have taken two such feeds for each double stroke of the machine, and at the return of the table to its first starting position ⅛ inch wide would be planed. By this double rate of progress divided between two cutting edges it results that there is theoretically only half the wear, but practically much less than half the wear, on the cutting edges between the first cut and the last over a large surface.

The advantages of the double cutting principle become more and more important, as the size of the surfaces and the weight of the articles become greater. The two-fold feed motion is effected by means of double ratchet wheels, which gives the power of feeding any of the boxes in any direction, as from left to right, or from right to left, or up or down, and to take that feed at each or either end of the stroke; so that the double feed arrangement gives advantages even upon work to which the double-cutting tool boxes may not be applied. The feed motions take place in advance of the belt-throwing motion, and the feed knocker fork is independent of the belt knocker fork; it follows that the machine may be stopped and started at any moment without disturbing the feed pawls and without marking the work. There is a belt-throwing handle at each side of the machine, and there are two bars on the American plan to throw a cross and open belt, one at a time, and to throw each one the complete width of the pulley face, neither more nor less, with a positive and invariable action. The bed of the machine is 45 feet long. The uprights and gearing plates are bolted to it, so that the machine is entirely self-contained. The bed has three parallel V guides for the table to slide in, and the V's have oil pockets at 5 feet pitch apart, fitted with miter disks supported on springs which roll the oil on to the V's of the table as it passes over them. The table is driven by two parallel steel racks with straight teeth, through double purchase steel gearing.

The table is made in two pieces with a single transverse joint, so that when a continuance of work is in hand, not requiring more than a 15 foot stroke, one half of the table may remain stationary at one end of the bed, and may be used as a setting-out plate or for erecting work upon. The transverse cut on the cross slide is driven by cross and open belts, with belt-throwing and feed motion similar in principle to those of the table.

The countershaft for driving this motion is attached to the cross slide by radius bars, so that the belts are of uniform length and tightness whatever be the position of the cross slide. The cross slide can be raised and lowered on the uprights by belt power and reversing gear. Machines of equal width to this, and in most respects similar, have been made by Messrs. Buckton for Messrs. John Brown & Co., of Sheffield, for planing armor plates, but the traveling table of those machines was 20 feet long, and this is the first machine on record that the makers know of having a 30 foot long table which will also admit of 12 feet between the uprights and 10 feet under the cross slide. Its capacity to use eight cutting tools, *i. e.*, four on each stroke, and to cut transversely in both vertical and horizontal planes, makes it still more unique.

