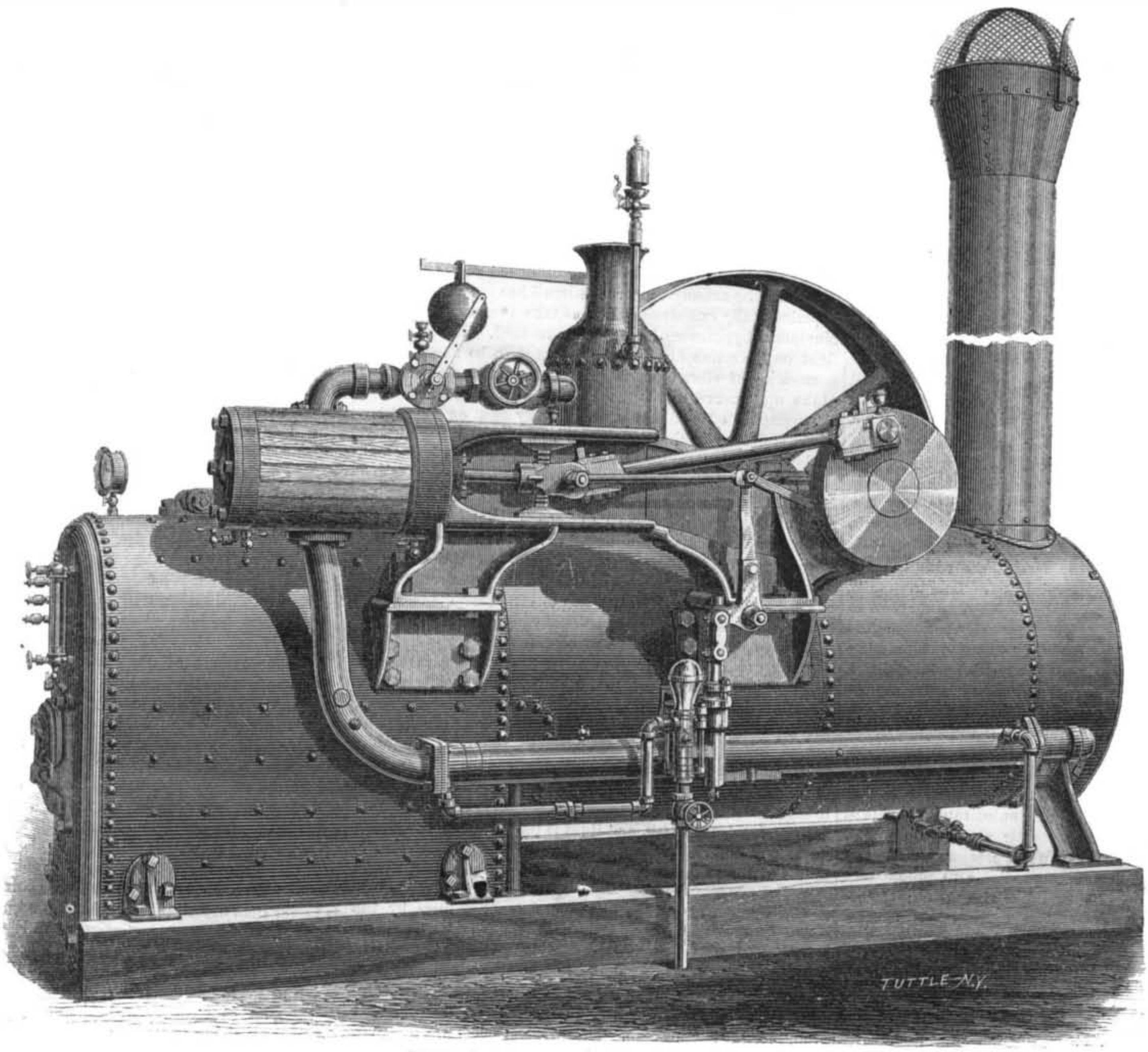
THE COOPER PORTABLE ENGINE.

