

Correspondence.

Multiplication of Minus Quantities.

To the Editor of the Scientific American:

As some of your readers are puzzling over the question why *minus* multiplied by *minus* gives *plus*, and *plus* multiplied by *minus* gives *minus*, I wish to explain thus:

In multiplication, it is all the same which of the factors you call the multiplicand and which the multiplier: $2 \times 3 = 3 \times 2$ and also $3 \times -2 = -2 \times 3$. Now multiplication means to take one factor as many times as there are units in the other factor: -2×3 is therefore *minus* 2 taken 3 times, thus:

-2
 -2
 -2

-6 , and by the above 3 multiplied by *minus* 2 must be the same. This shows how *plus* multiplied by *minus* gives *minus*.

Again: -2×3 being $= -6$, -2×2 being $= -4$, -2×1 being $= -2$, -2×0 being $= 0$, we see that the product increases by $+2$ for every unit of decrease in the multiplier. If we then decrease the multiplier still farther by single units, the product must continue to increase by *plus* twos, namely: $-2 \times -1 = +2$, $-2 \times -2 = +4$, $-2 \times -3 = +6$. Nothing seems simpler or clearer.

But if there is any one who yet fails to see how the product of multiplication can increase in proportion to the decrease of the multiplier, let him look at it in this way: It is a negative quantity (-2) which we multiply. The negative product decreases with the multiplier.

Three times *minus* 2 = *minus* 6, twice *minus* 2 = *minus* 4, once *minus* 2 = *minus* 2, no times (0) *minus* 2 = nothing (0).

We have here the products of -2 multiplied by $+3$; $+2$; $+1$; 0 ; each multiplier being one less than the preceding one; each product is -2 less than the preceding one. *Minus* one (-1) is one less than nothing (0). The product of -2×-1 must therefore be one *minus* two less than nothing (0), that is, $+2$. But how does -2 , taken away from nothing, leave $+2$?

To make this clear you have only to substitute $+2 -2$ for 0. Of course if I have two less two, I have nothing. But if from this nothing thus expressed, $+2 -2$, you take away the -2 , does it not leave you $+2$? C. F. ERHARD.

The Alluvial Lands of the Mississippi.

To the Editor of the Scientific American:

The reclamation of the alluvial lands of the Mississippi river can be accomplished simply by allowing sufficient breadth between the levees or banks on each side of the river for the water to escape through at flood height. This can be done by straightening the levees, running from bend to bend, and allowing a breadth of from four to six miles from levee to levee, which will allow a flow of water across the neck of points in the case of extreme high water, which gives a more direct and regular current than is attainable with the present levee system, from the fact that the current across the neck meets and counteracts the force of the channel current, and prevents its rolling with so much force into the bends and against the portion of the levee that is most exposed. Besides, it would facilitate the escape of water through the Valley to the Gulf. Straightening the false banks and widening the distance between them will allow of closing the side channels without danger to the levees, and will lower the flood water mark one or two feet.

The levees, once established on this basis, will seldom need repairs. But the present system of leveling in the points confines the water at flood height within the limits of its banks; and as the water rolls away from the point, it throws the current into the succeeding bend with its undivided weight, until the levee is forced in, and crevasse and overflow ensue. HORATIO F. HICKS.
 St. Paul, Minn.

The Centennial on Sunday.

To the Editor of the Scientific American:

Correspondents of some of your cotemporaries are advocating keeping open the Centennial Exhibition on Sundays, for the benefit of working men who may be poor or too occupied to lose a working day to go and see the show. Americans generally attend some church or pass the day with their families, believing six days' labor in the week to be sufficient. Now why should several hundreds be compelled to work all day on Sunday at the exhibition buildings, in attending upon the visitors, running the railroads, etc., for the accommodation of a throng of sight-seers? It seems to me it would be better for the limited class of persons that are unable to visit the exhibition on a week day to subscribe for the SCIENTIFIC AMERICAN, and read the accounts of what is exhibited, and study the illustrations accompanying the descriptions, rather than impose needless labor upon those who prefer and need one day of rest from the arduous labors of the week.

A MEMBER OF THE SOCIETY OF MECHANICS
 AND TRADESMEN.

The Demand for Labor.

