sent the filling of holes made by burrowing animals or by the roots of trees. In places there are thin sheets of lime carbonate, which have been concentrated by water from the loess above and deposited in the cracks in the ash.

Deposits near Edison. The ash of this region is four or five miles south of the station. The exposures are but two in number, but much larger than those near Ingham. Their general relations are the same. Where the wall of the valley is steep or vertical the ash appears, but where the slope is gentle, as where the loess has slidden down from above, it was not exposed. The larger of the two exposures near Edison extends along the side of the valley for a distance of several hundred yards, interrupted here and there by a mass of loess which has slumped, locally concealing it. The thickness of the bed is in places more than twenty feet. The ash is more uniform in texture than that near Ingham, there being none so coarse as the coarsest at that point. It seemed to be equally free from foreign matter. A reentrant in the side of the ravine in which the main exposure occurs, shows that the ash runs back from the wall of the ravine where the main exposure occurs, in undiminished thickness.

The second exposure near Edison is about a-half mile from the first and in another valley. The exposure is much less extensive than the first laterally, though nearly as thick. It is very probable that the ash is continuous between the two ravines in which it is exposed.

Deposits near Orleans. The best of the exposures in this locality is near the head of a small ravine tributary to the valley of the Republican river. Its general relations are identical with those of the ash at the other localities. As there, it is covered by loess, and as there, it appears only where the valley slopes are steep and where the loess has not slumped. The exposed part of the deposit here varies in thickness from five to twelve feet, and the ash is very fine and white.

Ash in lesser quantities was seen at several points in the vicinity. In some cases, especially where thin, it is more or less mixed with earthy matter.

At most of these places the ash showed more or less evidence of stratification; but in the faces exposed in 1894, the stratification was not of such a character as to make it altogether certain that the ash was deposited in water. If deposited in water, it must have been at a time when this region was covered with a lake, presumably a late Tertiary lake, to which the wind brought the ash. So far as the relationships of the ash were seen, it was only clear that the ash was deposited, and probably somewhat eroded, before the deposition of the loess, and that the loess was deposited before the valleys in the banks of which the ash is exposed were excavated.

It has long been known that volcanic ash exists in other localities in Nebraska. Some of these were noted long since by Prof. Todd and Mr. Merrill, but, so far as I am aware, no publication has been made of the ash at the localities here mentioned. It may be of interest to add that the volcanic ash from this region has already become an important article of commerce, under the name of pumice. It has been found to be available for all the various uses to which pulverized pumice is put.

ROLLIN D. SALISBURY.
UNIVERSITY OF CHICAGO.

THE MODERN VERSION OF THE LAW OF SUPPLY AND DEMAND.

A MOST interesting illustration of what the writer has called 'The Modern Version of the Law of Supply and Demand' is seen in recently published statistics of the copper production of Lake Superior, given out

by Mr. Stanton, Treasurer of the old Central Mine. This mine has been in operation many years and has continuously supplied the market, in competition with the Calumet & Hecla and other more favored mines, with almost uniform profit; notwithstanding all the fluctuations of business during its now long life. The statistics are published in *The Iron Age*, in a late issue, and may be there consulted for details. The general facts are that, in the words of the 'modern version,' above mentioned, "increase of demand has been accompanied by the decreased costs, due to increased supply and improved methods."

The older version reads: "Increased demand produced increased prices; increased supply gives lower prices." The fact has come to be, in all the great fields of industry in which, as now, ample capital can always be secured for any legitimate enterprise, and especially in those in which invention and the mechanic arts play any large part, that "*Increased demand and an enlarged market, like inventions and discoveries and improved methods, by permitting more economical operation of the system of production, decrease prices.*"

