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CULPABLE LOSSES OF ARMY HORSES.

A mistaken notion prevails in the community respecting the losses sustained by the great number of horses which have died of disease in Washington, and those which have been sold, as diseased, for a fewdollars after high prices had been paid for them by government. Many indifferent horses were undoubtedly purchased, but most of those which have died of disease, and those which have been sold as being useless for the army, were in good condition when purchased, and the loss which government has sustained by them can be traced to bad treatment.

The horse is an animal of fine organization and he requires to be nearly as well treated as his rider. In all nations where large standing armies are maintained, the governments support veterinary schools, from which competent surgeons are obtained for cavalry regiments. The horses of such armies are as well cared for as the soldiers. They have hospitals, good stables, and they are well fed and kept scrupulously clean. As the mounted troops hitherto required by our government have been few in number, no extended system, embracing the care of large numbers of horses was adopted; and under the altered circumstances of the present momentous war crisis, no proper head seems to have been selected to systematize and carry out measures for the organization of a large and efficient cavalry department. Many thousands of horses were purchased in the Northern and Western States and sent to Washington, where they were exposed for a long time to very inclement weather without stables, blankets or sufficient food of a proper quality.

Horses, like human beings, are very liable to become sick by a change ofclimate and water for drinking. This sickness will only last for a few days if the animals are properly treated, after which they will become acclimated and remain healthy with ordinary care. If they are not properly treated when first taken sick the disease is liable to become chronic and ultimately fatal. This was the case, we have been assured, with great numbers of the army horses sent to Washington.

It requires a mind of no ordinary grasp and experience of no common kind to superintend the army department relating to the horses of the cavalry, artillery and baggage trains. With respect to details, it appears that the right man has not yet been put into the right place, as it is reported by the newspapers that the horses of the army on the Potomac are now dying off daily in scores for want of proper care and provender.

Judging from the appearance and conduct of the majority of persons who are employed to take careof horses, it appears to us that a woful delusion is prevalent respecting the qualifications necessary for the performance of such duties. Any man capable of measuring out a peck of oats, carrying a pailful of water, or tumbling in a bundle of hay and throwing out a heap of manure from a stable seems to be held competent to take care of a horse, whereas it requires a man of good judgment, much patience, firmness, intrepidity, kindness and careful habits to take this charge. There is a sad deficiency of such characters connected with our cavalry departments.

The most gross negligence and incompetence have also been displayed in shipping numbers of valuable horses by sea, on expeditions down the Southern coast. Of 130 excellent horses sent from Boston to Ship Island, 68 were lost during the voyage, owing to the improper method of packing them on board. Their flimsy stalls broke down when the ship labored in the sea, and the animals were dashed from side to side kicking and trampling one another to death. During the Crimean war the steamer *Himalaya* transported from the 1st of June to the middle of October, 1856, 3,000 horses, out of which only 3 were lost. In fitting up this vessel the platforms of the stalls were raised two inches off the deck, to admit of cleaning, draining and washing. Each horse had a separate stall, the sides and ends of which were of plank, and padded with cowhide stuffed with straw. The horses wore canvas head-stalls, and sling eyebolts were fastened to the deck, over the center of each stall, by which the horse was supported with a wide band of canvas under his belly whenever his situation required it. No such precautions were provided for the shipping of our horses; hence the great loss which has been sustained.

PROFESSOR AGASSIZ IN BROOKLYN.

The late Augustus Graham, of Brooklyn, in addition to other charitable bequests, left in the hands of trustees a fund of $12,000, with directions that the interest should be expended for popular lectures of a character somewhat similar to the Bridgewater treatises. The will prescribes that the lectures shall be "On the Power, Wisdom and Goodness of God as manifested in his Works," that they shall be delivered in Brooklyn on Sunday evenings by the most eminent masters of science that can be procured, and that they shall be free to all. The course delivered winter before last was by the Rev. Dr. Huntington; the course last winter by J. P. Cooke, Professor of Chemistry in Harvard University, and for the course this winter the trustees have been so fortunate as to enlist Professor Louis Agassiz.

