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Contents :

(Illustrated articles are marked with an asterisk.)

THAT "DASTARDLY OUTRAGE" AGAIN.

We have been recently favored with a lengthy epistle from Mr. John Fehrenbatch, the author of a letter lately commented upon by us, relating to alleged grievances of workmen in the works of Messrs. Stearns, Hill, and Co., of Erie, Pa. The present document is little more than a repetition of the personal difficulties between the above named employers and their men, which, as we before remarked, is a subject interesting solely to the parties in the controversy and in no wise to the public. The circumstances have little or no bearing on the main question of the right of employers to hire or exclude exactly such persons as they please without resorting to outside dictation or advice.

Our correspondent mistakes the position we assume in regard to troubles of this nature, and evidently infers that we desire to champion the side of the employers as against the men in all cases and even in purely personal misunderstandings. We deal with these questions with reference to their effect upon one or the other of the great classes, employers or employed, impartially, and not with regard to any particular set of men or any especial establishment. If a concern treats its workmen in a manner calculated to give a basis for the generally unfounded assertions of trades' union demagogues, we endeavor by well meant advice to point out the fallacy and inexpediency of such a course; and similarly, on the other hand, we do not hesitate to condemn any body of workmen who, by attempts at intimidation or dictation, cause employers generally to adopt stringent measures calculated to restrict their privileges or injure their interests.

The letter before us includes an extract from a speech of the President of the International Union, in which the employers in question are stigmatized as "pirates and robbers of the rights of labor." This is not the way to bring about the amicable adjustment of any trouble. In our opinion, a wiser course would be to counsel moderation and proper respect for the rights of others.

SPONTANEOUS GENERATION.

All experiments thus far made with infusions of different substances, for the purpose of producing infusorial animalculæ, appeared to prove that the access of air was necessary for their formation. Pasteur, who has extensively occupied himself with these investigations, found at last that the germs of these animalculæ could, under certain circumstances, resist a temperature of 212° Fahr., as he obtained bacteria from solutions which had been previously boiled and afterward came only in contact with air which had been dried and purified by passing it through red hot pumice stone.

However, in 1869, Dr. H. Charlton Bastian took the matter up, and commenced trying if he could not produce animal life in a vacuum. He experimented with various fluids, especially infusions of hay and turnips; he placed them in one ounce flasks, having narrow drawn out necks, and heated the solutions in them rapidly till they commenced to boil over, so as to be sure that all air was expelled; then he kept them boiling for from a quarter to half an hour, while the steam was escaping with some force; then the neck was sealed up by melting the glass with a blowpipe flame, while at the same time the heat was withdrawn. In this way he produced after some practice a perfect vacuum, that is to say, one where air was excluded, and only watery vapor present. The proof of this was that the water hammer effect was quite obvious; this means that the water could be made to fall with a shock from one end of the tube to the other, without passing an atmospheric bubble, as is the case when air is present. When the little flasks were thus prepared, they showed the development of bacteria and other minute moving organisms just as well as if they had not been submitted to great heat, and air had access. The time required for this phenomenon varied from a few hours to several days. Even when the flasks, after being closed, were submitted for several hours to boiling water, the organisms appeared; and Dr. Bastian went even so far as to submit them for four hours to a temperature of 300°, and about 6° in excess, without preventing the subsequent development of the animalculæ. He reasoned then as follows: As the germs cannot come from the air and pass through the glass, only one of two conclusions is admissible. 1. That the invisible germs of the animalculæ are able to stand a heat of 306° without being killed; or (2) that living things can be evolved from non-living matter.

The first conclusion is that of Pasteur, and is based on the assumption of the old maxim *omne vivum ex ovo* (all life comes from an egg), deduced from the fact that it is known to be true for all the higher animals and plants, and that its extension to the lower forms of life, which are intermediate between animal and vegetable, is supposed to be a legitimate deduction on the ground of natural law.

The second conclusion is that defended by Dr. Bastian; he maintains that the doctrine of evolution, now established by an overwhelming weight of evidence, absolutely requires that living matter must at some time have arisen from that which was not living, and that, in absence of any reason to the contrary, there is nothing in reason should lead us to believe that the process continues to take place. He says that all analogy is against the possibility of the assumed germs retaining their life after being subjected to a heat of over 300°. No living being that we know of can endure the heat of boiling water, 212°, except a few seeds of the higher plants, which are protected by a very hard and non-conducting coat. Most animals and plants, indeed, perish at a much lower temperature. With regard to the bacteria themselves, they are mere specks of naked protoplasm; they are utterly destroyed at 140°, as sufficiently proved by the numerous experiments made by Pasteur, Bastian, and others. It is unlikely, therefore, that they should have germs capable of enduring 306°.