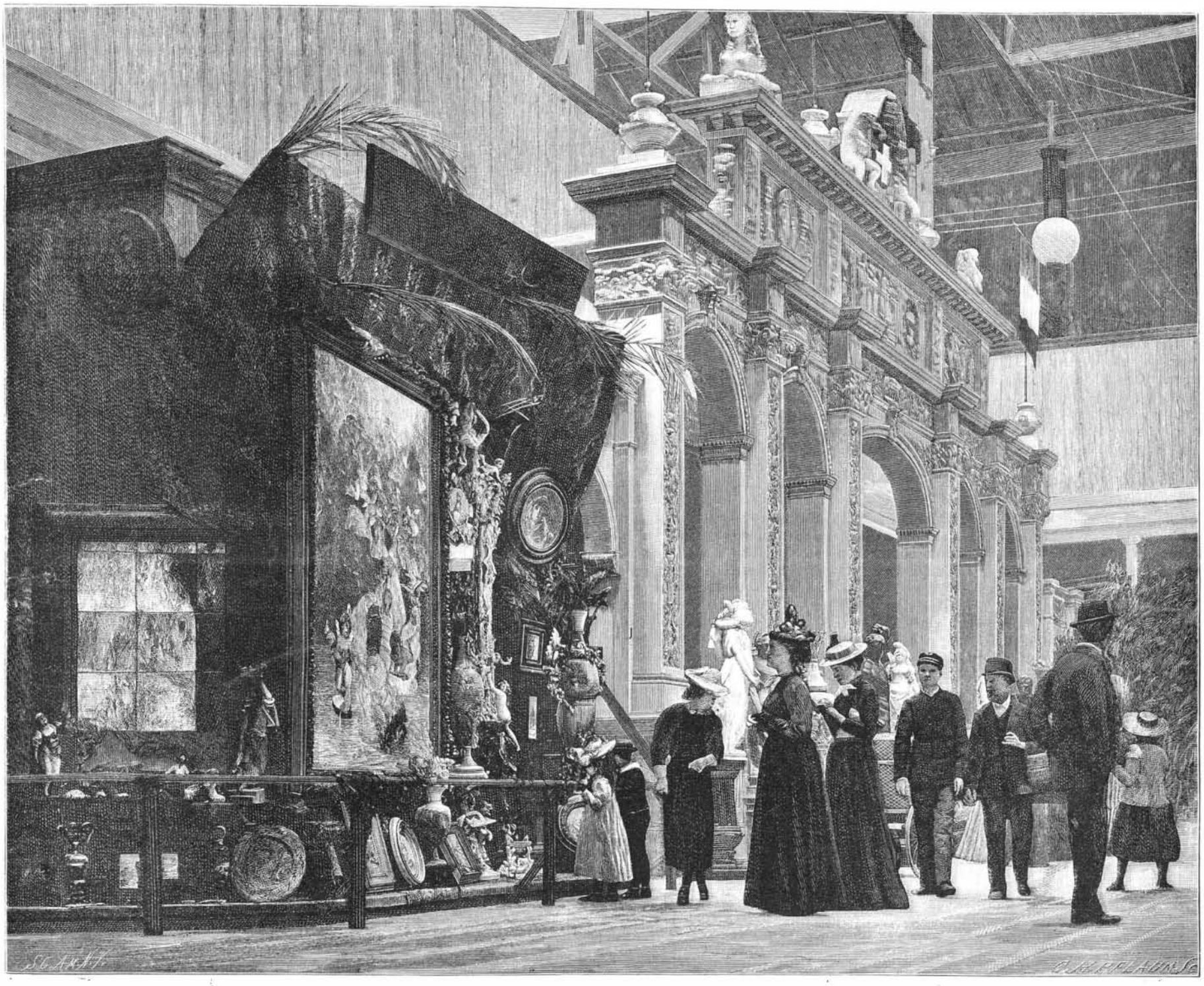
Devonshire Cream.

Persons on their return from their travels abroad express surprise that they can never get at home such delicious cream as they have in England and Scotland. It is known as Devonshire cream, and not many people, in this country especially, know what it is, but suppose it to be the particularly rich cream of the county in question, whereas every American housekeeper may have Devonshire cream on her own table if she will take the trouble to prepare it. Rich new milk is put in a very shallow vessel with an extended surface, and is then set on the range, where the milk will be warmed, but on no account must it boil or even scald. The heat will cause all the cream to rise to the surface in a very short time, and the pan is then taken off and placed in the ice box or in a cool place. When thoroughly chilled the cream may be taken off and will be nearly of the consistency of newly made butter. This is put in jars, and at breakfast is helped with a spoon and is delicious with oatmeal, jams, berries—everything in fact that ordinary cream is used for, its merits being that not only does one obtain the richest cream, but it will keep for two or three days without becoming sour. Why this English dainty is not used in this country to the same extent as in England is to be wondered at, but our dairy folk seem to know nothing about it.

THE WORLD'S COLUMBIAN EXPOSITION—THE ITALIAN EXHIBIT.

