawdust is placed in layers between them, and in this manner the rough Cyclopian masonry is built up. If the blocks were placed one upon another without the interposition of any non-conducting substance the whole would become frozen into one solid mass, which would be very difficult to deal with. The blocks, weighing 1 cwt. and ½ cwt., are forwarded to customers in the country packed in bags filled with saw-dust. The amount of importation of ice from Norway depends entirely upon the weather here during the preceding winter. It must not be supposed that the main portion of the ice consumed in this country is brought from abroad. Now, as of old, during a hard frost, nine-tenths of the ice consumed in the year by the fishmongers and the confectioners is procured from local sources. The quantity consumed at table is a fleabite to that which is employed in the preservation of food, and for this purpose rough ice is cheaper and better, for the reason that it freezes the matters subjected to it quicker than the block ice. Some of the dealers in rough ice, store away enormous quantities during a hard winter. Some of the wells belonging to them hold a couple of thousand tuns. As it is shoveled in by the costermonger from the parks, or the canals, so it remains until the whole is frozen into a solid mass, which has to be broken up with pickaxes when it is required. Fishmongers consume very large quantities of this rough ice, and the fishing smacks are now enabled to remain at sea a week or ten days by the aid of the ice they carry with them to pack away the fish as fast as it is caught.

Of course tropical weather such as we have had lately greatly increases the quantity consumed, both for the purposes and by way of a supplementary supply to our rough ice. For this reason all figures with reference to the imports of this commodity are fallacious as tests of the aggregate quantity consumed. Unlike the Americans, our taste for ice in our drinks depends upon the state of the thermometer. As a rule the Englishman likes his drink warm. Brother Jonathan, on the contrary, likes it cold. A piece of ice is heard tinkling in the tumbler as often in the winter as in the summer; he acquires during the tropical heat a habit which he continues throughout the arctic cold of his winters. Hence the consumption is pretty uniform throughout the year and nothing surprises him more when in Europe than the sparse manner in which this, to him, necessary of life is used.

During the present season Paris has been largely supplied with glacier ice from Switzerland. This is a great innovation, and possibly will produce a revolution in the ice trade. The desert mountain peaks, glittering in the sun on many an Alp, hitherto valuable only in a pictorial point of view, may come to be commercially valuable. When that day arrives, good-bye to the picturesque in one form at least; it will be sledged away to cool the palates of the snug citizens in the continental capitals. In the majority of cases, however, the glaciers are far too inaccessible to make the ice crops gathered from them commercially profitable.

If the ice trade between America and Europe has fallen off of late years through the greater accessibility of the supply from Norway, the former country still monopolizes the supply to the West Indies, the South American continent, and the East Indies, India, and China The crop of the winter of 1867–8, which seemed to be providentially abundant, in contemplation of the coming hot season, was one of the finest ever known—88,496 tuns were cleared for export from Boston in that year to the countries we have mentioned. The waste on the voyage in these warm latitudes renders block ice so costly in Australia that it is found more economical to produce it artificially by refrigerating machines, and such, worked by steam, capable of freezing thirty tuns per day, are now at work cooling the palates of the Australians, whose liberal habits with respect to the consumption of ice partake more of the American character than our own.

The value of ice as a preserver of life, as well as of animal food on the long voyage to our antipodes, has lately been shown in the successful transportation thither of salmon ova. After many failures, consequent upon attempts to preserve them in the same manner as in this country—namely, by placing them in a running stream of water, at the suggestion of Mr. Moscrop, of the Wenham Lake Ice Company, they were packed in moss and placed between blocks of ice in the ice well of the ship conveying them. This last experiment succeeded, and young salmon are now plentiful in the rivers and preserves of Tasmania. In return for thus exporting a valuable form of fish life to our distant children, they, as in duty bound, have attempted to make some adequate return—to send to the mother country some portion of the animal food which is a mere drug in their own market. Cargoes of beef and mutton in the carcass have been packed in ice and sent home. It arrived quite fresh, but the failure of this process, by which it was hoped to have fed one hemisphere with the redundance of another, was owing to the fact that iced meat required to be consumed immediately; the moment the protection of the ice is removed decomposition sets in with a rapidity which prevents any delay in the hands of the salesman. We may mention, by the way, however, that ice having failed in the chemical process of preservation of animal substances, known as Dr. Medlock's process, is possibly destined to accomplish the end required, and experiments are now being carried on by the Society of Arts to test its value.