Experiments were also made by Dr. Bastian with fluids capable, after being boiled, of nourishing bacteria when any were put into them, and of supporting their copious reproduction, though not evolving them anew when enclosed in hermetically sealed vessels. The uniform result was that 140° not only kills all living bacteria, but also prevents the further development or reproduction of any germ which might be supposed to exist. The natural conclusion is that they do not exist, and therefore these experiments exploded the germ theory.

We hope that these investigations will continue so as to obtain uniform results; as only then can a full discussion of the possible explanations ensue. In the meantime, Dr. Bastian's experiments are drawing the attention of the most eminent philosophical naturalists. For instance, Alfred R. Wallace ranks Bastian's book as equal in value to Darwin's "Origin of Species," or Spencer's "Principles of Biology," especially in regard to "curious and novel facts," "new and astounding views of the origin of life," "excellent reasoning," and "acute criticisms."

There is, however, one point to which we wish to draw attention; it is the assumption that these living organisms are evolved entirely from inorganic matter. This, we believe, is not strictly correct; the infusions all have organic origin; they are organic compounds, and it is well known that the organic compounds are not decomposed into their inorganic elements, except by actual combustion. Starch, sugar, gelatin, etc., are not destroyed, as such, by a temperature of 300°, therefore, if we attempt to generate living organisms from inorganic matter, we must not commence by using organic substances, but must confine ourselves to elements, or their simple inorganic chemical combinations.

RECENT GEOLOGICAL INVESTIGATIONS.

M. Jules Marcou communicates some interesting geological notes to the French Geographical Society, gathered from various eminent sources, while preparing a new geological map of the globe, recently forwarded to the Vienna Exposition. In Spitzbergen, M. Nordenskjold has found (independent of the crystaline rocks) palæozoic, carboniferous, triassic and tertiary formations. An important fact, from its bearing on the history of the earth, is the discovery of terrestrial flora dating from the tertiary miocene epoch, which show that the entire arctic polar region must have been covered with vast forests similar to those which now exist in the northern hemisphere as far north as the borders of the tropic of Cancer. In Norway, peat deposits have been found in Andae Island, one of the Loffoden group, which, like similar beds in Yorkshire, England, are of the jurassic epoch. The existence, in Russia, of an enormous triassic formation has been determined; this had, heretofore, by Sir Roderick Murchison and others, been attributed to the Permian system. In Syria and Egypt, continuous and extensive deposits of red sandstone indicate the homogeneous nature of the rocks of Asia and Africa. On the other hand, the most recent geological studies, made in New Zealand, Australia, and some of the Pacific islands, prove that Madagascar, in spite of its proximity to the African continent, appears to belong to a totally distinct formation which closely resembles that of New Zealand and Western Australia. In South America, MM. Musters and Pourtalés have found a group of extinct volcanoes between the Gallegos river, Cape Virgin and the eastern entrance of the Straits of Magellan.

M. Marcou considers the classification of stratified rocks, as generally laid down in modern geological treatises, as very imperfect and not justified except in a portion of the northern temperate zone. In the West Indies and California, and on the Missouri river, he states that the difficulties of classification augment in proportion as new discoveries are made. In the first mentioned part of the globe, for example, Dr. Waagen has found, in beds of limestone a foot and a half thick, forms of fossils which are generally distributed in very different deposits, and which are supposed to belong to carboniferous, triassic and jurassic rocks. These evidences are not accidental, but are multiplied in Nebraska, Illinois, California, Australia, and even in New Zealand.

THE BASE LINE OF ASTRONOMY.

When a land surveyor wishes to find the distance between two points, separated by an obstacle to direct measurement, say an impassable swamp or a sheet of water, he resorts to triangulation. To the right or left of the line to be determined, he lays off another line, from the extremities of which he takes the compass bearings of the points whose distance from each other he wants to learn. The angles thus found, together with the length of the measured line, are all the data needed for calculating the length of the required line. In extensive surveys, this principle of triangulation is used almost exclusively. A single base line is measured with great accuracy, and all the other distances in the survey are calculated by means of a series of triangles erected on it. The correctness of the entire work depends, consequently, on the exact determination of the length of the primary line. If there be an error in this, the utmost care in all subsequent observations and calculations cannot prevent the survey from going wrong. Hence the minute precautions always taken in choosing the site and determining the exact position of the base line, in reducing it to a perfect level and in finding its length to the minutest fraction, precautions involving the utmost niceness of instrumental construction, the utmost care and patience in observation and calculation, and repeated measurement, occupying months of time.