The kingdom of Italy has made a very creditable exhibit in the Palace of Manufactures and Liberal Arts. The exhibit is not large, but the wares placed on view show conclusively that the people of modern Italy have inherited a share, at least, of artistic ability from the glorious old masters. In fine mosaic, glass and lace work Italy excels, and her marbles, which are in many cases made by unknown artists, might well grace the home of the millionaire. Bronzes, tapestries and silken fabrics are largely made in Italy. Our view represents the entrance to the main exhibit of Italy from Columbia Avenue, as the central aisle of the Manufactures building is termed. Italy has also an annex at quite a distance from the main exhibit. The large picture at the left is really made of painted tiles of the usual size, the colors being fired in. The exhibit of lace made by a Venetian house is very fine and was much admired by the Duke of Veragua. There are several exhibitors of the curious ragged terra cotta figures called lazzaroni. The Italians excel in wood carving and fine cabinet making. Some of the examples exhibited are superb. It is really surprising to see how moderate some of the pieces of statuary are in price. Skilled labor can certainly be obtained at low rates in Italy.

The names of the exhibitors show their nationality, as Roccheggiani, Pasqualetti and Trilli. The exhibit of jewelry and small *objets d'art* is very fine and may be favorably compared with the larger exhibit in the same line made by France. The position of the Italian exhibit, being at the extreme south end, is rather unfavorable, as a portion of the exhibit is under the gallery and is, therefore, badly lighted.



THE WORLD'S COLUMBIAN EXPOSITION—ITALIAN EXHIBITS—PALACE OF MANUFACTURES AND LIBERAL ARTS.

The Preservation of Paintings and Drawings.

In the report of the commission on the action of light on water colors, it is pointed out that every pigment may be said to be permanent when exposed to light *in vacuo*, and the commissioners observe that "this indicates the direction in which experiments should be made for the preservation of water color drawings." Numerous experiments and practical trials have been made with a view of preserving works of art of this class from atmospheric deterioration by the exclusion of the atmosphere from their surfaces. The difficulty, however, appears to have been that hitherto no means were employed for detecting a leakage of air into the vacuum chamber, so that an unsuspected pinhole or the slightest infiltration of air through any undetected cause would destroy the vacuum and entirely mar the result. It was to remedy this defect, says the *Times*, that Mr. W. S. Simpson, C.E., set himself to work, and he has devised a very simple and effective means of overcoming the difficulty. He incloses the picture to be preserved in an air-tight casing, the front of which is glazed, there being a space between the face of the picture and the glass and another space at the back of the picture. The air is extracted from this casing, the extraction being effected by a Sprengel pump, and the small tube through which the air is extracted is hermetically closed directly the desired vacuum has been formed. The most important part of the invention, however, and that by which Mr. Simpson has rendered the vacuum system of preservation practicable, is a small indicator, on the principle of the aneroid, placed inside the casing, but out of sight. This indicator has a small arm which is visible before the chamber is exhausted, but which disappears out of sight and is hidden by the frame of the picture when the vacuum has been formed. Upon any leakage of air into the chamber occurring, the little tell-tale immediately comes in sight, thus again revealing the fact that the vacuum has become impaired, and enabling steps to be taken for remedying the defect without prejudicial delay. The whole arrangement is very simple, and the process of preservation practically consists in removing the painting from its original frame, placing it in an air-tight chamber, creating a vacuum, and replacing the whole in the original frame.

The American Standard of Living.

The fact is not only demonstrable, but stands proved and unquestioned, that the average standard of living is higher in the United States than in any other country in the world. The industrial masses, who embody the vital forces of the nation and represent its life and character, eat more and better food than the toilers of other lands, wear ampler clothing of superior quality, occupy larger and better furnished apartments, enjoy higher opportunities for culture, and find open avenues to advancement on industrial, social and intellectual lines. Every statistical investigation of the comparative condition of the world's workers brings into prominence the physical status of our own people. It is shown that the meat consumption here is more than thrice that of Europe for each individual, and fifty per cent more than that of Great Britain, the nation which takes most of the surplus meat of this country. More than seventeen pounds of cotton per head, and eight of wool, besides a liberal quantity of silk and linen, are required for each individual—two or three times as much as the average in Europe. A country containing less than one-twentieth of the world's inhabitants uses one-fifth of the wool in the world, and nearly as large a proportion of the cotton. In other words, the clothing required by an average Yankee would clothe an average family of the other inhabitants of the globe. This is not a guess, but a demonstration, as the world's supply of clothing material is approximately known. House room and furniture share in similar liberality of supply, and are supplemented by ingenious appliances for comfort and convenience in housekeeping.