In our illustration is shown one of the latest designs of portable engines, composed of an engine, pump, heater, fixtures, and connections, all mounted on the boiler; the last being supported on side timbers which form the foundation for the whole structure. The apparatus comes complete from the shop, having been previously tried by actual tests with steam, and is ready for work. All that is required is to place it in proper position and connect it to such machinery as it is to drive. The boiler is then filled and the fire started. This arrangement, it is claimed, saves all the expense and time required to build the engine foundations, set the boiler in brick work, and make the connections, as would be the case with stationary engine and boilers, while it adds greatly to the facility with which the machinery can be moved from place to place.

The construction of the device merits particular attention. The engine consists of a bed piece supported on lugs attached to the boiler. This piece contains the shaft, pillow block, slides, and cylinder head, and to it the cylinder is so attached as to allow of the expansion of the latter without strain on the joints. The valve gear connects directly, doing away with the rock shaft, and the valve is proportioned to use the steam expansively. The pump is a vertical plunger of short stroke, driven by direct attachment to the crosshead, obviating the use of a belt and making the feed positive, with easy work on the valves. The heater is of wrought iron, with cast iron sleeve and slip joint, proportioned to give a large heating surface to a thin sheet of water, thereby insuring a high degree of heat to the feed. All the moving parts are balanced so as to give steady motion at high speed. The journals and wearing surfaces are supplied with self-oilers, and the boiler with glass water gage, cocks, whistle, steam gage, etc.



THE COOPER PORTABLE ENGINE.

The internal arrangement of the boiler and tubes, it is claimed, has been thoroughly studied, so that the highest degree of evaporation is obtained with the least consumption of fuel. A jet blower is supplied for increasing the draft, and the chimney is provided with a spark catcher.

We are informed that when the Japanese Government (in 1870) ordered samples of machinery, the agents, after examination and tests, gave the preference to this engine over all others, and ordered a twenty horse power machine, with circular saw mill, to be sent to Japan. Letters since received show that the apparatus gave perfect satisfaction.

The engine represented in our engraving is of twenty horse power and is mounted with a slide throttle valve, in place of the governor as used with circular saw mills.

For further information address The John Cooper Engine Manufacturing Company, of Mount Vernon, Ohio.

Lawns in Midsummer.

We have touched the renewing and improving of lawns time and time again, says the Cleveland *Herald*, yet every now and then we are button-holed on the street with: "I wish you would tell me what to do with my lawns." Well, we ask about it. "Why, somehow, the grass seems to have got thin, and don't look good and strong; the soil is rather light, although every year I have given it a top dressing of manure in the fall and raked it off in the spring."

Yes, we say, just as many another man, void of the knowledge of the wants of the grass roots, has done. You have supplied a little stimulus, and a very little one, to enable the plant to make a first start in the spring, by reason of the ammoniacal alkali obtained from the leaching of the manure during the winter; and as soon as that is exhausted, which generally is ere the heated season comes in, the plant has nothing but the poor old soil and its broken roots to support it. Now, if you would first sow over your lawn fine bone meal at the rate of eight bushels to the acre, then plaster at the rate of one bushel to the acre, then cover the whole half an inch thick with fine garden soil, leaf mold, or fine chip mold from an old wood yard pile, and then sow clean blue grass seed at the rate of two bushels to the acre, and rake the whole with a fine tooth iron rake, finishing by rolling, we guarantee a lawn that will stay fresh and green all summer, no matter how dry the season. We hope that some of our button-holing friends will read this, cut it out and keep it.

THE FIRST AUTOMATIC FAN.