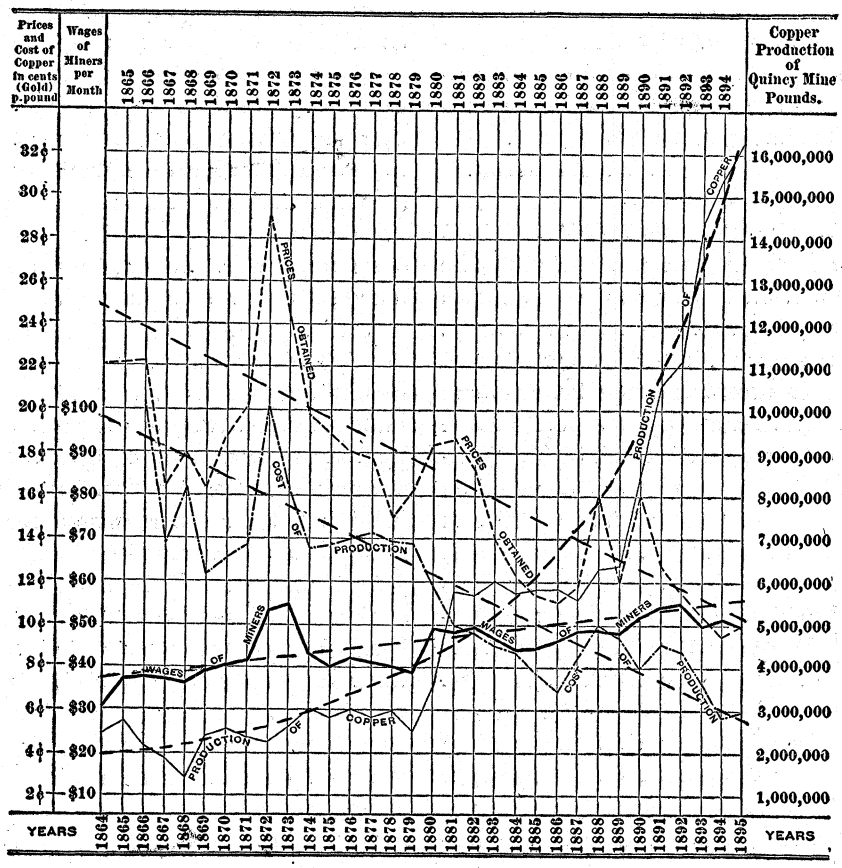
A contract for ten newly invented sewing machines could only be filled to-day, with profit, at a price, we will say, of $100 each; a contract for 10,000 could be filled probably at $10 each. A mine raising 100,000 tons of ore annually must charge more per ton, or accept lower profits, than if its production were a half-million tons, the office and general expenses being then assessed upon the smaller quantity. The fact above stated with reference to copper is true of silver, of gold in less degree, of iron, and of, in fact, all the products of mine and factory, and even of the soil in the long run.

The most generally illustrated action of the law of supply and demand, in recent times, would seem to be the following: Decreasing cost of production gives larger demand and stored capital permits larger supply. This reduced cost is also an element of the change in the case of copper production, which is more influential in causing the curious and interesting economic results observed, as above, in the case of copper, silver and other metals, than is any other. By improved processes and recent inventions the cost of production of the metal has been brought down to about one-half the figures of a generation ago, while the productiveness, and therefore the market value, of the labor engaged in this more efficient production is at the same time increased.

These facts are also shown in the accompanying diagram, which is reduced from the figures of the Quincy mine. It is seen that the introduction of improvements of methods and economics in various directions has produced a constant and a fairly steady diminution of prices in the copper market, while the resultant increasing demand has been met by a steady increase of supply—both measured by the production curve. Meantime the wages paid have been increasing as steadily throughout the period observed.

Prices are made in the general market and indicate the progress of the average of all mines in reduction of costs; for the market price, in all open business, is costs plus, in the long run, a fair business profit. Costs are determined by the conditions of the particular case, the progress of improvements and the influence of new inventions and discoveries. If the costs are not so far below the market price as to permit a fair profit to be in the long run made, the business languishes or expires. If the profits are abnormally large, more capital at once goes into production and reduces the excess by increasing supply, widening the market at a lower price.