Educational facilities, public and private, are extraordinary in extent and variety, including all that is comprehended between manual training exercises and post-graduate university courses, available alike to the child of fortune and the son or daughter of the industrious laborer. It is possible for the child of a common laborer to attain the highest honors of the university, as is constantly demonstrated in conferring the highest scholastic degrees. It is demonstrated that few of the more advanced nations in industrial skill and civilization pay wage rates two-thirds as high as ours, and many European states pay scarcely more than half as much. While a large part of this generous difference goes toward better living and higher intellectual development, much remains to the pecuniary credit of the individual, in home ownership or savings banks deposits or other property. A surprising illustration is furnished by the industrious and thrifty people of New Hampshire, whose deposits in savings banks alone average about one thousand dollars for each family, with nearly twice as many depositors as there are families.

This republican independence of spirit, this training of heads and hands, with generous living and thrifty surplus saving, inspires ambition for continued advancement, and insures the breaking of all barriers of class, which in foreign lands are chains of steel that bind to ancestral occupations and hold fast the birthright of caste. We have here a field of action which is at once an opportunity and an inspiration. This continent is a new world, furnishing at the same time a wide theater of action and a worthy inducement to effort. With every variety of climate, the result of altitude and situation, of configuration of surface and the course of adjacent ocean currents, all products of temperate and subtropical zones are certain rewards of labor. The vines of France, the olives of Italy, the fruits of Spain and the Mediterranean isles, are all grown on our southern and western coasts, while the cereals, fruits and vegetables of the temperate zone are produced in profusion elsewhere. Soils are equally various, in richness and in mechanical and hygrometric condition, available for the growth of almost everything required for use of man or beast.—*Dr. James Richard Dodge, in the Chautauquan.*

The New Mode of Constructing Foundations.

The method of converting a bed of sand into firm materials adapted for foundations, which Mr. Neukirch described before the American Congress of Engineers, is ingenious; but whether it is generally applicable, which the *Real Estate Record and Guide*, of this city, queries, remains to be seen. He converts the sand into a sort of concrete by forcing into it cement in powder through a pipe, by means of air pressure. The pipe has an internal diameter of about 1½ inches, and is drawn to a point at the lower end, in which there are three or more holes, of about three-eighths inch diameter. The upper end is connected by a bend and rubber tubing with the air pressure supply pipe in such a manner that the pipe can be raised, lowered, and moved while the air pressure is acting through it. In the air pressure supply pipe provision is made, by means of suitable branches and stopcocks, for connecting an apparatus which, by means of an injector device, enables any desired quantity of cement powder to be fed into the air current. The air pressure, together with the cement powder, issues through the small openings at the lower end of the lance pipe, and is driven with considerable pressure into the sand foundation. This is very mobile where it is entirely under water, and consequently the blowing in of the cement produces a motion in the foundation pit similar to that in a vessel of boiling water, steam bubbles instead of air bubbles being formed.

The cement carried by the air is retained by the wet sand and forms sand concrete. By the boiling motion an intimate mixture of the wet sand with the cement is effected. After the injection of air has ceased, the grains of sand, in subsiding, adhere very firmly together, and experiments have shown that a natural bed of sand, after having one-fifth of its volume of cement injected into it, will, after the operation, occupy a smaller space than before. This was shown by the fact that the surface of the sand concrete lay deeper than that of the surrounding natural sand bed. The introduction of the lance tube into the sand bed is effected by first blowing air through it, so that the air issuing from the lower end forces back the sand and in setting it in motion renders the sinking of the tube to considerable depths, such as 16 to 19 feet, readily possible in a comparatively short space of time; this operation is rather more difficult when the bed is not purely sand, but contains large stones, wood, etc. In this case it may be necessary to raise the tube again and to insert it at a different place, so as to avoid the obstructions. In order to insure a uniform mixture, the foundation pit is divided into small fields of from 8 to 12 inches square, and into each of these the required quantity of cement, which is ascertained by dividing the cubic contents of the field by the required proportion of the admixture, is blown. The lance tube is first sunk in each field down to the solid substratum by means of air pressure alone. When it has attained this depth, cement is supplied to the air current, and during the continued introduction of the cement powder the tube is slowly drawn upward until the required quantity of cement has been introduced.