There is a peculiar interest which attaches to the first crude embodiment of any well known device, which renders it almost as much an object of curiosity as the most recent ap-

plication of the same idea improved, altered, and carried apparently to perfection. The one, indeed, indicates the higher attribute, originality; the other, in its relation thereto, forms but a mark on an onward path which, while serving as a limit of present advancement, attained through the aid of past experience, must, in its turn, be left behind and forgotten, as that experience, augmenting, enables the engrafting, upon the pristine stock of newer, better, and more useful conceptions

To the vast array of quaint devices, with which the earlier archives of the Patent Office are replete, belongs the invention illustrated herewith. Our engraving, derived from the patent drawings, represents an individual not suffering under any painful malady, as might be inferred from his prostrate position, but "laying off," if the apt vulgarism be admissible, while calmly enjoying the luxury of a breeze raised by the oscillation of the fan above him. The latter, with its mechanism, is the first device of its kind ever patented in this country, and the inventor was Commodore Jas. Barron, of the navy, a name famous for gallant service in the war of 1812. The date of the patent is November 27, 1830, and from its specification we extract the following brief description of its operation: Within the box shown near the head of the couch is placed a train of clockwork, which moves a crank, shown in the left hand lower corner of the case. This crank actuates a pitman which, by means of a vertical arm, oscillates a rock shaft, supported as shown by two horizontal rods projecting from the box. To the upper arm, extending from the rock shaft, is connected the fan, which is thereby freely vibrated, while suspended from the ceiling, by suitable means.

In an old volume of the *Journal of the Franklin Institute*, we find an abstract of this patent, accompanied by editorial comment to the effect that "it is certainly a very complex mode of attaining the proposed object. We should find no difficulty in making a much more simple instrument for the purpose," a view which, perhaps, some scores of inventors have, since the date the above was written, demonstrated to their own, if not to the public's, perfect satisfaction. We need not add that, in this case, for obvious reasons, we omit our usual peroration beginning "For further information," etc.

Discovery of America--Columbus Anticipated

Interesting relics of the early discovery of America occasionally turn up. At a late meeting of the Mexican Geographical Society, Mr. Bliss stated that some brass tablets had been lately discovered in the northern part of Brazil, and not far from the coast, which careful examination had shown were covered with Phœnician inscriptions, telling of the discovery of America five centuries before Christ. The tablets had been acquired by the Museum of Rio Janeiro, with whose director he was personally acquainted, and the connection of this gentleman with the discovery of the tablets was in itself a guarantee of the correctness of the report. The inscriptions, so far as yet deciphered, relate that, from a port on the Red Sea, a Sidonian fleet sailed, and, following the east coast of Africa, doubled the Cape; thence following the African west coast, probably with the southeast trade winds of the southern latitudes, until the northeast trades, preventing further progress northward, forced the prows of the vessels across the broad Atlantic. At any rate, according to Mr. Bliss, the tablets record the fact of the Phœnician fleet having reached the Americas five centuries before Christ, at some point now known as northern Brazil; that the tablets give the number of vessels, the number of the crews, the name of Sidon as their home, and, indeed, various very interesting particulars. Mr. Bliss has promised, when he acquires further particulars, to hand them to the Society.

A GIGANTIC passenger depot, the largest in the world, is now in process of erection at Jersey city, N. J.

The Preservation of Wood.

When a country is first cleared, and timber is plenty, the only desire of the settler in regard to it seems to be to destroy as much as possible with the least amount of labor. Afterwards, however, the opposite course is taken, and endeavors are made to preserve it, and prevent waste and decay.

Many methods have been proposed for preserving timber, varying somewhat according to the use to which it is to be put, and the situation in which it is to be placed. These may all, however, be divided into two great classes; namely those which preserve the wood from external influences by forming an impervious coating on the outside, and those which consist in impregnating the wood with some substance which will enable it better to resist the action of fermentation and decay.

