Scientific American.

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY

At No. 37 Park-row (Park Building), New York.

O. D. MUNN, S. H. WALES, A. E. BEACH.

TERMS—Two Dollars per annum.—One Dollar in advance, and the remainder in six months.

Single copies of the paper are on sale at the office of publication, and at all the periodical stores in the United States and Canada.

Sampson Low, Son & Co., the American Booksellers, No. 47 Ludgate Hill, London, England, are the British Agents to receive subscriptions for the SCIENTIFIC AMERICAN.

☞ See Prospectus on last page. No Traveling Agents employed.

VOL. II., NO. 3.....[NEW SERIES.].....*Fifteenth Year.*

NEW YORK, SATURDAY, JANUARY 14, 1860.

RECOVERING LOST GOLD.

GOLD is among the heaviest of metals, and yet is of such a ductile character that it may be beat into leaves so thin as to be blown like the down of the thistle. It is found in almost every country, yet it is only under certain circumstances that it can be worked with profit. In California and Australia it has been found in nuggets and scales, and these have been so abundant as to yield large returns to the miners. It is also associated with quartz rock, as its matrix, in those countries, and in such quantities as to yield large returns for crushing the rock and securing the metal by amalgamation. Long before California came into our possession, and before its immense gold fields were discovered, we had gold mines in Virginia, North Carolina and Georgia, from which the precious metal was obtained from auriferous quartz. These mines are still worked, and by a scientific discovery, for which a patent was issued to Professor T. M, Fell and Mr. J. N. Wykoff, in the month of July last, they are destined to yield three times the amount of gold that was ever before secured by the old processes.

It is well known that some of the richest gold quartz does not present the appearance of gold. It is clear and white, and it is only by crushing, washing and amalgamating it with quicksilver, that the amount of gold contained in it can be known and obtained. This shows that the gold is disseminated through the rock in a very finely subdivided condition, and the question naturally arises, may not a great quantity of this metal be washed away in the water, owing to the particles being so fine as to float and remain suspended? To this we return an affirmative answer. By the invention alluded to, the *tailings*, and what has been called "the refuse of gold washings," have been operated upon, and more gold taken therefrom than by the first treatment when all the gold in the quartz was thought to be secured. By the new process the ground quartz is submitted to the action of heat, water and agitation in connection with mercury; and quartz, from which about from three to four dollars of gold per tun were taken out, has yielded an average of fifteen dollars. This process is now in operation at the Melville gold mines (about 20 miles from Fredericksburgh), in Spotsylvania county, Va., where it can be seen and examined. By it some ores of gold, which, by the old processes, had not yielded any precious metal, have been worked successfully. Thus from one pound of ferruginous sulphurets of gold as much as one grain of gold and half a grain of silver have been reclaimed. The leading idea of the invention is the bringing the mercury into such intimate connection with the fine gold by minute dissemination throughout the amalgamating vessels, as to touch all the particles, however fine, and combine with them. By such a method of treatment gold quartz, which has been held unprofitable to operate, may now be made to yield good returns; and the sands which abound in many parts of our country, where no gold was ever thought to exist, may yet be made to yield large profits for working.

Gold is found in small quantities in most countries; it is sometimes mixed with iron pyrites, copper pyrites and galena, but it is generally disseminated in veins through quartz rocks, and it is among these that it is principally sought. It is true that gold is obtained by washing the sands of rivers in Africa, Hungary, and some other countries, and no doubt the sands of many of our rivers, especially the mixed black ferruginous and quartz kinds, contain it in considerable quantities; but by the old methods of washing and amalgamating it would not pay to operate them. By the new method, however, these sands may be ground and operated with success for their gold, and we have seen some samples of such, from which, we were assured, more than fifteen dollars per tun had been reclaimed. Here is another spacious field for operation during the year 1860, to increase the yield of our precious metals.

QUICKSILVER OR MERCURY

The value of this metal is not generally appreciated. Without it no gold could be obtained from the quartz rocks that now yield it in large quantities. It is a very peculiar metal; at ordinary temperatures it is a fluid, but such is its affinity for gold that when brought in contact with it, a mechanical union is formed, and a different compound produced. The mercury seems to enter into the pores of the gold, as water passes up through a fibrous substance by capillary attraction. It forms an amalgam and separates the gold from the quartz and impurities, and in this manner the precious metal is obtained. But as the mercury and gold form an amalgam, the precious metal must be separated afterwards, or it can be of no use. In this emergency the nature of the quicksilver affords an easy solution to the problem. By placing the amalgam of gold and mercury in a bag of chamois leather, the mercury can be squeezed through the pores of the bag, while the precious metal is left behind. A perfect separation of the two metals, however, cannot be accomplished in this manner; some gold still remains combined with the mercury; but another and certain method of separation is at hand. By placing the amalgam in an iron retort and submitting it to heat, the mercury, being volatile, passes off in vapor, leaving the gold behind in a pure condition. The quicksilver is condensed after passing from the still, and is made to do duty a thousand times—over and over again—in reclaiming gold. It requires about two pounds of mercury for amalgamation to reclaim one pound of gold. Its avidity for gold is wonderful; the quality which it possesses of seizing upon the auriferous particles floating among the dirt and other products of the rocks, in water, is surprisingly strange.