Ice having been successful in preserving fish eggs, it is now being tried in the transportation of the eggs of various birds suited to the Australian colonies, and no doubt the substance that is so inimical to life when long exposed to its influence will speedily be made the agent in preserving in its embriotic stage from a too speedy development and death—in annihilating as it were the effect of the death-dealing tropical heat, which has hitherto rendered it impossible for the Englishman to surround himself with his accustomed animal life in his new found home.—*London Times.*

French Leather—How it is Made.

Pont Audemer is watered by no less than eight little rivers, all of which unite in the Risle, within the limits of the town. The little streams are carried zig-zag through the town, stopped here and there by locks and turned aside into canals and ditches, run through scores of mill wheels, carried one over the other in aqueducts, and so generally turned about every street and alley, that almost everybody in town can fish out of his chamber window. It is impossible to enter the town and go to the principal church without crossing at least two bridges. All along the edges of the little rivers may be seen groups of washerwomen, at work from morning till night, each kneeling in a little wooden box, to keep her knees dry, and turning the linen she is washing on a smooth flat stone, and beating it with a wooden paddle. There is probably not a washtub in all France.

THE FRENCH TANNERIES.

But it is not for the benefit of the washerwomen that all these streams have been captured and brought to town. It is for the tanneries. French leather is the best in the world beyond question. The leather of Pont Audemer is the best in France, and sells for from three to five cents more per pound than any other. This fact is all the more worthy of attention, for the reason that no remarkable patent proceeding or chemical process is used, but the leather is simply tanned in the good old way. Your correspondent is, like the *Republican*, radical, and believes in the latest invention, and the newest step of progress, but for once he feels obliged to change his colors, and these are his reasons: Upon his feet at this moment are a pair of boots, bought ten months ago at Pont Audemer at the cost of $4. They have been worn constantly ever since, and have done hard work, and taken very long walks. Yet there is not a frayed spot, nor anything to indicate that with prudent half soling in the future, as in the past, they will not last forever. They are made of calf, tanned according to old fashioned principles. Let us, by all means, have some conservatism in leather—the more the better. The hides used here come very largely from Buenos Ayres, the more so that the specialty of the town is rather in the sole and heavy harness leathers than calf. The calf comes largely from the United States, having been already tanned there. Here it is tanned all over again, and comes out the very best boot leather in the world.

The details of a great tan yard are hardly as agreeable to see and recount as some museum of pictures or fantastic old ruins of castle or abbey; but, after all, it is not so bad in the artistic point of view. The long, low sheds where the bark is stored; the yard stream, with rich brown tan, almost red in the sun light; the vats, half filled with inky-black water; the little stream that bubbles through among the strangely-shaped buildings, where, through open doors, are seen the bare-armed workmen bending over their task, make up a picture which does not lack in charm to the eyes. To the nose it is a different affair.

TAN BARK.

To commence at the beginning of the process, we will first pay attention to the tan bark. It is of course oak; but it is not, as in America, taken from large trees, for the simple reason that the larger the tree the weaker the tan. The bark is assorted according to the size or age of the tree from which it is taken. The smallest is very strong, and used for the very heaviest sole leather, and saddle leather particularly. A coarser grade of bark serves for common cow hides, strop leather, etc., and a still coarser for sheep, calf, and the light hides that are used for making glazed leathers. The way of grinding the bark is of more importance than it would seem at first thought. The mills consist of a long trough in which to put the bark, and a number of perpendicular wooden beams, which the machinery raise and let fall on the bark by means of an eccentric wheel. The beams are shod with an iron plate which terminates in a number of teeth or blades. The bark is thus half broken and half chopped in pieces, and is not reduced so finely as in the ordinary iron mills, but the inner portion of the bark, where the greater part of the tanning is, is reduced to a powder almost impalpable, so that the solution of the salt it contains is greatly facilitated. For heavy leathers this method of grinding is of prime importance, giving advantages both in time and quality of leather.