A Dinner Under a Gasholder.

On the occasion of the opening of the new Strandvei works of the Danish Gas Company, situated near Copenhagen, and built to supply the migratory population of the city with cooking gas, a dinner to 120 guests, representing the local authorities, press, etc., was given by the company's engineer (Mr. F. D. Marshall) and his colleague (Mr. Cridland) on behalf of the directors. The banquet hall used for the occasion was the huge dome under the Intze gasholder erected at these works, which was lighted by a series of Siemens lamps; and the effect was most startling. Several of the guests, however, when they came to realize the situation, and were informed as to the quantity and weight of the volume of water above them, became rather alarmed, and were much relieved when the proceedings terminated. In the evening, upward of a hundred of the workmen employed in the construction of the works were entertained by the company at a supper served in the same place.

Lowest Cost of Mining and Milling.

In reply to a correspondent who asked how cheaply ore can be extracted and milled under the most favorable conditions, citing instances, the editor of the *Mining and Scientific Press* says:

The Treadwell mine in Alaska probably secures better results from low-grade ore than any other large mine in the world. The Treadwell is practically an open quarry. The report of the Alaska-Treadwell Company for the year ending May 1, 1893, shows that the quantity of ore crushed was 237,235 tons, yielding an average of $2.13 in free gold. There were 4,276 tons of sulphurets saved by concentration and 4,584 tons treated, giving an average of $41.28 per ton. The average for all the ore treated, including yield from sulphurets, was $2.94 per ton.

The cost of work last year is given very fully in the report. Mining (237,235 tons) cost for labor 39·60 cents; supplies, 20·74 cents; total, 60·34 cents per ton. Milling (237,235 tons) cost for labor, 18·37 cents; supplies, 25·60 cents; total, 43·97 cents per ton. Chlorinating concentrates (4,584 tons) cost for labor, $5.3432; supplies, $3.649; total, $8.9922 per ton. Averaging all costs on the ore mined, the result was: Mining, $0.60; milling and concentrating, $0.44; chlorination, $0.17; general expenses at mine, $0.07; San Francisco office, $0.02; bullion charges (freight, insurance, etc.), $0.05; total, $1.35 per ton.

Probably the cheapest milling of ore ever accomplished in the world was by the use of a roller mill at the Spanish mine, Washington Township, Nevada County, Cal., four or five years ago.

At this mine the vein averages 90 feet. The hanging wall is a slate, soft, shaly, and not well defined. The true vein is on the footwall and consists of solid quartz, 4 feet thick. It does not pay for working. The pay is found on the hanging wall side, which contains many veinlets and streaks of ferruginous quartz carrying gold. Where no quartz is to be found there is no pay. The slate on this, the west, side is talcose.

The main tunnel was in 1,200 feet. The vertical distance from the surface to the end of the main tunnel was 350 feet. One of the methods of extracting ore here was as follows: There was an excavation from the tunnel to the surface which acquired the form of an open cut with sloping sides, too steep for a man to stand on. A Chinaman, armed with a churn drill, was lowered by a rope. He drilled a hole which, when deep enough, was charged with about five pounds of powder and fired, causing a large quantity of the soft slate to slide to the bottom, whence it was taken out through the tunnel. The mine employed a foreman, two white men, and eight Chinamen, who extracted about 4,000 tons of ore a month—enough to keep the mill at work. The wages paid were: White men, $3 per day; foreman, $3.50; and Chinamen, $1.50 per day.

The ore obtained came out of the tunnel by gravity, the empty cars being hauled back by mules. The ore was passed through a Blake rock breaker and then ground in a Huntington roller mill, of which there were three of 5 feet diameter and one of 4 feet. The mills, which made fifty-eight revolutions per minute, were fed by Hendy automatic ore feeders.

The following record of one month's run of the mine may be taken to indicate the low cost of working the ore, and to show also how very low grade an ore may be profitably treated when the conditions are all favorable:

MINE—COST OF PRODUCTION.

[Run: 28 days' work produced 3,443 tons of ore.]

	Labor.	Supplies.	Total.
Extracting ore	$703.50	$113.41	$816.91
Delivering ore to mill	160.20	17.95	171.15
Dead work	105.20	10.93	116.13
General expense	78.35	1.95	80.30
Total	$1,047.25	$144.24	$1,191.49
Cost per ton	0·304	0·042	0·346

MILL—COST OF REDUCTION.

[Run: 24½ days reduced 3,443 tons of ore.]

Mill expenses	$227.32	$194.33	$421.65
Water for power	....	161.70	161.70
Handling ore	154.50	5.35	159.85
General expense	78.40	1.95	80.35
Total	$460.22	$363.33	$823.55
Cost per ton	0·133	0·106	0·239
Bullion produced	....	....	$3,138.55
Total expense	....	....	2,015 04
Profit			$1,123.51

It will be seen from this that the ore only yielded a trifle over 91 cents per ton, yet a profit of 32·6 cents per ton resulted. The percentage of profit was 35·8 of the total. In the previous month, 2,796 tons of ore were worked, which yielded $1.16 per ton. The profit was 56 cents per ton, or about 48 per cent of the total. The profit that month on a yield of $3,268.49 was $1,572.91. The cost of mining was 37½ cents and of milling 23 cents per ton.

Water Tanks.

In a paper recently read before the Engineers' Society of Western Pennsylvania, on "Iron and Steel Water Tanks," Mr. W. C. Coffin stated that the most economical proportions for such were obtained when the height was equal to from two-thirds to the whole diameter. The height of settling tanks should be about a quarter the diameter. Stand pipes should have a diameter not less than one-tenth their height. The thinnest plates used in constructing such tanks or stand pipes should not be less than three-sixteenths inch thick, and the bottom plates should not be less than one-fourth inch to five-sixteenths inch thick. Dipping the plates in a hot bath of asphaltum before shipping protects the material better than any other method of painting. In painting the tanks care should be taken to see that the paint is of such a consistency that it will not scale off. This can be ascertained by dipping a piece of painted iron in cold and in hot water, and also testing it by a hammer.

NOVEL SCENE IN INDIA.

The illustration represents a scene which, it may well be believed, is not a very common one, even in India, where the greater portion of the population have had sufficient proofs of the danger to life from tigers to give them a wholesome dread of that animal. Our sketch, which is from the London *Graphic*, was made by a party traveling with the troops near Bombay. The captive tiger was in charge of a native, who was going around the country exhibiting him for such small sums as spectators might contribute.

A CAPTIVE TIGER IN INDIA.

The Periods of Incubation and Duration of Infectiousness of Zymotic Diseases.

A very valuable contribution to medical knowledge has been made by the report of a committee appointed by the Clinical Society of London, to investigate the periods of incubation and contagiousness of certain diseases. This inquiry, as the *Pacific Record* states, partakes somewhat of the nature of a collective investigation, and the quality of the committee was such as to warrant perfect reliance upon the accuracy of the work done. The report gives a complete list of all the cases in abstract form; but it is the general conclusions that will be of most interest to the medical profession at large.

The investigation of diphtheria showed that the usual incubation period does not exceed four days, and that it is oftener two days than any other period, while seven days may be set as the outside limit. The disease is undoubtedly communicable during its whole course and the duration of the infection period is very variable, although, as a rule, some unhealthy condition of the throat will be found to account for late cases of infection. While the disease is usually communicated by personal contact, there were found plenty of instances of infection through articles of clothing, furniture, or carpets, sometimes years after the original cases. Quarantine should certainly be continued for two weeks after apparently complete recovery.

