THE

Miners' Own Book:

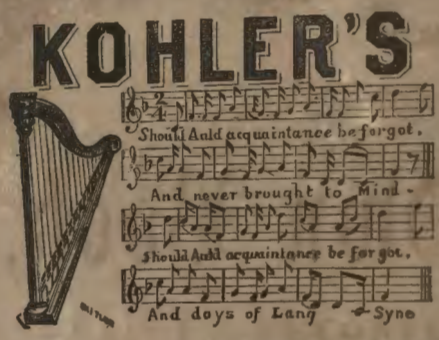
CALIFORNIA MINING

ILLUSTRATED AND DESCRIBED.

SAN FRANCISCO:

PUBLISHED BY HUTCHINGS & ROSENFIELD.

Whitton, Towne & Co., Printers, No. 125 Clay Street, corner Sansome.



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THE

Miners' Own Book,

CONTAINING

Correct Illustrations and Descriptions

OF THE

VARIOUS MODES OF CALIFORNIA MINING,

INCLUDING ALL THE

IMPROVEMENTS INTRODUCED FROM THE EARLIEST DAY TO THE PRESENT TIME.

SAN FRANCISCO:
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1858.

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NOTE BY THE PUBLISHERS.

The illustrations, as well as descriptions, of the various modes of mining embraced in this volume, have appeared from time to time, during the past two years, in the pages of our Magazine. Although we, at the start, were fully reminded of the great trouble and expense attendant upon the enterprise of properly illustrating the progress and extent of California mining operations, we never faltered in our efforts. Our work is now complete, and the satisfaction of knowing that it has been pronounced *good* by those whose opportunities and experience enable them to judge correctly, is the best portion of our reward.

While engaged in the undertaking, we were assisted by numerous friends in the mining districts, who cheerfully gave us all the information we desired, concerning their claims, machinery, etc. And it is at the earnest and repeated solicitations and advice of our mining friends, who have been struck with the correctness of our illustrations and descriptions, that we introduce the subject in the present shape.

There are many Californians who know little or nothing about our most prominent interest. They have heard and read a great deal about mining, yet we venture the assertion that were they to return to their Atlantic homes to-morrow, they would be unable to describe accurately a single one of the various modes that have been adopted to extract the precious metal from the earth. Our little volume is intended to supply this glaring want, by rendering familiar, through correct views and descriptions, everything connected with the immense mining operations of the State. We believe it is the first book of the kind ever published, and if it but succeed in meeting the approval of those qualified to pass upon its merits, we care not what others may say.

THE PUBLISHERS.

SAN FRANCISCO, May 10, 1858.

THE MINERS' OWN BOOK.

Sutter's Mill, the scene of the first gold discovery in California, is scarcely less known than the distinguished veteran and pioneer whose name it bears. It was at this spot, in the month of January, 1848, that MR. JAMES W. MARSHALL, of New Jersey, was startled by the appearance of the first specimens of the precious metal ever found in California.

SUTTER'S MILL, IN 1848.

"While we were in the habit at night of turning the water through the tail race," says Mr. Marshall, "I used to go down in the morning to see what had been done by the water through the night; and about half-past seven o'clock, on or about the 19th of January—I am not quite certain to a day, but it was between the 18th and 20th of that month—1848, I went down as usual, and after shutting off the water from the race I stepped into it, near the lower end, and there, upon the rock, about six inches beneath the surface of the water, I DISCOVERED THE GOLD. I was entirely alone at

the time. I picked up one or two pieces and examined them attentively; and having some general knowledge of minerals, I could not call to mind more than two which in any way resembled this—*sulphuret of iron*, very bright and brittle; and *gold*, bright, yet malleable; I then tried it between two rocks, and found that it could be beaten into a different shape, but not broken. Four days afterwards I went to the Fort for provisions, and carried with me about three ounces of the gold, which Capt. Sutter and I tested with *nitric acid*. I then tried it in Sutter's presence by taking three silver dollars and balancing them by the dust in the air, then immersed both in water, and the superior weight of the gold satisfied us both of its nature and value." The first piece of gold found by Mr. Marshall was worth about *fifty cents*. It was given with other gold, to Mrs. Wimmer, and paid out for goods. So that the whereabouts of the first specimen is to-day unknown.