THE FRENCH SYSTEM OF TANNING.

The hides are first thrown into a vat of lime water, where they remain until the hair is loosened, then they are taken out, the hair removed, and the hides put to soak in the river to remove the lime. After this they are scraped and carried to vats, where they are covered with "juice of tar"—that is, water in which tan bark has been soaked, until the solution is as strong as possible. After three or four days, the hides are again removed and scraped, and put into the vats, where the process is achieved. Here we find the first essential difference between the system of America and the French. In America, the hides are put into the vats with a good deal of water—here they are put in and packed firmly in the vats dry Then, when the vat has been filled up over them with three or four feet of tan, a few pails of "juice of tan" is poured over, hardly enough to moisten the whole mass.

The hides remain in these vats for at least six months—sometimes two or three years, the longer the better. For first class leather a year is required; but such is the increase of value in hides, in proportion to the time they rest in the vats, that they could not find a better investment for their money. Seven to ten per cent a year is added to the value of the leather by resting in the vats up to four years, after which time there is no further motive for letting it remain, as it has absorbed all it can contain of the properties of the tan After coming out of the vats. the leather is scraped, rolled, dried. and curried; but all these are operations that have no influence on the durability of the leather, being simply matters of ornamentation and finish. The secret of

THE EXCELLENCE OF FRENCH LEATHER

is resumed in these three observances:—1st. Using strong tan, *i. e.*, the bark of young trees. 2d. Packing the leather in the vats dry, and wetting the least possible. 3d. Letting the leather stay a long time in the vats.—*Cor. Chicago Rep.*

Preservation of Leather.

A contributor to the *Shoe and Leather Reporter* gives some valuable hints in relation to the preservation of leather. The extreme heat to which most men and women expose boots and shoes during winter, deprives leather of its vitality, rendering it liable to break and crack. Patent leather, particularly, is often destroyed in this manner. When leather becomes so warm as to give off the smell of leather it is singed. Next to the singeing caused by fire heat, is the heat and dampness caused by the covering of india-rubber. India-rubber shoes destroy the life of leather. The practice of washing harness in warm water and with soap is very damaging. If a coat of oil is put on immediately after washing the damage is repaired. No harness is ever so soiled that a damp sponge will not remove the dirt; but, even when the sponge is applied, it is useful to add a slight coat of oil by the use of another sponge. All varnishes, and all blacking containing the properties of varnish should be avoided. Ignorant and indolent hostlers are apt to use such substances on their harness as will give the most immediate effect, and these, as a general thing, are most destructive to the leather. When harness loses its luster and turns brown, which almost any leather will do after long exposure to the air, the harness should be given a new coat of grain black. Before using this grain black, the grain surface should be thoroughly washed with potash water until all the grease is killed, and after the application of the grain black, oil and tallow should be applied to the surface. This will not only "fasten" the color, but make the leather flexible. Harness which is grained can be cleaned with kerosene or spirits of turpentine, and no harm will result if the parts affected are washed and oiled immediately afterward. Shoe leather is generally abused. Persons know nothing or care less about the kind of material used than they do about the polish produced. Vitriol blacking is used until every particle of the oil in the leather is destroyed. To remedy this abuse the leather should be washed once a month with warm water, and when about half dry, a coat of oil and tallow should be applied, and the boots set aside for a day or two. This will renew the elasticity and life in the leather, and when thus used upper leather will seldom crack or break. When oil is applied to belting dry it does not spread uniformly, and does not incorporate itself with the fiber as when partly damped with water. The best way to oil a belt is to take it from the pulleys and immerse it in a warm solution of tallow and oil. After allowing it to remain a few moments the belt should be immersed in water heated to one hundred degrees, and instantly removed. This will will drive the oil and tallow all in, and at the same same time properly temper the leather.

