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RECLAIMING THE DESERT PLACES.

The explorations of French engineers have proved that the surface of the great Desert of Sahara is below the level of the ocean, in fact that it is the bottom of an ancient fresh water lake which has dried up by gradual changes in the surrounding levels, the streams which once supplied it now going directly to the ocean. It has been therefore suggested to change this desert back into a lake, and in this way to alter the whole climate of that country. This would, of course, create a moist atmosphere in place of the burning hot, dusty whirlwinds which are the curse of that region. There are, however, no rivers to be turned into the basin; and the artesian wells, successfully bored by the French, which create oases in the desert around them, give too insignificant a supply for such a great purpose. It has, therefore, been proposed to make a channel to the ocean, and lead the ocean water into the desert; but in consequence of the vigorous evaporation in that latitude, the water, when once spread out over any considerable surface, would probably disappear as quickly as even the largest sized canal could pour it in.

The Caspian sea, which is situated below the surface of the ocean, evaporates the waters of the Volga as rapidly as that colossal river, the largest in Europe, is able to pour them in. The water of the Volga is fresh, containing only a small percentage of salts; but this small amount of salt remains in the Caspian sea, while pure water only is abstracted by evaporation; thus the sea is very salt, and becomes more so every year. If now the collection of fresh water, in a closed lake, from which there is no exit but evaporation, ends in making a salt lake in a cold climate, the introduction of sea water to form such a lake under a tropical sun, as proposed for Sahara, would result in making a huge salt pan, which would gradually fill up with solid salt, till it reached the level of the supplying ocean; and we should only have transformed the dry sandy plains of the desert into dry salt plains, and which of the two would be the wore is a matter for discussion.

We think that a continuation of the French system of boring artesian wells in all available spots is the best method of reclaiming the desert. Many of these wells have already been completed, and it is indeed touching to read the description of the joy and religious enthusiasm of the natives when they see, for the first time, a bountiful supply of fresh cool water poured forth from the bowels of the earth in spots where never before was water seen for miles around. The creation of an oasis in the desert is the immediate consequence of each well; and in the course of years the dreadful Sahara may be so profusely clothed with artificial oases that most of its terrors will have passed away.

As to our American deserts, recent explorations and surveys of the great desert of the Colorado river have shown that it also was the bottom of a lake which has dried up, because the river has cut its channels in the rocks, through which it flows to the ocean, so low down (from 4,000 to 6,000 feet) that the lakes, formerly connected with and supplied by the river, lie now far above its present level. These lakes have for centuries collected at their bottoms the deposits of the Colorado river; and the now exposed surface consists, therefore, of an alluvial soil of extreme fertility (containing potash, soda, lime, and phosphates), which, however, cannot produce any crops on account of the total absence of moisture. The whole region is indeed a desert like that of Sahara; and like the latter, a portion of it lies below the surface of the ocean, as proved by barometric observations. It is believed that the waters of the Gulf of California formerly extended some 175 miles further inland than they do now, that subsequently the delta deposits of the Colorado (which were enormous, considering the deep channel which it has hollowed out for itself) formed a dam in the sea 175 miles from the shore, finally enclosing a sheet of water, which then dried up and now forms that part of the desert which is lower than the ocean.

It is proposed to lead the waters of the ocean into this low portion, so as to inundate it, and increase the atmospheric moisture in that region; and it appears that the plan is feasible, at a comparatively small cost; but one objection is that then a large portion, some 30,000 or 40,000 square miles, which otherwise might be made productive, would be sacrificed; and this plan is also open to the same objection as that of inundating the Sahara with sea water: it would end in the creation of an enormous salt pan. We prefer the other plan which has been suggested, irrigation from the upper part of the Colorado river, which, to be sure, would cost much more, but would reclaim all the highlands of this desert. The geologist of Williamson's expedition, Mr. W. P. Blake, points out that, by cutting a canal or deepening a certain small river low enough, so that the water from the Colorado could enter it at all seasons of the year, a constant and plentiful supply of water can be furnished to the interior of the desert and used for irrigation, while the surplus will fill the low portions with fresh water, find its exit to the Gulf by a pass to be constructed, and also establish navigation from the Gulf of California to the interior of the great lake. A thorough survey is needed, and also experiments in boring artesian wells: which, without doubt, would here be as successful as in the African desert, as is indicated by indisputable geological evidences.

A NEGLECTED SOURCE OF FOOD.

Ages ago when our forefathers were worshippers of Odin and the rest of the dead divinities of Northern Europe, horse flesh was accounted a delicacy fit for the gods. When a warrior died, the "funeral baked meats" were carved from his slain charger; and in all religious celebrations the horse figured, as the bullock did in the sacrificial feasts of other nations. Thus horse flesh and paganism were found to be inseparable when the Germanic and Scandinavian tribes were christianized by royal proclamation. The new made christain could not begin a dinner at which his favorite meat appeared without relapsing to his ancestral religion and going through the entire round of pagan rites with which horse flesh had been so long associated. As a natural consequence, horse flesh became not only synonymous with paganism but one of its defenses—we should have said bulwarks if the sound had permitted. Against it the bulls of the church were hurled, and its use was prohibited under pain of eternal damnation. Gradually, as christianity gained ascendency, the obnoxious meat passed out of use, and in process of time it came to be regarded by Europeans as "long pig" was by the christianized descendants of man-eating Fiji islanders, with an abhorrence as intense as the original liking had been.

Subsequent generations have inherited the prejudice and forget its origin. To this day the multitude stand ready" to cry unclean" the moment horse flesh is mentioned as an article of food, though it would puzzle them to give one substantial reason for so regarding it.

The truth is that no meat can be cleaner. The horse is one of the nicest of feeders, and as choice in his drinking as in his diet; and, as has been abundantly proved by the experience of modern Europe, where horse flesh has lately become an important element in the food supply, the meat which we reject is at once wholesome, nutritious, and nearly if not quite as savory as beef. As we are no longer in danger of relapsing into paganism with the taste of it, the only sanitary reason, moral or otherwise, for avoiding it is done away with.

There remains the economical reason for its disuse arising from the fact that good horses are worth more for other purposes. But the time comes when the best of horses ceases to be profitable for service. What then?

Occasionally a favorite animal is provided for in his old age and allowed to end his days in all the comfort that Nature will permit. The majority, however, are turned over to the tender mercies of the cruel to be used up, more or less speedily, in rough and ill requited labor. To guard their favorites from this unhappy end, it is becoming a common practice among considerate people to shoot their horses when no longer fit for the carriage, though they may still be far from worn out. Of the nine million horses in the United States, a million might fitly be disposed of in that way every year, to make room for younger and more serviceable animals. In other words, our food supply might be augmented by something like a thousand million pounds of good meat annually. We throw it away—for a prejudice!

That this prejudice will be overcome in time, we have not the slightest doubt. The tendency of our civilization is to multiply food consumers while lessening the relative number of producers. As a natural consequence we must be more and more careful to avoid unnecessary waste. Every available source of wholesome food must be husbanded, and this among them. Unfortunately those who would be most directly benefited by the addition of horseflesh to our lists of meats are just those whose prejudice against it is most intense. Here, as in Europe, it must first gain a place on the tables of the well-to-do.

Perhaps as simple a plan as any for effecting this would be the following: We have noticed the growing custom of shooting horses when their term of profitable service has come to an end by age or accident. Instead of burying the carcasses or giving them to the renderer to be converted into soap grease and fertilizers, the flesh might be properly dressed and distributed among those who, from curiosity or conviction of its wholesomeness, might desire to give it a trial. If pains were taken to announce this intention before hand, and to prove to intending eaters that the horses were in good condition and free from disease, there would be little difficulty, we imagine, in disposing of the choicer cuts. All that is required is a beginning, and this course would ensure it with the least amount of trouble and cost.

Who will make the experiment and report the result?

THE ASTRONOMICAL CONDITIONS OF LIFE.

Spectrum analysis, confirmed in so many particulars by the chemical analysis of mereorites, has familiarized us with the idea that all the bodies of Nature, the planets of our system as well as the suns most distant from us, are composed of the same elements, animated by the same physical forces, submitted to the same chemical laws, and present all the essential characteristics of the elements of which we are formed, even to the most delicate and minute details. Since therefore these same forces act under our eyes as essential agents of life, we are naturally led to consider the conditions of organic existence on our globe as applicable to the circumstances of other spheres. If in brief our earth is inhabited, why not the other orbs which fill up space, seeing that the same matter is everywhere present?

The caption of this article is also the title of a valuable paper lately published by the eminent French astronomer Faye, in which he considers the problem briefly outlined in the foregoing paragraph. He reviews the conditions of other worlds, as demonstrated by spectroscopic and various other modes of scientific investigation, and subsequently points out the impossibility of organic matter existing under the circumstances.

In order to develope the latent life in any germ, the surrounding temperature must not exceed 140° Fah., or fall below the freezing point of water. We are therefore led in the beginning to the fact that the development of life is comprised between very narrow limits of the scale of warmth and cold. Even on the earth, where the water, soil, and air are thickly peopled, there are regions where life disappears htrough a slight permanent lowering of temperature; and similarly the same result takes place by an increase of climatic heat. Life is equally limited by the isolation of the bodies which move in space. Every formation of an aggregate by the mutual attraction of smaller portions is accompanied by a development of heat which even the simplest organisms could not resist, and certainly life could not be transmitted from one globe to another by materials which even on entering our atmosphere pass suddenly from the cold state to intense incandescence. Consequently we are led to consider whether the life of organized beings is so simple that it may result from the spontaneous play of natural forces, and hence to the condtions under which such action may or may not occur.

The condition of temperature excludes immediately all bodies which shine by their own light, that is to say, every star that we see in the sky, except the planets. The nebulæ, formed as they are of incandescent hydrogen and nitrogen, are out of the question. Life therefore cannot be found except upon a cold globe associated with a hot body, which radiates to it the necessary additional heat. The suns serve precisely this purpose as regards their planets, and are marvellously organized to distribute a constant light and warmth during vast durations of time. But these sources must be of a nature to maintain life around them. Hence the variable stars must be excluded, o of the Whale for instance, which at times is of the second magnitude, and then gradually lessens in brilliancy and descends to the fourteenth magnitude, during 230 days. Similarly the stars that have already become cool, or are too small in mass ever to have had a very high temperature, must be left out of consideration, also the red, blue, and greenish blue stars, the light of which is deprived of the rays necessary for the development of organized beings, and lastly must be excluded the stars which exist in thousands in regions more or less contracted, where the temperature is necessarily above or below the circumscribed limits.

If now we pass to the examination of systems analogous to ours, other restrictions present themselves. In the first place, the condition of temperature excludes the planets of which the axes of rotation are too slightly inclined to the planes of their orbits, Uranus, for example, of which each hemisphere is exposed to the sun for a half revolution of forty-two years, and plunged in darkness during the balance of its course. Venus also, (the axis of which is inclined 37°, is subject to great variation of temperature. We are also driven to exclude such bodies as have too slow a rotation, and hence are subject to too great influence of nocturnal radiation (the moon), and to eliminate others which, like Saturn, are surrounded with opaque rings, the shadows of which produce continual eclipses.

Proceeding still further, worlds devoid of a proper atmosphere must be omitted. An envelope formed exclusively of other permanent gases, even, will not suffice; it would be too permeable by heat, and its moderating action too limited. It is only by the presence of water in a liquid state, and by the enormous quantities of heat which, by its changes of state, it is capable of absorbing, that our atmosphere is enabled to fulfil its functions. Again the water must not cover the entire globe, but must be disposed in seas, so equilibrated that their movements reduce themselves to simple oscillations in fixed basins. This result could not be realized upon Saturn, since its mean density is lower than that of water.

As we stated at the outset, the chemical elements necessary to life are largely extended throughout the universe. While nitrogen and oxygen have never been recognized by spectral analysis of the sun or the stars, the existence of the former gas has been determined to be probable in the nebulæ, and the latter is found in meteoric stones which are almost entirely composed of terrous oxides. Hydrogen is present everywhere; carbon has not been found by spectrum analysis, but is readily recognized in the carbonaceous meteorites. Calcium, and hence lime, is largely disseminated; iron is everywhere, while Janssen's curious absorption spectrum indicates the vapor of water in the atmospheres of many celestial bodies. Closer investigation, however, shows that these chemical conditions are confined within narrow bounds, that the formation of planets at the expense of the central mass is governed by mechanical causes quite independent of such conditions, so that it cannot be concluded *a priori* that the planets necessarily possess the required atmospheres. While, on one hand, the analysis of meteorites appears to show that these bodies are formed in a medium slightly rich in oxygen: on the other, it is evident that free oxygen cannot result but from an excess of the gas over the hydrogen absorbed in the formation of water. Atmospheres of other worlds then are formed poor in oxygen or else totally free from it, and, like those of Jupiter, Saturn, and Uranus, as proved by the spectroscope, are composed of vapors or gases which exercise an absorption unknown to our world.

The further progress we make into the domain of natural science, as applied to the heavenly bodies, the further away from us the apparent probabilities of life existing thereon seem to recede. The recent discoveries of the spectroscope only prove the necessary conditions encompassed by still closer limits; and so far from being able to admit that they are naturally everywhere realized, we are barely able to cite two planets of our system, other than our earth, where such conditions have any shadow of probability of existing; while on the only globe of which we can speak with certainty, the moon, we know them to be utterly absent.

IMPROVEMENTS IN SUGAR MAKING.

The methods of purification employed in the sugar industry depend almost entirely upon the action of lime and the elimination of that alkali by carbonic acid. These processes leave, remaining in the saccharine products, a certain proportion of organic matters and mineral salts which oppose to a certain degree the crystalization of the sugar, while also causing the formation of molasses and the mingling of the sugar with the residue. M. P. Lagrange has recently devised a method which is based on the elimination by the joint action of baryta and phosphate of ammonia of the organic salts of lime, of certain vegetable acids combined with potash and soda, and of the alkaline sulphates existing in the sugar products. By this process, without the aid of lime or salts of lime, and while causing the eliminations as above noted, M. Lagrange believes that he is enabled to produce the products, and to secure the best conditions of alkalinity, without forming glucose at the expense of crystalizable sugar. In factories, therefore, devoted to the manufacture of cane sugar, it would seem that this improvement is of considerable importance as doing away with the serious difficulties and large losses due to the glucose formation and the lime salts.

The purifying process generally in sugar manufactories is applied to sirups of 20° Baumé, which have already been submitted to the calco-carbonic treatment. The products being led into a serpentine or double bottomed boiler, phosphate of ammonia is introduced in proportion to the lime, of which the quantity has been determined by hydrometric analysis, so as to leave in the sirup but a thousandth part of lime absorbable by the black; then the baryta is added, in such proportion to the sulphates and organic matters that the sirups will eventually contain but one one-hundredth part of matters still precipitable by that substance. The whole is then boiled, filtered, and carried to the coarse black, leaving in the receptacles a residue which constitutes a most valuable fertilizer.

In refineries where the purification is made in the boiler where the crude sugar is melted, dissolved phosphate of ammonia is substituted for fine black and blood in such proportion to the lime as to leave a hundredth part of the alkali, which the black totally absorbs: the baryta solution is next added, in such proportion to the alkaline sulphates and organic matters contained as that but the quantity of alkali necessary for the easy maintenance of the alkalinity up to the molasses will remain. To obtain the best results, experience has proved that, for a sample of sugar indicating 88°, the proportion of phosphate of ammonia crystalized per 2,200 lbs. of sugar is 1·6 lbs., and that of the baryta, per same weight of sugar, is 6·6 lbs., using the hydrate of 10 equivalents of water.

The mixture after melting is boiled, when the precipitate swells, and a clarification ensues, comparable to that obtained with blood albumen. The sirup is then treated as in the instance already cited, and the residue from the filters is also applicable for fertilizing purposes. The products of establishments using the process are said to be largely increased.

In connection with the subject of sugar manufacture may be noted an important invention recently patented by M. Marguerite (represented in this country by Mr. Edmund Ratisbonne, 48 Broad street, New York city), through this office, for obtaining sugar from molasses by the addition to the latter of certain salts which provoke crystalization. The process is said to be especially valuable in treating third quality sirups as well as molasses. The operation consists in adding to the spent molasses (containing, say, fifty per cent of sugar, fifteen per cent of salts, and twenty per cent of water) crystalized sulphate of magnesia in the proportion of twenty per cent by weight, together with a little water to make a solution of the sulphate marking 100° Baumé. The whole is then subjected to centrifugal action in a machine having either perforated sides or very fine wire cloth. The sulphates of lime and potash precipitated are retained and the liquor is then filtered through charcoal and boiled *in vacuo*. After cooling, a certain quantity of pounded sugar is added to form nuclei and the sirup is lastly subjected to the ordinary temperature of fillings, the heat being alternately raised and lowered.

After a few days, crystalization becomes exceedingly abundant and continues to increase for some time, after which the hydro-extractor is employed. Other salts, such as sulphate of soda, sulphate and chloride of magnesium, chloride of manganese, sulphate of iron and zinc and their chlorides, and also the acetates, nitrates, and ammonia salts, though these are not so desirable, may all be used instead of the sulphate of magnesia, the proportions of which vary according to the nature of the molasses and the results of expense.

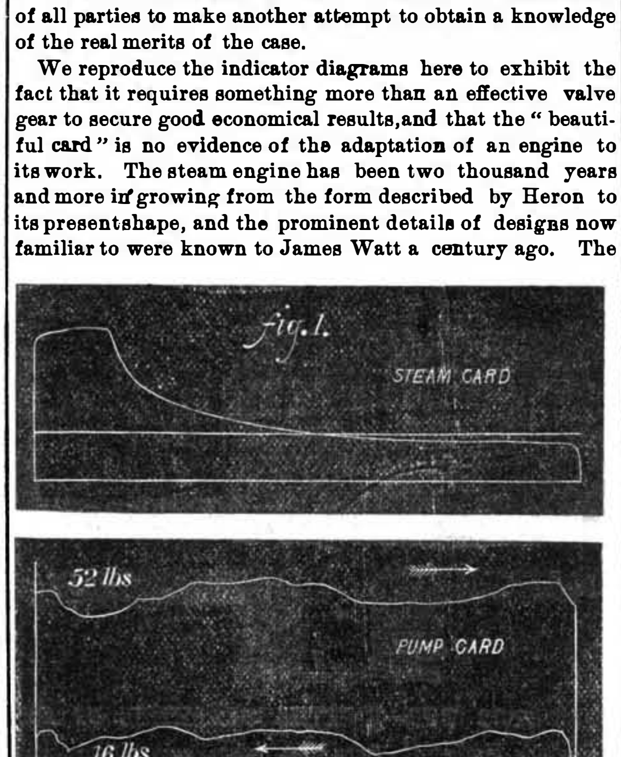
The crystalization of the sugar results from elimination of the potash, the salts of which are prejudicial, its place being taken by the magnesia, whose salts are favorable thereto. This invention we believe to be one of considerable importance in an economical point of view, and hence perhaps worthy of the closer examination of sugar manufacturers generally.

PUMPING ENGINE ECONOMY.

A *soi disant* "practical friend" writes us a note, referring to an editorial of March 2 (page 176 of our current volume) commenting upon that "Remarkable Report about Remarkable Pumping Engines," in which he informs us that the Providence pumping engines "were overhauled and boilers cleaned just previous to the two million gallon test," that indicator cards were taken, that the coal was screened, and that a maximum duty test could not be made "owing to causes still unexplained." He thinks that a different method of testing might have given a more satisfactory result; "but that there are many points, not embodied in the report," which influenced the decision of the board of experts. He encloses several of the indicator cards taken, a set of which we here reproduce as illustrating the peculiarities of the two styles of engine, the one being the representative of the standard drop cut-off single cylinder engine and the other being a good representative of rather conservative practice in the construction of "compound" engines.

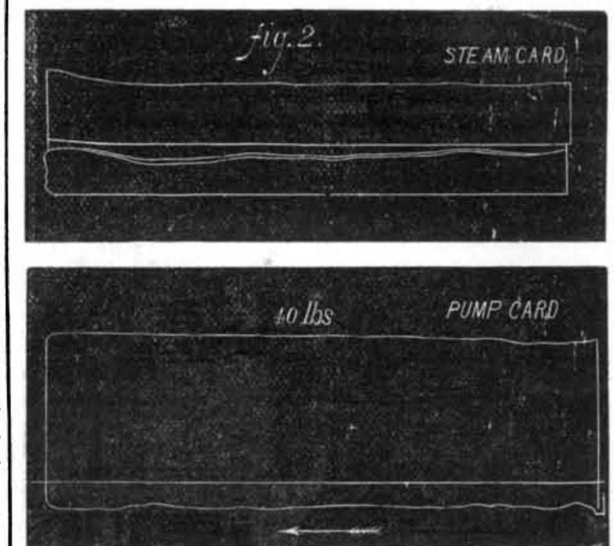
We based our remarks and strictures upon the report of the board, which we found published in the Providence *Journal* of March 2, in which the statements occur that: "The coal was not selected for any supposed superior quality, and was consumed just as it came from the yard without screening, picking or other special preparation," and "the engines and boilers, in both cases, were taken just as they were found, without any cleaning or other preparation." No mention, as we have already remarked, was made of indicators being applied to determine the cause of the low duty obtained. We have no reason to change our views as already expressed, views which we find expressed quite as strongly in the editorial columns of the *Engineering and Mining Journal* of subsequent issue and contemporary date. We have nothing to add: except that we are pleased to know that the examination was more complete than we had been led to suppose, and regret that the board should have rendered a report apparently inconsistent with the results, and that they should have allowed themselves to report at all before "circumstances permitted" a duty trial at full power and without the acquirement of essential data: and except that we are more than ever convinced that it is to the interest of all parties to make another attempt to obtain a knowledge of the real merits of the case.

We reproduce the indicator diagrams here to exhibit the fact that it requires something more than an effective valve gear to secure good economical results, and that the "beautiful card" is no evidence of the adaptation of an engine to its work. The steam engine has been two thousand years and more in growing from the form described by Heron to its present shape, and the prominent details of designs now familiar to were known to James Watt a century ago. The



problem of designing a good engine for any special purpose is still the most important and most difficult presented to the engineer; and we doubt if one in a hundred of those who attempt it are capable of doing creditable work. Indeed we believe that the number of engineers who are really familiar with the essential conditions of success might almost be counted on the fingers, and we are always distrustful of those who are most confident of their own powers as designers of steam engines.

In Fig. 1, we have copied the steam cylinder and pump cards of the Corliss, and in Fig. 2, those of the Worthington engine.



In the Corliss engine, steam is expanded from about one eighth stroke. In the Worthington there is no expansion by cut-off, but the ratio of expansion is the ratio of piston areas, —about three to one,—while the latter exceeded the former, on the two duty tests, by ratios of nearly two to one and four to one, respectively. The Corliss card is an exceedingly fine one, as exhibiting the action of the valve gear, but it gives no clue to the real value of the engine. The Corliss machine consists of five similar pairs of steam engines and pumps, coupled to one crank shaft; the Worthington was a single pair of cylinders, yet the pump card of the latter is beautifully smooth and far superior to that of the former. The vacuum on the steam card of the compound engine is better than on that of the single cylinder engine, as given by gage; but the difference seems less on the card. It is, however, sufficient to account for a part of the difference of duty.

The great causes of loss with the Corliss, we presume to be a short cut-off with low steam, large exposed surfaces in and outside the steam cylinders, and a boiler surface immensely disproportionate to the work done. This is shown to be the fact, also, by the evident tendency to equalization of efficiency at the higher duty test, and we are probably fully sustained in our demand for a careful test at full duty. We cannot understand yet why this was not made, and hope that we may be given good reasons for the neglect, if any exist.

The lesson taught by the affair, as it now stands, may be repeated in a few lines. It is as important for a designing engineer to know when expansion causes loss as to know when it may be expected to produce economy. It is important that the designer should understand the serious effect of external losses by conduction and radiation, and still more important that he should comprehend the nature and extent of losses by internal condensation and reëvaporation. It is important that an engineer should comprehend the necessity of making his boiler power just right, and that great losses will be incurred by error in making it either too large or too small for the work for which it is designed.

It is important that a constructing engineer should know that a loss of an inch or two of vacuum, a too tightly packed pump, or a leaky piston or valve, may destroy a hardly earned reputation.

It is important for the engine driver to understand these last points, and also that careless firing, an air hole or two, dead coals in the corners, or irregularity elsewhere, may mean a loss of very serious extent.

It is important that experts should understand all this, and many other matters not much less essential, and that they should: First, see what are the conditions under which the trial is to be made; secondly, see for themselves that everything is in order before commencing their test; thirdly, conduct the trial in such a way as shall reveal every defect and bring out every excellence of the apparatus tested; and finally, make a report that shall not only express their conclusions, but that shall enable all parties interested to see plainly the reasons thereof, and to judge for themselves whether the experts are experts, and whether their judgment is well sustained by facts, and is not warped by charity or prejudice.

A NEW disease to afflict horses and trouble their owners has appeared in New York and Brooklyn. It is called "pink eye," and appears to be a variation of the old epizoötic. The discharge in the epizoötic was from the nose; in "pink eye" it comes from the eyes, and for a time the horse becomes quite blind. It also causes a stiffness and swelling of the legs. The disease is not necessarily fatal, but minor diseases are superinduced by it. It is thought that the malady has been induced by the severe changes in the weather during the winter.

ALTHOUGH platinum is one of the heaviest of metals, yet its ductility is so great that Wollaston succeeded in drawing it into wire having a diameter of only one thirty thousandth part of an inch, a size so small that a mile length of the wire would weigh only one grain.