The first of these classes includes all paints and similar substances. In order to render paints effective, it is necessary that the wood shall be well dried before their application, as paint applied to the surface of wood which is filled with sap will tend to hasten, rather than retard, its decay. This it does by confining the juices of the timber and preventing the drying of the wood that would otherwise take place. The first paint that was used was most likely the native bitumen and asphalt that oozes from the ground in many parts of the world, and to this day we have not found any more effective substitute. But this is objectionable from its odor, the long time it occupies in drying, and its dark color; so that in the course of time other substances were substituted for it. Prominent among these are the so-called drying oils. Certain oils, such as linseed and poppy, have the property of drying when exposed to air, and forming a gummy mass. This protects the wood from the action of air and rain. But oil alone has but little covering power, and a substance painted with it retains almost its natural color, or at most is only darkened. In order to vary the color and more thoroughly cover up any defects in the work, and at the same time hasten the drying of the paint, it is customary to mix certain earthy substances with the oil. Chief among these is ceruse, or white lead. This gradually combines with oil and forms a hard mass. In order to hasten the drying of the oil, it is frequently boiled before being mixed with the lead. The lead paint made by mixing proper proportions of carbonate of lead with boiled and raw oil is undoubtedly one of the best and most permanent substances that can be applied to the surface of wood; but unfortunately it is expensive, and the use of the lead is objectionable on sanitary grounds, the workmen employed in putting it on being subject to severe colic and paralysis from the poisonous effects of the lead. On the ground of cheapness, sulphate of baryta is frequently substituted for part of the lead, and, in fact, in some cases for almost the whole. This, while it is not poisonous to use, possesses an inferior covering power; that is, it takes more coats to produce the same effect, and as it does not combine with the oil, it is liable after a time to chalk off.

Another substitute for lead is oxide of zinc. This is also not poisonous to the workmen, when free from arsenic, but it possesses little more covering power than baryta.

Quite frequently a mixture of lead, baryta, and zinc, is employed. Its chief recommendation is its cheapness. For painting in localities that are exposed to sulphuretted hydrogen, such as houses on the docks of large cities, a zinc or baryta paint is superior to one containing lead, as it does not blacken. Many attempts have been made to utilize various chemicals for painting purposes, and there is an endless variety of so-called chemical paints in the market. Prominent among these is the "Averill" paint, in which water glass or silicate of soda is a leading ingredient; but the general fault of all these paints is that, when made thin enough to work with ease, they do not possess sufficient body, so that what is saved in the original cost of the paints is expended in the labor necessary to put them on.

Paints of different colors generally depend upon white lead for their body, and derive their color from mixtures of various earths and oxides. For almost all the shades of red and brown, oxide of iron is used, under the various names of Venetian red, umber, terra di Sienna, brown ocher, yellow ocher, red ocher, etc., the various colors being due to the way in which it is prepared.

Oxide of chromium furnishes chrome green; oxide of copper, combined with various acids and with arsenic, gives various greens; lead combined with chromic acid forms the chrome yellows, the different shades being due to the manner in which they are prepared. For blue, we have Prussian blue, which is not very permanent, and of late years ultramarine, which is the best and most permanent of all colors.

Red lead, or oxide of lead, and sulphide of mercury give the most brilliant red; while for black, nothing is superior to carbon in the form of lamp black. For special purposes, such as painting the bottoms of ships or piles exposed to the action of the water, coarser kinds of paints are employed. The base of many of these is tar dissolved in naphtha; this is mixed with some substance such as oxide of copper, arsenic, or an alloy of copper and antimony, which is supposed to prevent the adherence of barnacles and other marine animals and plants. India rubber, dissolved in naphtha, has been used for the same purpose; lime soaps have also been proposed for this use. No substance has, however, been discovered that will resist the action of salt water more than a few months without requiring renewal; nothing that is known to chemists being absolutely insoluble in water. Lately there has been quite a flourish of trumpets over a certain compound invented in England by Count Szerelmy, and called *zopissa*. This is essentially a paint composed of boiled linseed oil, brown umber, lime water, sulphate of copper, Prussian blue, copperas, burnt clay, calcareous silex (whatever that may be), litharge, asphalt, red lead, gum animi, and turpentine. It was probably through mere modesty that the inventor stopped after adding these ingredients and did not continue through the drug shop. The paint is no better and no worse than one containing an impure oxide of copper for pigment, and linseed oil and asphaltum for the menstruum. It will no doubt protect the wood to which it is supplied in sufficient quantities, from external action, so long as it lasts.—*Boston Journal of Chemistry.*

Recent Researches on the Physiological Action of Light.