Influence of Smoke on Vegetation.

The influence of the products of oxidation of fuel on vegetation is different according to the nature of the fuel as well as to the conditions under which combustion has taken place. When the admission of the air has been freely made so as to allow perfect combustion, the products of the latter will be carbonic acid, water, nitrogen, and sulphurous acid, in case the coal was contaminated with sulphur. Of these only the sulphurous acid is of a vitiating nature. When, however, coal is subjected to a slow heat, quite a number of products are obtained, of which many are, even in small quantities very injurious to vegetable life.

Smoke is neither the product of very slow nor very quick combustion, it is therefore clear that it will not always act in the same manner. The smoke which ascends from the chimneys of our dwellings is the product of a nearly perfect combustion, this, however, is not the case when coal is burned in factories, for instance under steam boilers. The reasons for this assertion find their explanation in the following:

1st. Fresh coals are in short intervals added to the burning ones The formation of resinous and tarry matters, which on the hearths of our dwellings occurs but occasionally, therefore never ceases.

2d. The draft in the chimneys of our houses is little as compared with that of the high chimneys of factories and machine shops. The imperfect products of combustion of the former will therefore be condensed in the chimneys and partly be deposited, while those of the latter, will escape in the atmosphere and while condensed descend in the neighborhood of the chimney.

3d. Smoke always contains more or less solid carbon in minute division. The same will, while floating in the atmosphere, absorb part of the resinous and tarry matters by which it is surrounded. The thus impregnated carbon will, in descending upon the vegetation and in being deposited on the latter, not only form a hindrance to the absorption of the sun's rays, but, by its acid properties, doubly act as a destroyer.

Prof. Crace Calvert, is of the opinion that these facts explain why the vegetation in the vicinity of London is in a much more vigorous condition than in that of Sheffield, Leeds, Birmingham, and Manchester.

Owing to the inferior. coal which they use in these centers of manufactures it is not to be denied. that their air must be more contaminated with sulphurous acid, than it is the case on the banks of the Thames. This acid gas, however, will as all gases. be diffused very quickly in the atmosphere, particularly while at a high degree of temperature; its influence can therefore by no means be injurious in comparison to that produced by the deposition of soot.

Correspondence.

The Editors are not responsible for the opinions expressed by their correspondents.

For the Scientific American.

NEW APPLICATION OF THE SPECTROSCOPE TO DETERMINE THE MOTION OF THE STARS.

In order to explain this recent and most ingenious application of one of the most important pieces of modern apparatus, we must first understand what is the cause of the dark lines exhibited in the solar spectrum by the spectroscope, or rather, what they in general indicate

We follow in this explanation, of course, the undulatory theory,it being the only one which gives a rational explanation of all the phenomena. We will therefore not speak of the Newtonian doctrine of emission, which ought to have been abandoned long ago, and not be mentioned any more, as it is utterly untenable in the present state of our knowledge of the properties of light—a knowledge far in advance of any other branch of physical science.

Light is propagated like sound, by vibrations of some transmitting medium, but its vibrations are millions of times more rapid; so in sound the lowest perceptible tone is produced by about 16 vibrations per second, the highest by 9,000 or 10,000—a range of about 8 or 9 octaves. The lowest visible luminous vibration is produced by 450 billions vibrations in a second, the highest by 850 billions. (We call the square or second degree of a million a billion, the cube or third degree of a million a trillion, etc.) The lower vibrations produce the impression of red, the highest of violet, and the intermediate vibrations the different intermediate colors of the rainbow or spectrum, which in fact (as was already remaked by Newton) may be compared with the musical scale, of one octave, 450 to 500 billions vibrations per second produce red; 500 to 550 billions, orange; 550 to 600 billions, yellow; 600 to 650 billions, green; 650 to 700 billions, blue; 750 to 800 billions, indigo; and 800 to 850 billions, violet. We use here only the round numbers, as approximately near enough for our purpose. The numbers given represent the velocity of the vibrations where one color is shaded off into the next; the pure red, yellow, blue, etc, of course correspond with the intermediate velocity of vibrations.