It is well known that heretofore Prof. Agassiz has refused to deliver popular lectures, saying that his life was devoted to enlarging the boundaries of knowledge, and that he should leave to others the labor of its dissemination. But from his writing popular articles for the *Atlantic Monthly*, and consenting to deliver this course of lectures, it seems that he has changed his determination. It is with the highest satisfaction that we welcome the entrance of the greatest master of science in the world upon the field of that labor to which the SCIENTIFIC AMERICAN is devoted—the diffusion of a knowledge of science among the great mass of the people.

The first two lectures of Agassiz's course were delivered in the small hall of the Brooklyn Institute, but so many who went were unable to procure admission, that a successful effort was made to obtain the Academy of Music for the remaining four lectures. The third lecture of the course was delivered on Sunday evening, Feb. 2, and the spacious building was crowded from parquette to ceiling with as respectable and intelligent an audience as is gathered there on opera night. In the natural order of the course the theme happened to be one in which Professor Agassiz is especially interested, and he treated it in a manner so methodical and clear as to charm the attention and command the comprehension of every person in the house. A report of the lecture will be found on another page.

HISTORY OF HELIOGRAPHY.—On another page will be found the first of a series of articles we intend to publish on the above-named very interesting art, from the pen of M. A. Root, whose brief biography appeared in our last issue, under the title of "Fortunes and Misfortunes of an Artist." Mr. Root is about to publish a very useful and interesting treatise on the heliographic art, and the articles which will appear in these columns are extracts from the forthcoming work.

CHOOSING COTTON SEED.—A correspondent of the *Prairie Farmer* exhorts the farmers in Southern Illinois who intend to go into cotton planting next season to be very careful in the selection of seed. Sea-island cotton requires nine months of hot weather to mature to a full crop. The seed of this quality must not be used, but only that which is grown in the most northerly parts of Tennessee.

THE EXPLOSION OF GUNPOWDER.

On another page will be found a very interesting discussion on gunpowder by some of the best chemists in the city, and as they allude to the usual explanation of the matter we will give the explanation as we understand it.

Gunpowder is composed of five elements, all in the solid state, but by fire they are combined in new forms, by which about six-tenths of the mass is converted into gas; the chemical changes generating an intense heat. This change into the gaseous form causes an enormous increase in the volume, which is still further augmented by the rise in the temperature, and the ball is thus driven out of the gun.

Gunpowder is made by the combination of three substances, niter, sulphur and charcoal. Two of these, sulphur and charcoal, are simple elements, while the third is a compound substance. Saltpeter is the nitrate of potash and is composed of one equivalent of nitric acid, and one equivalent of potash. Potash, or potassa, is composed of one equivalent of the metal, potassium, and one equivalent of oxygen. Nitric acid is composed of one equivalent of nitrogen and five of oxygen, NO_5. The symbol of potassium is K, from the German name of the metal, Kalium. So the formula for the nitrate of potassa is KO, NO_5, and it will be seen that it is composed of three elements, nitrogen, oxygen and potassium.

The best gunpowder contains to the 100 pounds of niter, 17.76 pounds of sulphur, and 15.86 of charcoal, or carbon. This is precisely one atom of nitrate of potassa to three atoms of carbon and one atom of sulphur. And this, by being decomposed at the high heat which is generated when the powder is burned in a gun, is converted into one atom of sulphide of potassium, one atom of nitrogen and three atoms of carbonic acid,

$$KO, NO_5+C_3+S$$

becoming

$$KS+N+3CO_2$$

It will be remembered that the atomic weight of potassium is 39, of sulphur 16, of nitrogen 14, and of oxygen 8. In this case 100 parts by weight yield 59 parts of gas; and one volume yields 300 volumes; the sulphide of potassium being a solid, and nitrogen and carbonic acid being gases.

MALLEABLEIZING CAST IRON.

Malleable iron is more generally understood to be cast iron, which has been subjected to a roasting deoxydizing process, without being fused, by which it becomes soft and tough. Formerly, wrought iron was called malleable, because the art of softening and toughening cast iron was then unknown, but wrought is now understood to be purified iron, capable of being rolled, forged and welded under the hammer.