During the past generation, and particularly the twenty years preceding the com-



Relations between wages, prices, costs and quantity.
[*From The Iron Age.*]

mencement of the existing crisis, costs have been on the average, in the copper producing industry, steadily and rapidly diminished by the use of rock drills and high explosives, as well as by diminishing costs of transportation and handling. The reduced costs have permitted reduced prices, which, in turn, have stimulated demand. The enormous quantity of free capital now existing has permitted immediate response to the demand and corresponding increase of supply. And thus, in consequence of the greater influence of invention and improvements in the arts, and especially of the increase of the amount of available capital in these later years, we see what may be termed a reversal of the customary statement of the law of supply and demand, and 'increasing demand produces decreased prices.'

Commenting upon these figures, *The Iron Age* says:

"We need hardly add that these bald figures, eloquent though they be, do not tell the whole tale of the wonderful improvement in the condition of the workingman, when instituting a comparison between the days before the war and those of the last decades. Only he who knows the life of a young mining location in the woods, and of the condition of the communities of the Lake copper region at the present day, can grasp all its significance."

Invention, discovery and general improvement in all the useful arts now con-

trol substantially all economic phenomena, and determine costs, which in turn determine the demand, and the demand now always meets the supply at a price which gives fair business returns on capital.

R. H. Thurston.

IN MEMORIAM: JOHN GREGORY BOURKE.

In 1892 the country was startled by the announcement in the papers that Captain John Gregory Bourke, of the Third Cavalry, United States Army, had been assassinated in broad day and in a thronged court-room in Texas, by some friends of the bandit Garza, against whom the Captain was testifying and whose forces he had defeated on the Rio Grande frontier. The grief and indignation in the army were intense, and many tears were shed by eyes unused to weeping, for there was no man in the military service who had friends more numerous and sincere than those of Captain Bourke. But after some days of mourning, our joy returned on learning that the item in the papers was false, that no coward shot had been fired as reported, and that Captain Bourke still remained a terror to the marauders of the Rio Grande.

Four years passed, and again we were shocked with the sudden and unexpected tidings of his death. But on this occasion the tidings were, alas! true. Now they came from a hospital in his native city of Philadelphia, where, on June 8th, he had succumbed to the sequelæ of a surgical operation performed with a hope of saving his life. At the time it was not generally known that he was ill or stood in need of an operation. Such was the ending of a hero who had a hundred times faced death on the field of battle before the bullet of the civilized foe, and, literally, like the Baron Rudiger, 'Before the Paynim spear.'

Captain Bourke was a soldier by nature and knew no other profession than that of arms. At the early age of 19, while our Civil War was in progress, he volunteered as a private soldier (August, 1862), and served in that capacity until the close of the war. He so distinguished himself in this part of his career that he was appointed to the National Military Academy, upon the recommendation of his illustrious commander, General George H. Thomas, at the close of the war. After the usual course of four years at West Point, he was graduated in June, 1869, and received a commission in the Third Calvalry, with which regiment he remained until the time of his death.

During the seventeen years following his graduation he was doing duty on our Western frontiers, in lonely and isolated garrisons, where so many of our soldiers, in days past, have worn out years of miserable existence, and in active campaigns against hostile Indians.

After five years of work in Washington City, where he was ordered on special duty, connected with his ethnographic researches, he returned again to service with his regiment—not to a dull garrison life, but to the active, warlike service which seemed to be his usual lot. This time he fought, not the the civilized foe or the savage enemy, but the elusive outlaw of the Mexican border. How well he succeded is a matter fresh in the minds of all.

In 1893 he had another brief respite from his military duties, when we all met him in charge of the rare collection in the mimic convent of La Rabida, at the World's Columbian Exposition. When his work there closed he returned to his regiment and assumed command of his troop at Fort Riley, Kansas. But he had not rested long until he was called again to Chicago, but by a sterner duty than that which called him there before. He came to quell the rioters of 1894 and to protect the United States mails. He discharged his difficult duties on this occasion, as usual, with credit to himself and profit to his country.