Vibrations of a lower velocity than 450 billions per second manifest themselves simply as heat, without light; those of a greater velocity than 850 billions, as a chemical power; and consistent with this is the fact that the red and orange rays produced by the lower vibrations have also, with the dark space beyond the spectrum,a heating power, and the blue and violet rays, produced by the vibrations of higher velocity, possess, with the dark space beyond, no heating, but chemical power (the photographic rays).

In the solar spectrum as exhibited by the spectroscope, the velocity of the vibrations increases regularly from the red end of the spectrum to the violet; and if all possible intermediate velocities did exist,the spectrum would be continuous; but the fact that it is not continuous, and possesses a multitude of dark spaces, proves that certain definite velocities are wanting; so, for instance, at the place corresponding with a velocity of 560 billions, there is a dark line in the solar spectrum, indicating that vibrations of this definite velocity are wanting, we may have those of 550 and 570 or thereabout, but between these limits the dark space proves the nonexistence of rays of that definite velocity.

Now, in sound, the apparent velocity of the vibrations is increased or diminished, in proportion as we approach or leave the sounding body, with a velocity rapid enough to be compared with that of sound itself. The result is a change of pitch; and the whistle o an approaching locomotive will appear sharper, and of a retreating one flatter, than its real pitch—a fact well established by theory and experience.

This peculiarity rests on the same principle as that the waves, encountered by a steamer, appear larger when both are going in the same direction; and shorter, when the steamer moves against the direction in which the waves are transmitted. (See page 117.)

When now we move towards a luminous body, with a velocity great enough in relation to that of light to make the waves appear to be sensibly shorter, we must perceive a change in the tint of color, as in sound we perceive a rise of pitch. This change will be toward the more rapidly vibrating or violet end of the spectrum—that is, from red to orange, from orange to yellow, from green to blue, etc. When we recede from the luminous body, of course the reverse will take place. Now this slight change of color, even if possible to observe its existence distinctly, is not adapted to be measured like the pitch of a tone. This is impossible, from the nature of color; but the definitely located dark lines in the spectrum, as exhibited by the spectroscope, may be correctly measured as regards their exact locality; and all that is necessary is to compare the spectrum of a luminous body, which remains at the same distance, with the lines of the spectrum of a body to which we are approaching, or from which we are receding.

The last class of observations have quite recently been made by Mr. Huggins, of the Royal Society of London. Among others, he has compared the spectrum of the star Sirius with that of a flame producing some of the same lines, and found that (notwithstanding the enormous velocity of light, as well in its transmission through the universe, as in the velocity of its waves) not only was the incomparably slower motion of this star rapid enough to exert an appreciable change in the position of the dark lines, but he succeeded in measuring its amount. He found, for instance, that a certain dark line, corresponding with a bright line in a flame of hydrogen, was shifted toward the red end of the spectrum, which indicated that we are receding from that star; and from the amount of displacement, it was calculated that the motion was not less than 144,000 miles per hour. This was reduced to 90,000 miles, by taking into account the direct velocity of the earth, in its annual orbit round the sun, at the time of the observation.

When we consider that the only means thus far possessed of estimating the motions of the stars in relation to us, or of the earth in relation to the stars, was the apparent displacement of the stars among themselves, and that this apparent displacement is found to be very irregular, by reason of different motions and consequent changes in relative positions of the stars among themselves, we must conclude that this new method of measuring stellar motion is a very promising one; and when extended to most other stars, will open an entirely new, unexpected, and unexplored field of research in astronomical science. P. H. VAN DER WEYDE, M.D.

Water-Seeking---The Divining Rod.