If the exact survey of a State or a strip of coast line is worthy of so much preliminary care and cost, how much more so is the survey of the universe! In surveying the earth, it is possible at any time to test the correctness of the work by measuring a new line and comparing its length thus found with the length obtained by calculation. In the survey of our Atlantic coast, for example, such a test line was measured on an island in Chesapeake Bay, the original base line lying on Mount Desert Island off the coast of Maine; the result proved the substantial accuracy of the entire work of triangulation covering the larger part of seven or eight States. In astronomy, there is no such ever present means of testing results and ensuring correctness. Everything hinges on the determination of the primary base line, so that any error in it inevitably vitiates the estimate made of every other astronomical distance. And still more, the dimensions and weights of all the heavenly bodies beyond the moon, not less than their distances from the earth and from each other, are determined by calculations which involve the astronomical base line as a known element. It is the foundation, in fact, of all mathematical astronomy. Hence the importance of its determination with the utmost possible accuracy.

The base line in question is the sun's distance from the earth. The measurement of this distance with all attainable exactness, and the determination of the maximum limit of unavoidable error, constitute the most important problem now engaging the attention of the astronomical world. The rare opportunity which will be afforded by the approaching transits of Venus for attacking this fundamental problem, under the most favorable conditions and with all the improvements in means and methods attained by modern science and mechanical skill, very naturally raises those phenomena to the highest rank among the astronomical occurrences of the century. They cannot pass without furnishing data for greatly reducing the known inaccuracy of the current estimate of the sun's distance, and consequently for a more correct determination of all other astronomical magnitudes. "Known inaccuracy!" some may exclaim, especially those whose ideas of heavenly bodies and spaces have been gained from ordinary text books, with their positive statements and professed precision. "Is not astronomy an exact science? And are not the magnitudes it deals with known with mathematical exactness?" If they were, the coming transits of Venus, instead of being scientifically the most momentous events of the age, would be matters of comparatively small account. A few astronomers might make a note of them, but they would hardly engage the attention of all the governments of the civilized world, or give occasion for costly expeditions to the remotest parts of the globe. The figures of astronomy are, and must ever be, approximations to the truth. The question is how small can the margin of error be made.

At present the limits of error, in the measurement of the line on which all other astronomical measures depend, are so far apart that sixty worlds like ours, standing side by side, would not be sufficient to fill the gap. As a consequence, there is an uncertainty of at least four thousand miles in the exactest estimate of the sun's diameter, or some hundreds of millions of cubic miles in his calculated volume; and every other magnitude beyond the moon is proportionately indeterminate.

Ten years ago the accepted figures were very much farther from the truth. For forty years, Encke's estimate of the sun's mean distance, deduced from the observations of the transit of Venus in 1761 and 1779, that is, in round numbers 95,000,000 miles, had held its ground; but so many lines of evidence converged to prove those figures too great that astronomers could not refrain from making the enormous reduction which took the general public so much by surprise about a decade ago. Noticing this astronomical change of base, Sir John Herschel wrote: "The superficial reader (one of a class too numerous) may think it strange and discreditable to science to have erred by nearly four millions of miles in estimating the sun's distance. But such may be reminded that the error of 0·33″ (thirty-two hundredths of a second) in the sun's parallax, on which the correction turns, corresponds to the apparent breadth of a human hair at 125 feet, or of a sovereign at 8 miles off."

It is on such minute measurements that the approximate exactness of astronomy depends. The limit of probable error in the latest and most satisfactory determination of the sun's distance is somewhere about half a million miles, say one eighth part of the last correction. We may leave it to the reader to calculate how extremely delicate the observations of the coming transits must be to effect any considerable reduction in this apparently great but relatively minute inexactness.

EFFLUX OF STEAM.

If a fluid issues through an opening, without friction, the velocity of its flow will be the same as it would acquire in falling through a hight due to its pressure. For instance, suppose that steam at atmospheric pressure flows into a vacuum. Steam at atmospheric pressure, or 14·7 pounds per square inch, will have a pressure of 14·7×144=2116 8 pounds on the square foot. A cubic foot of steam, at this pressure, weighs about 0·0364 pounds, so that the hight of a column of steam, necessary to produce this pressure per square foot, would be 2116·3÷0·0364=58153 feet. The velocity acquired by a body in falling through this space is found by extracting the square root of 64·32×58153. This gives 1934 as the velocity in feet per second with which steam at atmospheric pressure will flow into a vacuum, if there be no frictional resistance. In practice, it is found that when a fluid is discharged through an orifice or tube, the actual velocity is less than the theoretical, so that a coefficient of correction is necessary in using the theoretical formula. Numerous experiments have been made upon the velocity of discharge of water, air and steam, those upon water being the most extended and reliable. It is difficult, when experimenting with steam, to maintain a constant pressure, and the velocity is so great that it is not easy to make an exact measurement. For these reasons, the results of different experimenters vary greatly. In this article, we shall endeavor to give the most accurate results that have been obtained.

There is one case, in the flow of water, in which the actual velocity of discharge varies but little from the theoretical. We refer to that in which the water flows through a mouth piece shaped to the form of the contracted vein. This mouthpiece has a length about equal to the diameter, and is constructed with a bell shaped mouth, its diameter being decreased at the middle of its length to about eight tenths of its original size. Experiments with this kind of mouth piece in the case of steam, however, show varying coefficients of velocity for discharges under different pressures. The table given below will illustrate this.

TABLE OF COEFFICIENTS OF THE VELOCITY OF DISCHARGE OF STEAM INTO THE ATMOSPHERE, THROUGH A MOUTHPIECE HAVING THE FORM OF THE CONTRACTED VEIN.

Pressure in pounds per square inch above atmosphere.	Weight per cubic foot.	Coefficient.
1	0 0396	0·93
5	0·0510	0 85
10	0·0598	0·78
20	0 0815	0 71
30	0·1025	0 69
40	0·1232	0·68
50	0·1436	0·67
60	0 1636	0·66
70	0·1833	0·65
80	0·2030	0·64
90	0·2224	0·63
100	0·2410	0·62

These coefficients have been determined experimentally for orifices varying from four tenths of an inch in diameter up to one and a half inches. We will now explain how to use them, illustrating by an example.

The expression for the theoretical velocity is $v=\sqrt{2gh}$, or the velocity of discharge in feet per second is equal to the square root of twice the acceleration due to gravity multiplied by the hight due to the effective pressure. The actual velocity is equal to the theoretical velocity multiplied by the proper coefficient.

EXAMPLE: With what velocity will steam at a pressure of 50 pounds by steam gage issue into the atmosphere through a mouthpiece having the form of the contracted vein? Answer: 50×144=7200 pounds pressure per square foot. 7200÷0·1436=50139 feet=hight due to pressure. $\sqrt{64·32\times 50139}\times 0·67\times 1203$=velocity of efflux in feet per second. Corrections can be applied to the coefficients given in the preceding table, to adapt them to other cases than that in which the steam issues through a mouthpiece having the form of the contracted vein.

For a tube having rounded edges, and a length equal to once and a half the diameter, deduct 0 03 from the coefficient for any given pressure. For a tube with square edges, and a length from once and a quarter to twice and a half the diameter, deduct 0·13 from the coefficient. For a plain tube whose length is 12 times the diameter, deduct 0·24 from the coefficient. When the length of the tube is 24 times the diameter, deduct 0·28 from the coefficient.

To find the velocity of efflux through an orifice in a thin plate, the thickness of the plate being not more than one tenth the diameter of the orifice, correct the coefficients given in the table as follows: Deduct 0 36, when the pressure does not exceed half a pound per square inch. Deduct 0·21 when the pressure is equal to one atmosphere.

We will give an example in one of these cases, as it will illustrate the method of proceeding for all: Suppose steam of 40 pounds pressure per gage issues through a pipe one inch in diameter and twenty-four inches long, what is its velocity? Answer: 40×144=5760 pounds pressure per square foot, and 5760÷0·1232=46753 feet, hight due to pressure.

$\sqrt{62\ 32\times 46753}\times(0·68-0·28)=694$, velocity of efflux in feet per second. The preceding constants were determined experimentally by Mr. George Wilson, of England. It will be observed that they apply to orifices from four tenths of an inch to one and a half inches in diameter, and having lengths from one tenth to twenty-four times the diameter, the experiments having been made on the efflux of steam through orifices varying within these limits. Approximate formulas, for general use, have been established by the late Professor Rankine, and we will give these, illustrating them by examples.

Case 1: When the pressure of the medium into which the steam flows is less than three fifths of the pressure in the reservoir, the number of pounds of steam discharged through a pipe or orifice is found by multiplying the area of the pipe (in square inches) by the pressure of steam in the reservoir, and dividing the product by 70. Example: How much steam will be discharged from a boiler into the atmosphere, through a 3 inch pipe, the pressure per gage being 15 pounds? Answer: Here the absolute pressure in the boiler is 15+14·7=29·7 pounds per square inch, and the area of the pipe is 7 07 square inches. Hence the quantity of steam discharged per second will be (29 7×7 07)÷70=2·99 pounds. The volume of this steam will be 2·99÷0 0707=42·4 cubic feet, and the velocity of discharge in feet per second will be found by dividing the volume by the area of the pipe in square feet. This gives the velocity: 42·4÷0·0492=864 feet per second.

Case 2. When the pressure of the medium into which the steam is discharged is more than three fifths of the pressure in the reservoir, the number of pounds of steam discharged per second is found as follows: Multiply the area of the pipe (in square inches) by the product of the external pressure divided by 42 and the square root of the difference of the internal and external pressures divided by two thirds of the external pressure. Example: Steam of 5 pounds pressure, per gage, is discharged through a 2 inch pipe into the atmosphere. Absolute pressure of steam in boiler=5+14 7=19·7 pounds (absolute external pressure=14·7 pounds). Area of pipe=3·1416 square inches. Applying the rule, we find the quantity of steam discharged per second=3·1416 × (14·7÷42)×$\sqrt{(19·7-14·7)\div(\frac{2}{3}\times 14·7)}$=0·785 pounds. The volume of this steam is 0·785÷0·0487=16·1 cubic feet, and the velocity of discharge is 16·1÷0 0218=739 feet per second, 0 0218 being the area of the pipe in square feet.

With the formulas given above, our readers will be able to solve nearly any question that may arise regarding the efflux of steam, with sufficient accuracy for most practical purposes.

EZEKIEL PAGE.

We regret to hear of the demise of Ezekiel Page, formerly of Boston, Mass., inventor of the machine for turning oars. Mr. Page's name has been associated with this particular branch of industry for more than a generation; and at one time he possessed the only factory in the world wherein oars were made by machinery. Indeed at the present day the chief business connected with the oar trade in this country remains in the hands of the Page family. The manufacture has been so perfected that little chance remains for improvement. It is difficult to obtain a poor article from any concern where the Page machinery is used, because the mechanism never slights its work, but imparts true and exact proportions to every piece of lumber. Clumsy ill-shaped oars must be looked for in shops where the labor is done by hand.

Ezekiel Page's first improvement in this line was patented in 1842, for a new method of sawing out the oar lumber. The old method was to saw the logs into square sticks equal in size to the width of the oar blade, one oar being cut from one stick. By giving a peculiar movement to the carriage of the saw machinery, Page was enabled to get two oars out of the same block. He produced two blades where only one before was made. This gave him the oar monopoly and entitled him to rank as a benefactor of the race. His name will be for ever honored by every loyal boatman.

Page's next improvement, patented in 1845, was a mechanism for producing the swell on the oar handle. This he accomplished by means of a contrivance for moving the slide rest of the lathe, in such a manner as to compel the cutters to shape the wood to the exact form required.

Ezekiel Page, at the age of 62 years, rests from his labors. He never made much noise in the world, and yet he contributed, for the use of his fellow men, a discovery of immense economical importance. Think of the millions of oars now used in all parts of the world, and then remember that he taught us how to double the number out of the same piece of wood.

There is one other legacy that he has left us, more precious even than his useful inventions. It is the record of a generous, upright, amiable and well-spent life. Ezekiel Page was an honest man.

Friction of Water in Pipes.

In our article on this subject, on page 48 of the current volume, the formulas should have been printed as follows:

1. Prony's formula:

$$h=0·00040085\times(L\div d)\times[(v+0·15412)^2-0·02375].$$

2. Brooklyn Water Commissioners' formula:

$$h=0·00046749\times(L\div d)\times(v+0·397)^2.$$

3. Lane's formula:

$$h=0·000625\times(L\div d)\times v^2.$$

We republish them, as, separated from the verbal explanations given in the article, they might be misunderstood.

SCIENTIFIC AND PRACTICAL INFORMATION.

BLACK VARNISH FOR ZINC.