The arrangements by which the mind is brought into relation with the outer world are—(1) a terminal organ, such as the retina, or the intricate structures of the internal ear, or the touch corpuscles of Wagner, for the reception of impressions from without; (2) a nerve, endowed with a special sensibility peculiar to the sense for the conveyance of influences from the terminal organ to the brain; (3) a sensorium or brain in which, on receiving these influences, changes occur which give rise to the phenomena of consciousness.

The nature of the specific change produced on the terminal organs by the action of external stimuli has not hitherto been experimentally examined. Let us take the case of the eye. Numerous hypotheses have been advanced. The action of light on the retina has been conjectured to be a mere communication of vibrations, an intermittent motion of portions of the optic nerve, an electrical effect, a heating effect, or a photographic effect like that produced by light on a sensitive surface; but up to this time there has been no experimental evidence in support of either of these views.

The result of investigations made by Mr. Dewar and Dr. McKendrick, of Edinburgh, communicated to the Royal Society of Edinburgh, has been to show that the specific effect of light on the retina and optic nerve is a change in the electromotive force of these organs. They have been able to demonstrate this by the use of the well known arrangement of Du Bois-Raymond for collecting electric currents from animal structures.

From each of the troughs a wire passes to a key so as to enable the experimenter to stop the current at pleasure, and thence the current passes to the galvanometer. They then lay the eye on a glass support between the cushions, and carefully adjust the points so that the one touches the cornea and the other the transverse section of the optic nerve, or the one may touch the surface of the nerve and the other its transverse section. When the optic nerve of the eye to be operated upon and the cornea are brought into connection with the galvanometer, and light is passed through the eye, there is at first an increase, then a diminution, and on the removal of light there is another increase, of the electromotive force.

The amount of change in the electromotive force by the action of light is about 3 per cent of the total. There has been no difficulty in demonstrating the effect in the eyes of the following animals, after removal from the body: reptiles, snakes; amphibia, frog, toad, newt: fishes, gold fish, stickleback, rockling; crustacea, crab, swimming crab, spider crab, lobster, hermit crab. The greatest effect was observed in the case of the lobster, in the eye of which Messrs. Dewar and McKendrick found a modification in the electromotive force by the action of light to the extent of about ten per cent. With the eyes of birds and mammals, they had great difficulty. It is well known that, in these animals, the great source of nervous power is abundant supply of healthy blood. Without this, nervous action is soon arrested. This law, of course, holds good for the retina and optic nerve. When, therefore, they removed the eyeball with nerve attached, from the orbit of a cat or rabbit recently killed, and placed it in connection with the clay points, they found a large deflection of the galvanometer which quickly diminished, but all sensitiveness to light disappeared within one or two minutes after the eye had been removed from the animal. This fact of itself shows that what has been observed is a change depending on the vital sensibility of the part. It was therefore necessary to perform the experiment on the living animal under chloroform. By so fixing the head that it could not move, and by removing the outer wall of the orbit so as to permit the clay points to be applied to the cornea and nerve, the same results have been obtained in the case of the cat, rabbit, pigeon, and owl.

Without going into minute detail, which the space allowed for this short article will not admit of, the results of this inquiry have been as follows:

1. That the specific effect of light on the eye is to change the electromotive force of the retina and optic nerve.

2. That this last applies to both the simple and to the compound eye.

3. That the change is not at all proportional to the amount of light in lights of different intensities, but to the logarithm of the quotient, thus agreeing with the psycho physical law of Fechner.

4. That those rays, such as the yellow, which appears to our consciousness to be the most luminous, affect the electromotive force most, and that those, such as the violet, which are least luminous, affect it least.

5. That this change is essentially dependent on the retina, because, if this structure is removed while the other structure of the eye lives, though there is still an electromotive force, there is no sensitiveness to light.

6. That this change may be followed into the optic lobes.

7. That the so-called psycho-physical law of Fechner does not depend on consciousness or perception in the brain, but is really dependent on the anatomical structure and physiological properties of the terminal organ itself, inasmuch as the same results as to the effect of light are obtained by the action of the retina and nerve without the presence of brain.