MESSRS. EDITORS:—At times we meet with reference, especially in fictitious writings, to those who can find, with a hazel twig, the places of water courses beneath the ground. Many will unhesitatingly declare that this cannot be done, and that it is merely a whim of the credulous. Hence, it may well become those who are interested in scientific truth, to consider whether there is any reliance to be placed in the claimed power of successful water-seeking.

An elderly gentleman, of most reliable character, states that when he was a youth, and lived at his home, some miles north of Philadelphia, water was obtained for domestic purposes from a natural spring situated a little below the house. A neighbor, who lived upon higher ground, and made use of the same spring, at considerable inconvenience, had made repeated and unsuccessful attempts to secure a well.

At length, hearing of a man in another place, more than twenty miles distant, who could decide, by the use of a branched stick, upon good localities for wells, he sent for him. On arriving, the man passed about the grounds with a suitable stick in his hands, and pointed out a favorable spot at some distance from the house where the surface of the earth was nearly twenty feet higher than places one would ordinarily select.

He also, though an entire stranger in the region, followed the curving line of the hidden stream across a road, and through fields, to the spring mentioned above. A well was dug on the line proposed, with entire success; and, subsequently, a second one. Each was a little over twenty feet in depth, though the latter was at a point some sixty feet lower on the surface.

A gentleman at Andover, Mass., a few years since, purchased a fine residence, that was poorly supplied with water. Repeated attempts had been made to sink a well, but in consequence of rock, or firm clay, no water was reached. The owner secured the services of a member of the Theological Seminary in the place, who was said to have the water seeking ability. He took in his hand the stock of a whip, and held it by the portion toward the small end, so that the heavy part would be erect. On his passing across a certain portion of the grounds, the end that had been upward would bend down sufficiently to make less than a right angle with the portion in and below the hand, and would swing round as he went forward. After successive observations he pointed out a line, beneath which he claimed there was a stream of water in the earth; but at what depth he did not attempt to decide.

If any other of those present held the rod, it did not move; but if he placed his hand on that person's shoulder, it would give the same indications as in his own. If he placed a silk handkerchief between his hand and the rod it failed.

A well was dug in accordance with his suggestions, which, passing down along the vertical face of a buried ledge, at the depth of seventeen feet, afforded a fine supply of water. He selected places for a number of wells in the town, and always with success.

His explanation of the phenomenon was, that the flowing stream was charged with resinous electricity, and, that when a stick, fitted for the purpose, was carried in the hand of a person vitreously charged, and brought over that water, it would be attracted.

That there are streams in the earth we have many reasons for believing. Some years since there were two manufacturing establishments in England, a considerable distance apart, which made use of large quantities of water. It was found that when the pumps of one were used actively, the wells of the other were drained, and it became necessary for them to secure their water on alternate days. This proves a communication between those wells.

In the boring of artesian wells, also, proof of the existence of subterranean streams has been afforded. Hitchcock says, that " at St. Ouen, in France, at the depth of one hundred and fifty feet, the borer suddenly fell a foot, and a stream of water rushed up." A paper has stated, that, in Chicago, twelve hundred feet below the surface, a vein eight feet in depth was reached, with a current so strong that a long lead, upon a fine wire, lowered into it, was snatched from its position very much as an insect upon a hook is taken by a fish.

It is not difficult to conceive of these streams being in an excited electric condition; and this view is favored by the assertion of some philosophers, that lightning more frequently strikes upon their course.

And, again, we know that persons are not unfrequently in a highly electric state, as manifested when one, especially if partially insulated by wearing rubbers, has taken a vigorous walk on a clear and windy evening, in a dry atmosphere; for then, upon folding together the edges of an outer garment, on removing it a line of sparks, attended with sound, often appears along the meeting edges. It is also shown, by some persons being able, after moving the feet along a carpet, to light gas with the finger.