To the Editor of the Scientific American:

Your correspondent in Harlem, in speaking of the troubles of a tool maker, seems to overlook the fact that at the present time the supply of labor is in excess of the demand, which, of course, puts the workman or the seller of labor in the power of the purchaser or employer of labor. The remedy which he suggests, that each man should have a certificate of his skill, is right enough for some purposes; but what

is the use of a certificate when there is no situation? If two men with certificates of equal merit apply for work from the same employer, who requires but one, and stern necessity compels one man to accept any terms, he that will work for the lowest wages will of course get the preference. These men should say to each other: "There is not work for us both, but, by each working half time until there is more demand for men, we shall each not only have a fair share of what wages there are earned, but prevent the employer from pitting one against the other in the struggle to live." This remedy, I believe, should be applied at all times when the supply of labor is in excess of the demand. Of course, to those at present fully employed, it would create a slight stringency in the money market; but it would drive absolute want from many a fireside.

Toronto, Canada.

ONE OF THE EMPLOYED.

How Strikes may be Prevented—Free Trade the Remedy.

To the Editor of the Scientific American:

In the edition of your paper for March 18, a correspondent complains of the fact that certain parties, after advertising for tool makers, were unwilling to pay more than \$2.50 *per diem* for competent men. He thinks that the state of affairs which enables an employer to hire a skilled man for that sum is not right, and he proposes to rectify matters by having the trade "legally recognized, so as to have a complete and perfect registry kept of all men who pretend to be skilled workmen," the wages being regulated by a mixed board of employers and employees. The first thought that occurs to me on reading such letters is to wonder that a man of sufficient ability to write a letter at all, or make tools requiring intelligence in their construction, should have so little acquaintance with the laws which control wages and kindred matters, as is exhibited by D. In expressing his disbelief in the efficacy of strikes to smooth the way of the working man, D. shows that his is not as hopeless a case as others; but he has a longing for governmental interference between employer and employed that savors too much of communism to be acceptable to working men of self-dependent power. He condemns strikes, but attributes the prevalence of those organized acts of folly to the fact that employers get men to work for the lowest wages they will take. Why will not D. and men who argue in his train of thought consult their own action, and learn the true explanation of the labor troubles? Does D. ever pay \$10 for a pair of boots when he can get as good ones for \$5? If he does not, how can he expect an employer to act on different principles, and pay \$4 a day to workmen when other men of equal skill ask to be employed at \$2.50? "But," says D., "they are not of equal skill, and the employer does not get as profitable return from the \$2.50 as he would from the \$4 00 one." Will not D. see that the employer, in the majority of cases, knows his own business best, and that it is better that he and the workman should make terms on which to exchange money and labor rather than call in the assistance of outside parties to settle it for them? Would D. maintain that it would be better to make him give A \$10 for the boots than get them of B, for \$5, or exchange four days' labor for what can be had for two days'?

Men will be better off when they learn to look facts in the face, and not delude themselves with sentimental longings for a Utopian state where "everything is lovely." This wages and labor question is simply a continuation of the fight for existence which Science shows to have gone on in the past among all living things, and still goes on.

The present writer is a working man, and as anxious as anybody to get the best price for his labor; but he has had the good fortune to have read works by the working man's best friends, the writers on political economy, and he has become convinced that the truth, as established by Nature and confirmed by experience, is what should guide working men in their efforts to improve their general condition. It is unfortunate in the extreme that elementary works on political economy are not studied in the public schools. From the halls of Congress to the humblest workshop in the land, profound ignorance reigns on subjects of vital importance to the public welfare. When grave and reverend senators eloquently advocate excluding the products of foreign countries, so as to reduce competition with the interests they represent, there can be no consistency in the bosses of those factories condemning the principle of strikes. But both are wrong. The striker is wrong, not in refusing to work if he does not like the wages, but in obliging others to desist from working for the wages he refused. The protectionist is worse than the striker; for while looking solely to his own interest, he pretends to have the welfare of his working men at heart, and besides uses the public money and officials to secure himself against competition, that is, he can sell dear where but for them he would be obliged to sell cheap. The labor problem is so complicated that no one can, in newspaper articles, explain and make clear every point of the subject; but a vast deal of good can be accomplished by directing the attention, of those most interested, to sources where the subject is discussed in full. If every working man, and every employer too, in the country would read Bastiat's little book on political economy, I think that it would do much to put an end to strikes and disagreements among employed and employers. It would show both parties how dependent on each other they are, and teach them the folly of quarreling. It would also open the eyes of working men to the mistake they make on the whole, when they sustain the doctrine of protection and monopoly. Capital is simply preserved labor, pickled down for future use. The workman's capital is his skill and strength; he ought to be allowed to exchange it at will, and where he can do it to the best advantage; but the striker and protectionist deprive

him of that right. When justice comes to rule the world, protectionist and striker will have no advocates. In that day it will be admitted that perfect freedom is the condition most conducive to general and individual prosperity, and that, although competition and the introduction of machinery may occasion temporary suffering, the cause of virtue, happiness, and progress is best promoted by free trade.