The great genuine improvement, in the treatment of cast iron to render it malleable, was made by Samuel Lucas, of Sheffield, England, who obtained a patent in 1804, and his process is the one which is in general use at the present day for the same purpose. The articles of cast iron to be malleableized are placed in a suitable furnace with a layer of sand between them to prevent them from adhering, then they are covered with a pulverized oxide of iron, and subjected constantly to a high but not fusing heat for about six days and nights, then allowed to cool very slowly. The theory of the process is that the excess of carbon in the cast iron which renders it so hard and brittle unites with the oxygen of the pulverized iron ore in the furnace and passes off as carbonic acid gas, leaving the iron soft and malleable without changing its form. This was one of the most valuable discoveries ever made in metallurgy. It is now extensively practiced as an especial branch of art in every civilized country. Most cast iron articles intended for bridges, carriages, or for any purpose where they are to be subjected to vibrations are malleableized. Cast iron nails can be rendered so soft and tough by thus treating them, that they may be clinched almost as easily as those made of wrought iron. In 1838 Charles Burjot obtained a patent in England for treating raw pig iron with a mixture of the oxyde of manganese and charcoal in powder, in a furnace whereby he obtained malleable iron. The pigs were laid in alternate layers in a furnace with the mixture of manganese and charcoal between them, then they were kept at a red heat for two or three days, and subsequently left to cool in the furnace for three days. The second process is a mere modification of the first. Cast iron articles, without being melted or having their form altered are thus rendered malleable.

Wrought iron is incapable of being melted and cast, but by mixing it with three times its weight of pig iron it will fuse under a strong heat and may be cast and annealed. Castings possessing the same properies as those of malleable iron may thus be obtained, but unless made of cheap scrap iron they would cost more than castings entirely of pig iron malleableized.

ENAMELING IRON.

Enameling iron is almost a new art. No metal is capable of receiving a coating of vitrified porcelain or enamel unless it is capable of withstanding a red heat in a furnace. Articles of cast iron, as a preparation for enameling, are first heated to a low red heat, in a furnace, with sand placed between them, and they are kept at this temperature for half an hour, after which they must be allowed to cool very slowly, so as to anneal them. They are then subjected to a scouring operation with sand in warm dilute sulphuric or muriatic acid, then washed and dried, when they are ready for the first coat of enamel. This is made with six parts, by weight, of flint glass broken in small pieces, three parts of borax, one of red lead and one of the oxide of tin. These substances are first reduced to powder in a mortar, then subjected to a deep red heat for four hours, in a crucible placed in a furnace, during which period they are frequently stirred, to mix them thoroughly; then toward the end of the heating operation the temperature is raised, so as to fuse them partially when they are removed in a pasty condition and plunged into cold water. The sudden cooling renders the mixture very brittle and easily reduced to powder, in which condition it is called frit. One part of this frit, by weight, is mixed with two parts of calcined bone dust, and ground together with water until it becomes so comminuted that no grit will be sensible to the touch when rubbed between the thumb and finger. It is then strained through a fine cloth, and should be about the consistency of cream. A suitable quantity of this semi-liquid is then poured with a spoon over the iron article, which should be warmed to be enameled, or if there is a sufficient quantity the iron may be dipped into it and slightly stirred, to remove all air bubbles and permit the composition to adhere smoothly to the entire surface. The iron article thus treated is then allowed to stand until its coating is so dry that it will not drip off, when it is placed in a suitable oven, to be heated to 180° Fah., where it is kept until all the moisture is driven off. This is the first coat; it must be carefully put on, and no bare spots must be left on it. When perfectly dry the articles so coated are placed on a tray separate from one another, and when the muffle in the furnace is raised to a red heat they are placed within it and subjected to a vitrifying temperature. The furnace used is similar to that used for baking porcelain. This furnace is open for inspection, and when the enamel coat is partially fused the articles are withdrawn and laid down upon a flat iron plate to cool, and thus they have obtained their first coat of dull, white enamel, called biscuit. When perfectly cool they are wet with clean soft water, and a second coat applied like the first, but the composition is different, as it consists of 32 parts, by weight, of calcined bone, 16 parts of China clay and 14 parts of feldspar. These are ground together, then made into a paste, with 8 parts of carbonate of potash dissolved in water, and the whole fired together for three hours in a reverberating furnace, after which the compound thus obtained is reduced to frit and mixed with 16 parts flint glass, 5½ of calcined bone and 8 of calcined flint, and all ground to a creamy consistency, with water like the preparation for the first coat. The articles are treated and fired again, as has been described in the preparation coat, and after they come out of the furnace they resemble white earthenware. Having been twice coated, they now receive another coat and firing, to make them resemble porcelain. The composition for this purpose consists of 4 parts, by weight, of feldspar, 4 of clear sand, 4 of carbonate of potash, 6 of borax, and one each of oxide of tin, nitre, arsenic and fine chalk. These are roasted and fritted as before described, and then 16 parts of it are mixed with the second enamel composition described, excepting the 16 parts of flint glass which is left out. The application and firing are performed as in the other two operations, but the heat of vitrification is elevated so as to fuse the third and second coats into one, which leaves a glazed surface, forming a beautiful white enamel. A fourth coat, similar to the third, may be put on if the enamel is not sufficiently thick. The articles may be ornamented like china ware, by painting colored enamels on the last of the coats, and fusing them on in the furnace. A blue is formed by mixing the oxide of cobalt with the last-named composition; the oxide of chromium forms a green, the peroxide of manganese makes a violet, a mixture of the protoxide of copper and red oxide of lead a red, the chloride of silver forms a yellow, and equal parts of the oxide of cobalt, manganese and copper form a black enamel when fused. The oxide of copper for red enamel is prepared by boiling equal weights of sugar and acetate of copper in four parts of water. The precipitate which is formed after two hours moderate boiling is a brilliant red. The addition of calcined borax renders all enamels more fusible.

MORE ABOUT NOVA SCOTIA GOLD FIELDS.

A pamphlet on this subject has just been issued by Dr. Gesner, of this city, as a communication to the London Geological Society. On page 7 present volume SCIENTIFIC AMERICAN we presented some extracts from an article, by Mr. O. C. Marsh, on this subject. Dr. Gesner has visited the mines, and this pamphlet is the result of his labors and observations. In a geological sense it is interestng.

In the central portions of Nova Scotia there are extensive ranges of granite and other rocks varying in hight from 500 to 1,000 feet above the level of the sea. Metamorphic rocks of great thickness lean against the granite, and these are succeeded by the silurian and coal formations and trap rocks. Dr. Gesner informs us that "the gold has only been discovered in the metamorphic rocks which touch the granite on one side and the silurian on the other." At Tangier gold was accidently discovered, in 1860, in a small stream flowing into the Atlantic about fifty miles from Halifax. Gold is found in this place in quartzite, metamorphic clay, and greywacke. In form it resembles rough, feathery metal obtained by pouring any molten metal among cold water. The average yield of gold to the tun of ore is not stated, but about 600 miners were employed at this place last summer. Seven other diggings were visited, but the description of Tangier would nearly apply to them all, with the exception of "The Ovens," which seems to be a curious place. The name has been to the given locality on account of large and peculiar excavations made in the rocks by the sea. They are formed in a peninsula which is about one mile in length by a half in breadth, jutting out into Lunenburg Bay. The precipices are about fifty feet in hight above the water, and the southern side of the peninsula is principally composed of metamorphic slate containing thin seams of quartz in which the gold is found mixed with sulphurets of iron, mispickel and mica. In one of the caves in "The Ovens" considerable quantities of gold have been washed by hand from the sands on its floor. The amount of gold obtained at this place, without machinery, from June to December, 1861, was valued at $120,000. It varies in size from small spangles up to rough pieces about the size of a walnut. By Dr. Gesner's essay Tangier gold contains 96.50 of pure metal and 2. of silver. The gold of "The Ovens" contains 93.06 of gold and 6.60 of silver.

Of the gold-yielding rocks of Nova Scotia Dr. Gesner says:—The Province contains an ample amount of the precious metal to warrant most expensive operations and the construction of machinery for its mining and purification.

ACCORDING to the London *Times* one serious defect, of an almost if not quite irremediable character, exists in the construction of iron-cased ships, as constructed at present, and is fully exemplified in both the *Warrior* and *Black Prince*. This evil is the penetration of water between the teak and armor plates. This water naturally forces for its exit a passage between the joints of the armor plates, and the opinion at present is that nothing can remedy this under the circumstances of tongued and grooved-edged plates hung on a ship's sides by through bolts. Caulking is stated to be useless, and that cannot be wondered at considering the slung weight to be dealt with, and the ship's motion at sea. But the effect of the action of the water in the grooves of the plates and upon the iron bolts can only be expected to be such that in four or five years from the time of commission each ship will require replating.

THE COMPARATIVE ECONOMY OF STEAM AND WATER POWER

A correspondent writes from Wisconsin asking our opinion in relation to the comparative cost of steam and water power.

A few years ago the proprietors of whale ships in New Bedford, seeing that their business was likely to be ruined by the manufacture of lard oil, cast about them for some other investment by which they might keep up the prosperity of their town. Among the plans suggested was the erection of cotton manufactories to be driven by steam; but the very obvious objection occurred that it would be impossible to run steam mills in competition with those driven by water in which there was no current expense for power. At that time General James was receiving large pay for superintending the erection of cotton manufactories, and on being consulted by some of the New Bedford capitalists, he wrote a plausible pamphlet to prove that steam was cheaper than water! This pamphlet was loaned by one of the schemers to Mr. Rhodes, a very clear headed business man of large wealth, who had not heard much of the discussion, having been absent on a tour through the West. When Mr. Rhodes returned the pamphlet, the lender asked him what he thought of it. He replied,

"Oh! it is conclusive. He makes out his case. By the way, did I tell you my experience in Cincinnati when I was there?"

"No, Sir."

"When I landed in Cincinnati the shops were all closed and I supposed at first that it must be on account of the funeral of some prominent citizen. But the drays were rumbling about the streets, persons were going into and coming out from the stores, and everything seemed to be in activity, so that I was quite puzzled. Finally, I went into a large store, and found it brilliantly lighted with a great number of lamps, and ladies busy as possible buying goods. I asked the proprietor what it meant. He looked up and asked me what I referred to."

"Why," says I, "this closing your shutters and lighting up your stores with lamps."

He straightened up, and staring me in the face with the greatest astonishment, replied,

"My friend, is it possible that you have lived to this age, and don't know that lard oil is cheaper than daylight?"

SULPHUROUS ACID AS A DISINFECTANT.

There are three classes of disinfectants; the first removes offensive odors by absorbing them, the second by destroying them, and the third prevents their formation. The most powerful of the first class is charcoal, of the second chlorine, and of the third sulphurous acid.

The decay of vegetable matters is generally effected by the absorption of oxygen from the atmosphere. Sulphurous acid has a very strong affinity for oxygen, and when it is present the oxygen combines with it instead of combining with the organic substance, and thus the decay of the latter is prevented, or, at least, retarded. In other words sulphurous acid acts as an antiseptic. This is not the case with either charcoal or chlorine; neither has any tendency to preserve substances from decaying. If a piece of meat which has begun to spoil is buried in charcoal it will soon taste and smell perfectly sweet, but its decay will not be retarded. Charcoal is not an antiseptic.

Sulphurous acid acts as a disinfectant not merely by preventing the formation of offensive odors. There is a class which it destroys, some by taking out their oxygen and thus decomposing them, and others by combining with them and forming new substances.

For use in stables probably the best disinfectant known is sulphurous acid mixed with magnesia. While it has a very powerful action in keeping the air sweet, it is perfectly dry and consequently not injurious to the feet of the horses, and it does not impair the value of the manure.