Mercury has been known from the remotest ages; it is chiefly found in a state of nature combined with sulphur, and as a sulphide it is called cinnabar. There are extensive tracts of mercury ore in California, where it is smelted and distilled, and the fluid metal secured for the gold miners. It is placed in iron flasks for use, and it is a singular fact that while it has such an affinity to unite with gold, it has none for iron. Great quantities of it pass off in the amalgamating process, about five per cent being generally lost at each operation; hence fresh supplies are continually required to restore the waste. The quicksilver mines of California are very valuable, and severe contests at law have arisen in regard to the titles by which the cinnabar lands are held. Although mercury is a fluid and beaten gold very ductile, yet no sooner do these two metals combine than the gold becomes extremely brittle, or rather the amalgam formed with gold and mercury is very brittle. A gold ring rubbed with quicksilver becomes perfectly *rotten*—so brittle as to break very easily.

EFFECT OF ARTIFICIAL LIGHT ON VEGETATION.—In answer to an inquiry on this subject, a correspondent of the London *Builder* states:—"I planted vegetables in a place where daylight could not penetrate, over which I suspended a paraffine oil lamp, with a reflector to throw the light upon the plants. They have grown up a beautiful dark green. I have also lighted a greenhouse with lamps every night, and find it not only increases vegetation, but gives a beautiful deep tinge to the plants."

POWER LOOM EXTENSION.—Warren Dutcher, of Milford, Mass., obtained a patent June 27, 1846, for an improvement in power looms. He has now made an application to the Patent Office for its extension for seven years beyond its original date. The testimony in this case closes on the 28th of May, and the petition is to be heard on the 11th of June, at 12 o'clock, at the Patent Office.

SCIENCE IN FAMILIAR THINGS—SALTING THE STREETS TO REMOVE SNOW—ITS EFFECT UPON HORSES' HOOFS.

Coming to our office the other morning, we saw a man strewing salt along the railroad track for the purpose of melting the snow. This is the common practice on our city railroads, but objections have been made to it on account of its injurious effects on the horses' feet. Both of these facts—the melting of the snow by the salt and the injury to the horses' feet by the liquid—are instances of the application of the most beautiful and subtle principles of science to the common affairs of life. There are several substances besides snow and salt which are solid when separate, but which, on being placed in contact, become liquid; why they do so is wholly unknown. It is just as completely a mystery to Professor Faraday or Professor Doremus as it is to the most ignorant laborer that strews the snow with salt. But the cold that results from this change of the two substances from the solid to the liquid form is one of the exhibitions of latent heat—a matter which has been the subject of profound and laborious investigations, and which is found to play a part in the operations of steam and air engines, in the artificial making of ice, and, indeed, in almost all the mechanic arts. The subject, when properly stated, is perfectly simple.

If a piece of very cold ice, of a temperature far below the freezing point, is brought into a warm room, the ice will become warm gradually till it reaches the temperature of 32°, at which point it will remain till the ice is all melted, when the increase of temperature will be resumed, and will go on till the water becomes as warm as the air in the room. If the relative temperature of the room and ice is such that the cold ice is warmed one degree a minute, it is found that the temperature rises at this rate till it reaches 32°, at which point it stops and remains for 140 minutes, during which the ice is all melted, after which the rise in the temperature again goes on at the rate of one degree a minute. The heat, which enters the ice while it is melting, does not affect the thermometer and is not perceptible to the senses; it is hidden, and therefore called latent heat. The sensible heat, which becomes latent in the change of bodies from the solid to the liquid condition, varies with different substances—in water, as we have seen, it is 140°; in sulphur it is 144°; in lead, 370°; and in zinc, 493°.

Now, it is found that when two solid substances are changed to the liquid condition by simply being brought in contact, this change is accompanied by the conversion of sensible into latent heat; a large amount of heat is rendered latent, and this is absorbed from surrounding substances. This is the philosophy of freezing mixtures. If one pound of salt is mixed with two pounds of snow and a thermometer placed in contact with the mixture, as the mass melts it will absorb so much heat from the mercury as to carry it down to 5° below zero. If a horse's foot is in the mixture a portion of this heat must come from the foot, and it is not strange that it should frequently leave the part so intensely cold as to prove injurious.

NEW PHOTOGRAPHIC PROCESS.

[Translated for the SCIENTIFIC AMERICAN.]

The discovery, by Mr. Schweitzer, that the cuprate of ammonia ($Cu_2\ O + H^4\ N\ O$) dissolves easily the fibers of cotton, has brought me to think whether this fact could not be applied with advantage to the photographic process. After a great many experiments I have succeeded in finding out an easy and not very expensive method.

The simplest and readiest way seemed to be, to dissolve in a solution of cotton, in the above-named copper salt, newly precipitated oxyd of silver, to spread the solution on a glass plate, to dry the stratum on the same, and to pass it through diluted hydro-iodic or hydro-bromic acid. Thereby certainly a white stratum of iodide or bromide of silver is obtained, but I never succeeded in producing a clear and transparent picture. Below the stratum of cotton forms always a continuous layer of reduced silver, and the picture on the surface is lost. In vain I applied simple bromide of cuprate of ammonia ($Cu^2\ O + H^4\ N\ O + Br$) or simple iodide of cuprate of ammonia ($Cu^2\ O + H^4\ N\ O + I$); in every case a brown stratum of metallic silver formed below the picture. I communicate this fact to save others from making useless experiments.

By using the following means I succeeded to perfection: