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Contents.

(Illustrated articles are marked with an asterisk.)

TAKING A CHANCE.

David said in his haste: "All men are liars." With equal truth and greater deliberation he might have said: "All men are gamblers." There is a fascination in taking a chance that is quite irresistible to most men, especially when the cost of the chance is small compared with the possible outcome; and the greater the promised prize, the less apt men are to think of the overwhelming probability of drawing a blank.

Just now the adventurous spirits of the country are feverish with a desire to get to the Black Hills. They know, or ought to know, that the ills that await the pioneer in that disputed region are blacker and more numerous than the hills; but report says gold is there, and multitudes are bound to have a chance for it, in spite of Uncle Sam, the Sioux, or any other hindrance.

The probabilities are a hundred to one against success in any individual case, even if the precious metal should be found in paying quantity; they are as strongly in favor of sickness, suffering, and violent death to such as win their way there. Yet the possible prize outweighs all the risks, and so dazzles the imagination that it alone is seen.

But these are reckless adventurers, you say. A life of privation and danger is what they specially enjoy. They are constitutional gamblers, and no fair type or illustration of the prudent average man of civilization.

True as to their character, but not true as to their representative character. Judging from their conduct on occasion, we must say that prudent men of business, popularly supposed to calculate the probable success or failure of any new enterprise with the passionless accuracy of a machine, are as likely to take a wild chance for a big prize—quite as likely to overlook the enormous probability that the promised prize is a fiction—as the most adventurous miner on the frontier. The one stakes health, strength, comfort, life, against a fabulous "pile;" the other stakes what is just as dear to him—his cash. Hence we have the familiar saying that the average capitalist can more easily be persuaded to go out of his regular line of business to take hold of a downright swindle (take hold honestly, we mean) than of a legitimate enterprise of reasonable promise. To the latter, he applies his customary business maxims, criticises percentages, and is the more cautious the less he knows of the nature of the proposed undertaking. In the other case, his credulity is in direct proportion to the extravagance of the promise and the depth of his ignorance.

For example, we will suppose that you, courteous reader, are a scientific metallurgist, and that you have wrought out and patented a process for the better separation of the silver from argentiferous galenas. You are in want of capital to carry out your project, so you go to the Hon. Mr. Mortgage Bond, the well known millionaire, and lay the matter before him. You show him that by the usual processes a considerable percentage of the silver remains in the lead, much to its detriment. You show him that, by your process, which is less costly than those in use, the silver is more completely separated from the lead, giving you a threefold profit, in the cheaper process, in the gain in silver, and in the superior softness of the lead.

"That is all very plausible," he will reply; "but I'm a banker. I don't know anything about metal working. But I do know that schemes like yours never turn out so well as the projectors imagine. Then the risks are very great. You will have to compete with all the wealthy firms already in the business, and they control the markets and the mines. You will have this other difficulty to contend with, and that, and that, and that."

In vain you try to convince him that you will have the inside track: that with a cheaper process and a purer product, you need fear no competition. You can afford to pay more for the ore and so command it, while the demand for pure soft lead is such that you need have no fear of the rivalry of those who supply an inferior quality. Your breath is wasted. The cautious capitalist is shy of patent processes. He looks only at the risks of the undertaking, and resolutely shuts his eyes to the merits which make success highly probable.

But (begging your pardon) suppose you are an arrant swindler, and that, instead of laying before our incredulous capitalist a legitimate enterprise of assured success, you go to him with a cleverly devised fraud: say a scheme for turning lead into gold. You talk glibly and with a great show of learning. You quote from a long list of authorities to prove that the growing opinion of chemical investigators is that all matter is substantially one at bottom: that the different qualities of the so-called elements are the product of varying molecular arrangement. You assure him that such is actually the case; you have demonstrated it by the transmutation of different metals into each other, as for instance gold into iron, iron into silver, silver into lead, and lead into gold. You present him with a brick of gold weighing a pound, and tell him that it is the product of three pounds of lead. Theoretically two pounds of lead are equivalent to a pound of gold, you tell him confidentially, but there is some waste in the process of transmutation.

It needs no argument to show that it is a "big thing," too big for any one man to handle. So you propose to establish a stock company to develop it, the Universal Company of Gold Refiners, of which the Honorable Mortgage Bond shall be president, with the lion's share of profit, in consideration for the capital required to set the project on foot. Of course it would not do to publish the fact that the gold is made on the premises; that would bring down the price of gold with a rush, and disorganize all established values. Secrecy would be essential. But if he had any doubt that the product was really gold, he could easily prove its quality by sending the sample brick to the mint to be tested.

Ten to one, the Hon. Mortgage Bond would bite. It would be too great a prize to miss. He could afford to risk a little on it, and would take the chance.

One more illustration: perhaps a better one for these days of Keelys and the like, not to mention their dupes.

It is well known that, as coal is now burned, the best of engines develop but a small percentage of the actual power of the fuel consumed. Suppose a clever inventor should devise a boiler capable of evaporating a third more water with a tun of coal than any boiler now in use. The supposition is not an extravagant one, and the increase of power could be easily demonstrated. The economy of such an improvement would ensure its ultimate adoption, subject only to the risk of some one's inventing something better; yet the maker of it would find it no easy task to induce men of means to furnish the capital required to put the improvement before the manufacturing public.

But suppose the same man were to get up a perpetual motion of the modern type, call it the Schwindler motor or something of that sort, and have it certified as something transcending all known principles and powers by two or three engineers of easy credulity. There would be no end of newspaper correspondents to write it up in the most eloquent English, with head lines to match. The greatest invention of the age! Unlimited power at nominal cost! No fuel required! Simplicity and safety combined! Power derived by catalysis, evolving the expansive force of nitroglycerin with the precision and gentleness of a jack screw! Explosion impossible!! Power of engine inexhaustible!!!

To interested enquirers, Mr. Schwindler could frankly say that he made no secret of his sublime invention, being confident that a grateful public would see him suitably rewarded for the stupendous benefaction he was about to confer on humanity at large. He would call the motive power of his miraculous engine expansive glycerin, not nitroglycerin, but something still more powerful, yet absolutely controllable. Its power would be developed by the passage of the glycerin over a certain compound of metals known only to himself, by which the bland liquid would be converted by catalytic action into cold vapor of enormous tension: the vapor, having done its work, to be discharged into a receiver enclosing another combination of metals whose opposite catalytic power would reconvert it into liquid glycerin without loss of substance. Once charged—and a gallon of commercial glycerin would suffice for a thousand horse power engine—the generation of power would be perpetual, without additional expense. Combining superior economy with absolute safety, the Schwindler motor could not fail to supersede all others, the Keely motor not excepted.

And there would be no lack of men eager to take a chance in a scheme so promising. What if it does fly in the face of all experience? Haven't we railways, telegraphs, steam navigation, and a score of brilliant achievements that were once as incredible to the conceited professors of Science who thought they knew everything?

It is the gambler's delusion in another form. The magnitude of the promised prize hides the multitudes of blanks.

It is useless to tell those infatuated with the dream of impossible riches that the marvelous projects which achieved success were the legitimate outcome of scientific investigations, and always in harmony with the previously discovered laws of Nature. The swindler's victims will know nothing of such things. They are not amenable to sober reason. There's a big prize in view, and they are determined to "go" for it.

THE KEELY MOTOR DECEPTION.

We continue to receive hundreds of newspapers from all parts of the country, containing the most fulsome endorsements of this most puerile deception. Nothing more lamentably exhibits the general lack, in this country, of elementary scientific education, than the editorial comments upon this subject by many of the papers. With very few exceptions, the writers are unable to perceive why the Keely chimera may not be true, the general line of argument and thought being that, inasmuch as modern discovery has heretofore revealed and produced inventions quite as startling as anything assumed by Keely and his abettors, therefore *it may be* that what he claims is well founded; and it is unwise, imprudent, to throw doubts upon his statements, especially when they are so thoroughly supported by other persons of reputed intelligence and veracity. To all of which it is a sufficient reply to say that any inventor who pretends to get something out of nothing, or to produce more force or more substance out of a given quantity of materials than they possess, is a deceiver, no matter how many respectable people join hands, like the Keelyites, to support the deception.

"People," says Keely, "have no idea of the power in water, I mean that can be drawn out of it. I purpose to run a train of thirty cars from Philadelphia to New York at the rate of a mile a minute, out of as much water as you can hold in the palm of your hand."

Both of these statements are incorrect. Estimating approximately, the power in water, or the power that it can be made to furnish, whether in liquid or vaporic form, is perfectly well known. Four thousand gallons of water, falling one foot in a minute, furnish one horse power. One sixteenth of a horse power is furnished by one cubic inch of water, if converted into vapor at the ordinary atmospheric pressure. To run a train of thirty cars from Philadelphia to New York, at the velocity of sixty miles per hour, would require not far from two hundred barrels of water and over two tuns of coal.

These are among the elementary facts pertaining to motive engineering, which no Keelyite can set aside; and which, if they were kept in mind by editors, would enable them to perceive at a glance the grossness of the present deception.

In further illustration of the need of better educational training among our business men, as a protection against stock-jobbing deceptions wrought and maintained in the name of Science, we give in another column a few gems from the most recent declarations of Keely. These were lately made to the correspondent and reporter of *Inter-Ocean*. We also give extracts from the statements of some of Keely's chief assistants, showing the rise, progress, and management of the deception. The price of the Keely stock, which at one time was very high, is beginning to ebb, and in a short time all the beautifully engraved stock certificates will doubtless find their way into the cellars of the rag and paper dealers.

THE NEW PHYLLOXERA REMEDY.

We took occasion recently to announce the discovery, by M. Dumas, of an efficient phylloxera remedy, in the alkaline sulpho-carbonates, a class of salts which hitherto have been more objects of scientific curiosity than available for any beneficial employments. As the vine growers in this country are directly interested in the result of M. Dumas' very important investigation, we propose briefly to review the nature of the above chemicals, in giving below a few facts, for which we are indebted to *La Nature*, relative to the researches of the well known French chemist.

Everybody is familiar with the potashes, sodas, and the lime of commerce. If in these substances the oxygen contained be replaced by sulphur, the sulpho-carbonates of potassium, of sodium, of calcium, and its analogue, the sulpho-carbonate of barium, are obtained. Of these, the salt most utilized at present is the sulpho-carbonate of potassium, made by calcining sulphate of potassium with carbon, forming by reduction a monosulphide of potassium. A saturated solution of the latter is made in water, and sulphide of carbon added, when, after prolonged agitation, a reddish orange liquid, marking 37° to 40° on the Baumé areometer, is obtained.

While the sulphide of carbon is by itself an efficient insecticide, it offers disadvantages through its volatility, injurious vapors, etc., which neutralize its benefits. The sulpho-carbonates on the other hand have no disagreeable odor, are not dangerous to handle, are not inflammable, and are unalterable in the soil. When in contact with acids, however, even if these be the weakest, and especially when acted upon by the moist carbonic acid which arable earth imbibes, the salts are transformed into carbonates, and disengage sulphide of carbon and hydrosulphuric acid in vapors, both of which, and especially the first, are highly poisonous. To combat the phylloxera, such gases, as experiment has proved, are the only effectual means. It is necessary not merely to poison the insects upon the vines and roots, but to render the earth in the vicinity uninhabitable by them. Besides some such substance as the salts alluded to must be employed on account of the slow reaction of the acid, keeping up a supply of deleterious gas for several days, or longer than the insect can defy its influence by shutting its respiratory orifices.

It is found that 1442 grains of sulpho-carbonate of potassium will poison from 111 to 132 cubic feet of air, and will drive insects from 198 to 284 cubic feet of earth, killing not merely the comparatively delicate vine louse, but the larvæ of crickets and other large insects. The mode of application is to make a hole at the root of the vine, about 1 foot deep and 16 inches broad. Into this pour five or six quarts of water mixed with from six to eight quarts of the sulpho-carbonate solution at 40° Baumé. When the liquid is well absorbed, the hole is filled up, and the operator passes to another vine. The solution is thicker than water, and, when mingled therewith, percolates slowly through the ground, reaching the deepest roots.

In order to render the sulpho-carbonate of potassium or of sodium, which salts closely resemble each other in their toxic properties, easily portable, M. Dumas suggests mixing them with twice their weight of slaked lime. The powder thus obtained is very easily sprinkled over the surface of the soil.

RATE AND CAUSE OF GLACIAL MOTION.

The movement of a glacier has many resemblances to that of a river. It follows the windings of the valley; is more rapid in the center than at the sides, at the surface than at the bottom, because the center of the surface is subject to the least friction; the part having greatest motion changes to the right and to the left of the center as the glacier changes its direction; it moves more rapidly when the descent is steepest, and where there are least obstructions; it becomes broken up and uneven when the bed is rough; and a large stream is often made up of smaller ones joining one another. The distance to which the ice river flows depends upon temperature and the amount of precipitation. In cold and wet years, it may extend fifty feet further than ordinarily; while under opposite conditions, the lower edge of it may melt away more rapidly than it advances down the valley, and hence seem to recede. It always descends in summer beyond the region of snow and ice, and flowers and other summer vegetation are not uncommon in close proximity to the ice mass. The force with which a glacier advances is so great that trees and forests, houses and villages, offer no more apparent resistance than a straw in its way.

Many students of glaciers have made investigations more or less carefully, respecting the rate of glacial movement. But there are so many modifying circumstances—as position and formation of the valleys; inclination, size, and thickness of the glacier; influences of the seasons and the weather—that even in the same glacier the rate is so variable that no universal law can be established. Some move most rapidly at the upper part, least at the lower, and just the average in the middle, while others move with greatest rapidity at their lower extremity. Eight inches per day may be considered a fair average of all glaciers and all parts of each. In the earlier investigations on this subject, only rough and inaccurate means were used for making the measurements, such as building a hut on the ice, or leaving some object, as De Saussure's ladder, on the surface, and noting how far it had descended each year, or after an interval of several years.

The works of James D. Forbes on glacial phenomena rank among the classics of physical science. He was a precocious Scotch youth, whose mother, by the way, came very near being the wife of Sir Walter Scott when she was young; the only thing that prevented was the simple fact that she said "no" when Sir Walter wanted her to say "yes." Young Forbes was studying Science, and entreating his father to buy him a telescope when a mere child. At eight, he composed sermons. Before ten, he was reading Phædrus with his father, having previously read Cæsar. At seventeen he was contributor to the Philosophical Journal, then edited by Sir David Brewster. At twenty-four he was elected to the chair of Natural Philosophy at Cambridge. He was then a member of the Royal Societies of Edinburgh and London, and writer in the Edinburgh Review. This savan, better known as Principal Forbes, made the first accurate determinations concerning the rate of glacial movement. He used the theodolite which his father gave him, in place of a telescope. By mounting this upon the glacier in various positions, and taking an exact point of observation on the wall rock, he made correct measurements at fixed intervals of time. He also set up rows of pegs in exact line across the glacier, and, by noticing their later deviations from a straight line, determined the rate of motion in different parts.

From these exhaustive and delicate observations, he arrived at the following conclusions: (1) Glacial motion is approximately regular; (2) it is nearly as great during the night as during the day; (3) a marked increase of motion is due to heat of the weather; (4) the center of the glacier moves more rapidly than the sides.

The cause of this motion has been subject to much discussion, and, cold as the subject is, it has occasioned frequent heated contests and many warm words. Beds of tough clay will rest on a considerable slope without sliding; loose stones and *débris* will rest on a hillside with an inclination of 80°; and at the embankment formed by the material shot out from Mount Cenis tunnel, the inclination is much steeper than this. But ice, more rigid than the hardest clay, will move on a slope inappreciable to the eye. And the question stated is: "What property does ice possess which enables it to creep upon slopes down which only fluids and semi-fluids can move?" De Saussure ascribed the motion of ice to a mere gliding or sliding upon an inclined plane, like that of a piece of slate detached from the roof. But this could not take place over a very rough bed or in presence of an immovable obstruction. De Charpentier—and, in his earlier writings, Agassiz—explained the movement by an expansion of the mass due to freezing, in the crevices, during the night, of water which melted during the day. But this would necessitate an alternation of rate between day and night which the best observations do not detect.

In review of Principal Forbes' results, it is not strange that he looked upon the glacier as a river of ice, and attributed its motion to the viscous or plastic nature of the mass, in consequence of which it is urged downwards by its own weight, like tar or treacle. An infinite number of minute rents occur when the ice is subject to violent strain, and the bruised surfaces are forced to slide over one another, producing a *quasi* fluid character in the motion of the whole. This is quite consistent with the rapidity of motion in different portions, due to friction, inclination, and bulk of the glacier, and its compression on entering a narrow passage, and expansion as the channel widens. But we can hardly conceive that ice, with its known unyielding and brittle nature, could thus be changed merely by its own weight. Tyndall also ascribed the motion to fracture and regelation, due to the pressure of its own weight, and extending to every minute particle. Faraday had previously noticed that two moist pieces of ice freeze together when in contact. Canon Mosely opposed the last two theories with the idea that there is a constant displacement of ice particles over and alongside one another, to which is opposed that force of resistance known in mechanics as shearing force, which force weight alone is not able to overcome. He claims that, considering ice a solid body throughout, there must be some other force besides gravity to drive it forward, as even clay, so much more yielding than ice, does not descend by mere weight.

Another theory held by Professor James Thomson and his brother, Sir William, and advanced by two or three others about the same time, is based on the idea that the freezing point of water is lowered by pressure. Condensation as the result of pressure diminishes the capacity for heat, and hence some latent heat becomes sensible. This free heat, instead of remaining free, expends its force in melting contiguous molecules of ice. As water occupies less space than ice, the melted ice makes more room for the unmelted particles; these then have space to yield to pressure, and move in the direction in which it is exerted. The water, subject to less pressure, moves in the direction of gravity, and, coming in contact with ice colder than itself, freezes. The ice again resists pressure and is melted, and in this way there is a constant change in the position of molecules, which has the effect of giving ductility and movability to the mass. Ice has been subjected to great force in Bramah's hydrostatic press, by which it can be made to assume any desired shape by the use of suitable molds. This is explained by supposing that the pressure liquifies the ice, which, in the melted state, conforms to the shape of the mold and then consolidates when the pressure is removed. This theory seems quite plausible and is accepted by many. The only apparent objection is in the question as to whether the weight of the superincumbent mass is capable of producing pressure sufficient to liquefy the ice below; and we are not aware that this question has yet been conclusively answered.

Croll's theory, which is considered the only tenable one by another class of physicists, ascribes the motion to heat rather than to pressure. The heat of the sun melts the surface of the ice, and if it were constant would in time melt the solid mass; but when the sun's rays are removed from any molecule, it congeals and, by its condensation, gives off heat which melts another molecule. The molecule, during the instant it remains water, is acted upon by gravity and assumes a lower position in the ice mass; this on freezing gives off its heat to a lower molecule, which in its turn seeks a lower place. The heat of the sun is thus transmitted through ice by the melting and freezing process, from molecule to molecule, and every melted molecule sinks lower in the mass. Thus the sun's heat causes the ice gradually to work down hill. The sun is aided in heating the interior, by warm winds and rains which are admitted by cracks and fissures (always abundant), by the internal heat of the earth, and by heat caused by friction of the moving mass on the bottom. Experiments made by Professor Agassiz, by means of a hole in the ice 200 feet deep, lead to the conclusion that the internal part of a glacier has a comparatively high temperature, and in winter this is greater than the surrounding atmosphere. But his results were somewhat contradictory, and the real state of temperature in the center is mainly a matter of conjecture. The objection to this theory appears in Forbes' results, that motion is approximately regular—nearly as great during the night as during the day.

All the investigations thus far noticed on the rate and cause of glacial motion have been confined to local glaciers, like those of the Alps. In our own age there is manifestly but little opportunity to study phenomena connected with any existing continental ice sheet. We may some day obtain information in this line from a study of a sheet glacier of Greenland, and would doubtless have been able before now, if arctic explorers had succeeded in reaching points sufficiently far north. Agassiz said, at Penikese: "Since we have no positive data, we can form some idea of their motion by the number of icebergs which they send forth annually; for these icebergs could not exist but for the advance of the glaciers into Baffin's Bay, where their ends are lifted up by the water, broken off, and floated south. We do not know what these icebergs amount to, though it would not be difficult for an observer at the south end of Baffin's Bay to ascertain approximately by counting the number of icebergs that pass a given point annually." He assumes that the continental glaciers moved at least as fast as 100 feet per year. At this rate it would take over 50 years for a boulder of Lake Superior copper to travel one mile south; and as some are found 500 miles south of their home, it would have required 25,000 years to reach this distance. This affords us one of the many indications of the vast antiquity of our globe.

In the Boston Society of Natural Science a few weeks ago, Professor Shaler, while accepting Croll's theory in the main for the movement of local glaciers, advanced the belief that the cause of *sheet* glacial movement was the melting of ice at the bottom by the pressure of the superincumbent mass, and that this water, in its effort to escape in the direction of least resistance—or towards the edge,—would push forward boulders, gravel, etc., and thus cause the southerly movement of erratics. He thinks the ice sheet itself did not move, and attributes the cause of scratchings on the boulders and bed rock to local movement at the edge of the ice sheet when it was melting, which movement Mr. Croll's theory may explain. The continental glacier, on account of the unevenness of the earth's surface, must often have moved up hill for miles, and sometimes for hundreds of miles, if it moved at all, and for this he thinks there is no adequate explanation.

SCIENTIFIC AND PRACTICAL INFORMATION.

GROWING ROSES.

"An Old Rosorian" says: "Roses require a strong soil, highly enriched with good rotten manure; an open situation and loamy soil for the strong growing, hardy kinds, and a protected aspect and light soil for the teas and other tender varieties. The hybrid perpetuals in my judgment are the most desirable among the hardy roses, as they are the best for all the various purposes to which they are applied in garden and lawn decoration. The teas, however, are the diamonds *par excellence* of the race, although needing great care in their culture. I advise that they be grown in pots, and sunk in the ground during the summer, and removed to a cold frame or greenhouse during the winter. If left remaining in the open ground, they should stand on the south side of a wall, fence, or hedge, and on the approach of cold weather, receive a covering in the form of a shed open to the south, and the plants have a liberal supply of manure over the surface of the ground, and plenty of leaves over the whole plant. If roses are set out in autumn, perform the operation very early in November, so as to allow the roots to obtain a hold in the soil before cold weather. Give them a thorough dressing of manure to protect against sudden changes. Choose a dry day for planting, the drier the better. Be careful to tread the soil firmly around the plants; this is very important. A cloudy day is the most desirable for removal; and moisten the roots first, to be followed by a thin coat of dry earth over the fibers."

CHEAP COOKERY.

We noticed, while visiting a large steel-making establishment recently, that the workmen at noon ingeniously utilized the ingots of steel, which lay cooling in the yard, as cooking stoves, and seemingly prepared their dinners over the heated metal as easily as over a fire. The idea is a good one, and might be adopted with advantage by the men in all metal-working concerns. We believe that the custom is not common among the workmen in this country, nor in the ironworks in England, though it owes its origin to and has long been practised in the tin melting establishments of Cornwall. It is considered quite a civility there to offer a visitor a chop nicely broiled over a recently run ingot of tin. The big hammer block, we were told as an especial wrinkle, is the best place to fry things, as it is smooth and usually just hot enough. Ingots are ordinarily rough and generally somewhat too warm. In winter time, a workman can economize considerably, and at the same time get a hot dinner, by thus utilizing the wasted heat of the metal.

PORTLAND CEMENT.

Three tests are used:—1. Resistance to tensile force. 2. Specific gravity. 3. Water test. The first is by making a specimen briquette in a mold with a transverse section of 2·25 square inches, the specimen being held vertically in clips, which is placed under the short arm of a steel yard balance, and broken. Mr. Bazalgette used a test of 500 lbs. on an area of 2 25 square inches after 7 days immersion in water. The second method is by finding the weight in pounds of the struck bushel. The water test is useful when the others cannot be applied. It consists of gaging a small quantity of the dry powder with water, and immediately immersing it in water. If the sharper edges crack or break away after a short time, the cement is too hot or fresh, or is inferior in quality. The weight of good Portland cement ranges from 100 lbs. to 130 lbs. per bushel, equal to from 80 lbs. to 102 lbs. per cubic foot. The lighter kinds set more rapidly than the heavier, but are weaker. Mr. Bazalgette specified a specific gravity of 110 lbs. to a bushel.

THE VORACITY OF PICKEREL.

According to M. Peupion, who has been practically investigating the subject, a pickerel will eat 47 pounds and 4 ounces of fish per pound of its own weight per year.

THE following is one way to cut a bottle in two: Turn the bottle as evenly as possibly over a low gaslight flame for about ten minutes. Then dip steadily in water; and the sudden cooling will cause a regular crack to encircle the side at the heated place, allowing the portions to be easily separated.