Information regarding typhoid fever is somewhat unsatisfactory. Its usual incubation period is twelve to fourteen days, and the limits may be placed at nine and twenty-three days. It is infectious throughout its whole course and for at least a fortnight after convalescence. This last statement of the committee should not be taken for more than it is worth, for there is good evidence that the stools of convalescents from typhoid may contain the infectious principle much later than two weeks after convalescence has been established.

Although epidemic influenza is included in the report, it is much less interesting than the other diseases mentioned, because its infectiousness is not universally admitted and information regarding it is scanty. Its incubation period appears to vary from one day to five, and usually to be two or three days.

In fixing the incubation period of measles, the appearance of the rash was taken as a starting point, because of the difficulty of determining the time of beginning of the period of invasion. This would probably lengthen the actual time of incubation by about four days, but as given it is found to be fourteen days very exactly, more than three-quarters of the cases reported following exposure in thirteen, fourteen, or fifteen days. Exceptionally the interval may be as short as seven or as long as eighteen days. Measles is communicable throughout its course, and, as is well known, the contagion is active when the catarrhal symptoms first appear. Quarantine with disinfection may safely terminate three weeks after the appearance of the rash.

Mumps has a very long incubation period, and the majority of observations makes it very exactly three weeks, with a limit of fourteen days on one side and twenty-five days on the other. It is most infectious at the start, beginning four days before the parotiditis appears, and the danger of communicating the disease becomes gradually less for two weeks, when it may be considered to be over.

German measles or rotheln appears in from two to three weeks after exposure, its incubation period being very irregular. It is infectious two or three days before the rash appears, and in most cases quarantine need not be continued more than two weeks.

Scarlet fever has an incubation period that is measured by hours rather than by days. A large majority of the cases appear in from twenty-four to seventy-two hours after exposure; but a respectable number develop during the first twenty-four hours, and some are delayed as long as eight days. Infection begins with the earliest symptoms and is very active in the later stages of the disease during desquamation. Quarantine should be at least eight weeks, and in all cases as long as any desquamation continues. This is the disease which is of all most readily communicated by a third person, probably through the medium of the clothing. The mild cases, without eruption and but slight sore throat, are common distributors of the disease.

The labors of the committee served to confirm the old rule that twelve days is the usual incubation period of smallpox, although this time is sometimes reduced to ten or increased to fifteen days. The disease is communicable from the start until the last scab has disappeared; but the danger of infection is not great until the disease has become well developed.

Chicken-pox resembles smallpox closely in the features of the periods of incubation and infectiousness, except that fourteen days is the usual time of incubation rather than twelve. The danger of communicating this disease lasts until all scabs have come away.

The text-books give so much latitude to the incubation periods of contagious diseases, particularly the exanthemata, that the information obtained from them is of but little use, and it is an excellent thing to have some reliable and accurate rules for guidance in the important matter of quarantining not only those who actually suffer from contagious disease, but also those who have been exposed to it.

Treatment for Children.

In a recent number of the *Medical Record*, Dr. J. W. Huddleston, of this city, describes a very successful method of treating young children for diarrhea, without diet or medicine, namely, by means of injections of water. He simply washes out the little one in a very thorough manner. The infant, bared of shoes, stockings and diaper, is placed across the mother's lap face down, with the legs hanging by her side. Beneath the child's abdomen is a sheet of rubber cloth which is held snugly around its waist by the mother; the lower end of the cloth rests in a small tub placed beside the mother's chair. A two quart fountain syringe filled with a salt solution of nearly normal strength (six per cent) is hung about four feet above the baby. The water is at the temperature it flows from the faucet—*i. e.*, from 68° F. to 75° F. In the middle of the tube leading from the bag is a glass pipe which serves to show when the current is flowing freely. To the nozzle is attached a large soft rubber catheter (size No. 12). This is anointed with vaseline, passed up the baby's rectum and colon as far as it will go, and the entire contents of the bag allowed to flow through it.