Arago refers to the surprising pleasure which it afforded him to see, not only a few metals, but wood, and various other substances, affected by the poles of a magnet, being either attracted or repelled. Remembering that magnetism and electricity have many common features, and are even considered by some of our best natural philosophers as different manifestations of the same agency, is it absurd to conceive it possible that a rod, in the hands of a person in a certain electrical condition, may be attracted by a hidden stream of water in an opposite state?

We should not be deterred from thoughtfully considering the subject, simply because some may be incredulous. An aged philosopher was regarded deranged, by casual observers, when he was experimenting with films of viscid water upon the properties of light, though his researches were to result in brilliant conclusions for science. And, always, efforts employed in searching out the more subtile and recondite laws of matter have a rare value, and hence are not to be regarded as trivial.

Massillon, O. J. K.

Returning Condensed Steam to the Boiler.

MESSRS. EDITORS:—As a constant reader of your paper, I take the liberty to ask you the following questions: I have a tubular boiler in the basement of my mill, and wish to heat three floors above with steam; the top of the boiler, which is horizontal, is three feet below the lowest floor. which I wish to heat. Can I not, with perfect safety, take steam from the top of my boiler, and allow it to return (or the water that condenses from it) by the pipe that feeds the boiler, provided I put in suitable cocks to shut off either the pump or the return condensed water, as it becomes necessary to use the pump, and would it not be perfectly safe to shut off the condensed water at such times as I should find it necessary to pump? I am told by parties who make piping mills their business, that my plan is not safe, and I must return my condensed water to a tank, and then pump it in. I cannot understand why this should be so, and would like your opinion on the subject in the SCIENTIFIC AMERICAN, together with such information as you may be willing to give.

Suppose I allow all my pipes to slant one thirty-second part of an inch to the foot, toward the upright supply pipe, and have that one and a half inch diameter, will not all condensed water run back to the boiler, and will not everything be safe, say at eighty pounds steam, or less?

Stoughton, Mass. C. S.

[Your proposed plan is one very generally in use. You would, however, not be able to return the drip or condensed steam from the first floor, three feet, as the weight of the column would not be sufficient. Your method of slanting your pipes toward the upright supply pipe, and having that of good diameter, is correct. There is nothing dangerous nor difficult in the arrangement, if properly put up and properly attended to —EDS.

How to Catch Rats.

MESSRS. EDITORS:—In reading your excellent paper, I have frequently noticed devices for the extermination of rats, mice, and other vermin. Different contrivances have, from time to time, been presented to the public, and each claiming to possess some superiority which others have not attained. I do not doubt concerning their efficiency; but as a general thing, the cost of patent machines places them beyond our poorer population, while many of the wealthy are incredulous, and prefer to employ the old style of trap. Now if a drop of oil of rhodium be poured upon some bait, in a common or wire spring trap, and the said trap be set in an infested locality, only a short time will elapse ere the cage will be found occupied by vermin. Rats and mice possess a great liking for the oil, and, when scented, will risk anything to obtain it. I have cleared my cellar of the pests by the above method, and others have tried it with similar success. The oil of rhodium costs about one cent per drop, but a drop will last several days.

New York. J. C.

[Rhodium oil is an extract of a Chinese rose-tree—*Convolvulus Scoparius*—and the perfume is similar to that of roses. This oil, as well as that of anise and asafœtida, is often used to attract fish, insects, and other animals.—EDS.

The Shifting of the Center of Gravity of a Revolving Wheel Tested by an Astronomical Fact.

MESSRS EDITORS:—Our earth is, in relation to the sun, a wheel, or rather ball, of which the plane of rotation is vertical; its axis being in March and September horizontal, and inclining gradually, until in July and December it reaches an inclination of 23°, of course all considered in relation to the great luminary, of which the attraction of gravitation surpasses that of the earth more than three hundred thousand times.

If now the theory that the center of gravity shifts toward the descending portion of a wheel or ball be true, the center of gravity of our earth must continually be shifted toward that side which, in its daily rotation, is moving or falling toward the sun, that is, toward that meridian where it is 6 A. M.; and this shifting of the center of gravity would necessarily be perceptible in the tides. A high tide wave would