The method of investigation pursued by Messrs. McKendrick and Dewar is applicable to the other senses, and opens up a new field of physiological research. The specific action of sound, of the contact of substances with the terminal organs of taste and of smell, may all be examined in the same manner; and we are in hopes of soon seeing results from such investigations.—*Nature.*

Saddle Trees.

A correspondent, R. C., of Texas, remarks that his State has always been famous for the production of saddle trees; and although California and other States have been rivals, Texas has always stood first on the list. "The ordinary plan of making a saddle tree is not only tedious but incorrect, owing to the want of an accurate plan, and the consequent use of guesswork. I claim to have produced a simpler plan, by which a man, using patterns, can make a good saddle tree. Within the last few years, several makers have conceived plans to make saddle trees that would allow the fastenings to rest on the front end of the side boards, and the front part of the seat on the side boards and on both sides of the prongs of the horn piece, forming not only the fastenings but a part of the rig also.

The tree was a desirable one on its claims; but there was a serious objection to it. The projecting part of the side boards in front of the horn tapered down straight with pointed or square corners so as to admit of the fastenings; and so the bottom part of the side boards had to be made straight, with a straight twist, and the ends in front would hurt the horse's shoulders. To remedy that defect, I cut the side boards tapering back towards the seat far enough to receive the prongs of the horn and the fastenings. This flaring or tapering twist also enabled me to change the entire shape and bearings of the tree, making a general improvement on the whole arrangement."

Uses of Waste Paper.

A writer in one of our exchanges (we have forgotten which) says that few housekeepers are aware of the many uses to which waste paper may be put. After a stove has been blackened, it can be kept looking very well for a long time by rubbing it with paper every morning. Rubbing with paper is a much nicer way of keeping the outside of a tea kettle, coffee pot or tea pot bright and clean, than the old way of washing it in suds. Rubbing them with paper is also the best way of polishing knives and tin ware after scouring them. If a little soap be held on the paper in rubbing tinware and spoons, they shine like new silver. For polishing mirrors, windows, lamp chimneys, etc., paper is better than dry cloth. Preserves and pickles keep much better if brown paper instead of cloth is tied over the jar. Canned fruit is not apt to mold if a piece of writing paper, cut to fit each can, is laid directly upon the fruit. Paper is much better to put under carpet than straw. It is thinner, warmer, and makes less noise when one walks over it. Two thicknesses of paper placed between the other coverings on a bed are as warm as a quilt. If it is necessary to step upon a chair, always lay a paper upon it, and thus save the paint and woodwork from damage.

Watering House Plants.

The English *Garden* is inclined to dispute the rule that water "should be given in moderately small quantities, and supplied frequently." If the causes of failure where plants are cultivated in windows were minutely investigated, the dribbling system of watering would be found to be the principal cause. A plant ought not to be watered until it is in a fit condition to receive a liberal supply of that element, having previously secured a good drainage, in order that all superabundant water may be quickly carried off. Those who are constantly dribbling a moderately small quantity of water upon their plants will not have them in a flourishing condition for any length of time. This must be obvious to all, for it is quite evident that the moderately small quantity of water frequently given would keep the surface of the soil moist, while at the same time, from the effects of good drainage, which is essential to the well being of all plants in an artificial state, all the lower roots would perish for want of water, and the plant would become sickly and eventually die.

A FRENCH writer, in estimating the future of science, points out that in fifty or a hundred years' time the English language will in all probability be spoken by eight hundred and sixty millions of individuals, while the German will be the language of one hundred and twenty millions and the French of sixty-nine millions only, and that in consequence science is likely to seek English channels of publication, scientific books having at best a limited sale and necessarily seeking the widest audience.

NARROW GAGE passenger cars, as generally constructed, stand thirteen inches nearer the rail, and have about fifteen inches less overhang at the side; hence, the center of gravity is considerably lower than on the standard gage, making the car ride very steadily, and with less oscillating motion than is usually observable upon the wide gage. The seats, thirty-six to a car, are arranged double on one side and single on the other, with the order reversed, midway of the car to distribute the weight equally.