Rochester, N. Y.

E. R.

The Great Engineer for President.

To the Editor of the Scientific American:

Your nomination of James B. Eads for President was a happy thought, whether it will amount to any thing or not. There are many, who now never go to elections, who would go if there were any hope of electing a man of his intellect, who could not be corrupted. "But," says one, "what evidence have the people at large of his great intellect, or of his incorruptibility?"

By his works we know him to be a man of great intellect; and by his dealings with men, as well as with Science, we know that he is not liable to be led astray. The choice of his education in the exact sciences shows that he was born a lover of truth; and his success in mastering and applying them indicates an intellect which will not easily turned into uncertain ways.

What could produce a happier Centennial event than to elect such a man President, one who has never been soiled by politics, whose great intellect has always been on the track of truth, with such universal success?

Lyons Falls, N. Y.

D. S. HOWARD.

[For the Scientific American.]

ARTIFICIAL ICE.

BY P. H. VANDER WEYDE.

It has been explained in the previous article, published on page 177, current volume, that when, without the aid of heat, water is evaporated by means of a vacuum, aided by the absorbent action of sulphuric acid on watery vapor, the latent heat needed for the formation of this vapor will cause the abstraction of so much heat as to freeze five eighths of the remaining water. In a liquid more volatile than water, this evaporation takes place more readily; and hence many attempts have been made to produce cold by the evaporation of very volatile substances, such as alcohol, various ethers, carbon bisulphide, liquid ammonia, and even nitrous oxide and carbonic acid. Among the partially successful attempts, I may mention those made some 15 years ago by Professor Twining, of New Haven, and Siebe, in England; they used common ethylic or so-called sulphuric ether. More recently, about 10 years ago, Tellier, in France, used methylic ether, of which the effectiveness was supposed to surpass that of the ethylic ether in proportion to the lowness of its boiling point, which is at about 0° Fah., while the common ether boils at 90° Fah. It was, however, soon found out that there is no advantage in using liquids of such very low boiling points, as part of the power used has to be employed for working powerful compression pumps to reduce the obtained vapors to the liquid condition, as of course economy of the process absolutely requires the use of the same liquid over and over again. The use of two other liquids was patented some eight years ago: one, carbon bisulphide, by Professor Paersh, of New Orleans, and chymogene (petroleum ether), by myself. The first of these liquids boils at 112° Fah., while the latter has the advantage of being cheap and abundant, being a by-product of petroleum distillation, where it can be obtained in various degrees of volatility, varying in its boiling points from 20° to 50° or more Fah. It ought to be stated that the vapor of the substance is quite dense, being 4 times heavier than atmospheric air, while in its fluid condition it is decidedly the lightest of all liquids, its specific gravity being 0.6. So that while water, when evaporating, expands to 1,728 times its volume, forming a vapor of which the specific gravity is about half that of the atmosphere, the expansion of the liquid, when assuming the state of vapor, is only equal to $1,728 \div 2 \times 4 = 216$ times. As the amount of expansion which various liquids undergo, when evaporating, bears a close relation to the amount of latent heat absorbed by the vapors, this small expansion may appear disadvantageous to the use of light liquids producing heavy vapors, for the purposes of refrigeration; however this is especially in the case of chymogene, compensated for by the fact that, in displacing vapors by the air pump, we have only to do with volumes; and as the figures representing the latent heat of vapors have only relation to equal weights, it is evident that a heavier gas will, for the same bulk, contain an amount of latent heat proportional to its specific gravity, and will therefore withdraw, during its formation, a proportionately large amount of heat from the material to be cooled. As an offset to this, the latent heat of gases is almost in inverse proportion to their specific gravity; so that after all, the amounts of latent heat for equal bulks do not differ widely, but vary only slightly from just under 400 to a little over 600 Fahrenheit units of heat.

Chymogene possesses one special advantage in its boiling point, which is not so high as to require so great a degree of exhaustion to evolve the vapors as is the case with water, and even alcohol, carbon bisulphide, and ether, nor so low as to require extraordinary pressure to recondense the vapors to the liquid condition, as is the case with ammonia, methylic ether, and especially nitrous acid and carbonic acid.

In regard to the two last named substances, they were thoroughly tried, in their liquefied condition, as to their adaptability to produce cold and refrigeration. The first, nitrous acid, boiling at 130° below 0° Fah., was tried by me; and in 1864 I applied for a patent for the invention, but soon