Professor Böttger prepares a black coating for zinc by dissolving 2 parts nitrate of copper and 3 parts crystallized chloride of copper in 64 parts of water, and adding 8 parts of nitric acid of specific gravity. This, however, is quite expensive; and in some places, the copper salts are difficult to obtain. On this account Puscher prepares black paint or varnish with the following simple ingredients: Equal parts of chlorate of potash and blue vitriol are dissolved in 36 times as much warm water, and the solution left to cool. If the sulphate of copper used contains iron, it is precipitated as a hydrated oxide and can be removed by decantation or filtration. The zinc castings are then immersed for a few seconds in the solution until quite black, rinsed off with water, and dried. Even before it is dry, the black coating adheres to the object so that it may be wiped dry with a cloth. A more economical method, since a much smaller quantity of the salt solution is required, is to apply it repeatedly with a sponge. If copper colored spots appear during the operation, the solution is applied to them a second time, and after a while they turn black. As soon as the object becomes equally black all over, it is washed with water and dried. On rubbing, the coating acquires a glittering appearance like indigo, which disappears on applying a few drops of linseed oil varnish or "wax milk," and the zinc then has a deep black color and gloss. The wax milk just mentioned is prepared by boiling 1 part of yellow soap and 3 parts Japanese wax in 21 parts of water, until the soap dissolves. When cold, it has the consistency of salve, and will keep in closed vessels as long as desired. It can be used for polishing carved wood work and for waxing ballroom floors, as it is cheaper than the solution of wax in turpentine, and does not stick or smell so disagreeable as the latter. A permanent black ink for zinc labels is prepared by dissolving equal parts of chlorate of potash and sulphate of copper in 18 parts of water, and adding some gum arabic solution. The black polish above described is recommended as permanent and capable of resisting quite a high temperature.

MANUFACTURE OF CHLORATE OF POTASH.

To manufacture chlorate of potash on a large scale, it has been recommended by W. Hunt to adopt the following method: Milk of lime is made to trickle down over bricks, placed in a tower where it comes in contact with a continuous current of chlorine gas. Chlorate of lime is the chief product, and, by treating this with chloride of potassium, chlorate of potash is formed, which can be purified by crystallization.

YELLOW GLASS FOR PHOTOGRAPHIC PURPOSES.

The following simple method of testing the actinic properties of yellow glass for dark rooms is by Le Neve Foster, and the only apparatus required is a cheap glass prism. When a strip of white paper is placed on a dull black surface and looked at, through the prism, by daylight, it has the appearance of the rainbow, showing a complete spectrum. On bringing the yellow glass in question between the prism and the strip of white paper, those colors which are absorbed by the colored glass disappear. If on looking through the prism any blue or violet rays are seen, it is certain that the glass transmits the chemical rays and hence is unfit for photographer's use. If only red and yellow be seen, it is non actinic.

TESTING SULPHATE OF ALUMINA.

Sulphate of alumina frequently contains an excess of acid which injures it for use in dyeing. Whether the sulphuric acid be present in excess is easily ascertained by stirring the pulverized salt into alcohol, which dissolves the free acid but not the salt. It is then only necessary to filter the solution and test for acid with litmus. The amount of sulphuric acid can also be obtained volumetrically. Pure sulphate of alumina produces with a decoction of campeachy wood a dark violet or purple color. If free acid be present, the color is browner.

PROGRESS OF THE HOOSAC TUNNEL DURING THE MONTH OF JULY, 1873.—East end section: Heading completed December 12, 1872. Central section: Heading advanced westward, 151 feet. West end section: Heading advanced eastward, 137 feet. Total advance of headings during month, 288 feet. Length opened from east end westward, 14,235 feet; length opened from west end eastward, 9,677 feet. Total lengths opened to August 1, 1873, 23,912 feet. Length remaining to be opened August 1, 1,119 feet.

ALBUMEN EXTRACTED FROM MILK.—Schwalbe has found that if oil of mustard be added to cow's milk in the proportion of one drop to 1·1 drams, the milk does not coagulate even after being kept for a considerable period: but that the caseine is transformed into albumen. If this discovery, says *Les Mondes*, is confirmed, it will be of considerable importance in the printed fabric industry.

SQUEAKING BOOTS AND SHOES.—To prevent the soles of boots or shoes from squeaking, says the *Shoe and Leather Chronicle*, rasp, with a coarse rasp, the outsole and insole, and every other piece of leather that comes in contact in friction by the action of the foot. Then apply freely good wheat or rye paste. If this is well attended to from heel to toe, the boot or shoe will not squeak.

COLT'S FIREARMS COMPANY has just received an order for 30,000 pistols. Smith & Wesson have commenced work upon 20,000 Russian pistols, and will make about 150 daily.