After the discovery of gold became generally known, although the forests and glens were almost unbroken, the "prospector," with his pick and shovel upon his shoulder, his pan in his hand, and his knife and trusty revolver in his belt around his waist, began to wander among the hills, and up the ravines and gulches "prospecting" for gold.

In 1849 and 1850 it was very common for small companies of men to start on a prospecting excursion, with several days' provisions, cooking utensils, blankets, tools, and fire-arms, at their backs; and with this small mule-load, climb the most rugged and difficult mountains; descend and cross the most rocky and dangerous cañons; endure fatigue and hardship; and brave privation and peril almost entirely unknown at the present time.

At that period the precious metal was supposed to be found only in rivers, cañons, gulches, or ravines; and, as the latter were the readiest prospected, and the easiest worked and often paid very well; they offered the most tempting inducement to the prospector; and consequently, were the first places sought after and tested by him.

PROSPECTING.

Having arrived at a spot which looked inviting, and which he thought would "pay," down would go his pan and pick, or shovel, and after removing some of the loose earth or stones which were lying on the top, he would commence making a small hole—generally about the size of his hat!—in the lowest part of the ravine, from whence a panful of dirt would be taken, and washed; and if found to be rich, a "claim" or "claims" would be immediately staked off. After placing his pan by the edge of a pool or stream, the "prospector" takes hold of the sides with both hands, and squatting down lowers it into the water, then, with a kind of oscillating and slightly rotary motion, he moves it about and beneath the surface for a few moments, then, after drawing it to the edge of the pool, he throws out the largest of the stones, and assists to

dissiolve the dirt by rubbing it between his hands; the washing is then repeated; and, while the muddy water and sand are afloat out of the pan into the pool, the gold, if there is any, settles gradually to the bottom of the pan and is there saved.

If a little only of very fine gold was found, it was called in miner's phraseology "finding the color," and if from ten to twenty-five cents were found to the pan, it was called "a good prospect." Now, however, with improved modes of mining, and less extravagant expectations, from *one* to *three* cents is pronounced "good pay dirt."

Next to the broad wooden bowl of the Mexicans and Chileans, as implements for the more speedy separation of gold from the earth, the *cradle* or *rocker* holds an important place; from the fact that it was the first appliance, superior to the pan, used with effect in all parts of the mines. Its size and weight rendering it portable, it was easily transferred from place to place, and even now is much in use as a prospecting implement upon a scale more extended than can well be executed with the pan.

THE CRADLE AND MANNER OF USING IT.

Our description of the cradle or rocker, is this: an oblong box from three to three and a half feet in length, eighteen to twenty-two inches in width, and about nine inches in depth at the upper end, with a bar across the middle; one end of the box is left open or has no end board. There is no cover to the box or cradle; but a separate box, sieve, or hopper, is made to fit into and occupy the half of the cradle furthest from the open or lower end; this hopper is about four inches in depth; the bottom is of sheet iron, perforated with holes about three-eighths or half an inch in diameter, and one and a half inches apart.

Under the hopper and sloping downward toward the upper end of the

cradle, is the *slide* or *apron*. This apron being somewhat hollow or concave on its upper side, and covered with canvass, retains much of the gold that falls upon it.

Rockers are attached to the under side of the whole, quite similar to those of a child's cradle; near the middle an upright handle is attached, by which motion is given to it.

The hopper being nearly filled with auriferous earth, the operator being seated by its side, while rocking the cradle with one hand, dips and pours on water with the other, from an adjacent pool or rivulet, using a half gallon tin dipper for the purpose.

The water dissolving the earth, it falls through the sieve upon the sloping apron, which conveys it to the upper end of the bottom of the cradle. On this bottom, about the center, is a "riffle-bar" placed crosswise, and one a little deeper at the lower end; and while the lighter sand and dirt passes over them with the water, the gold, by its greater weight, is retained by them, and thus kept from passing out at the lower end.

The coarse stones and gravel remaining in the hopper after the water runs clear are then thrown out, the hopper replaced and refilled, and the process repeated. As often as is necessary, the apron, riffle-bars, and bottom are cleaned of the sand and gold that has concentrated upon them; the larger portion of the fine gold being generally found upon the canvas of the apron.

The cradle, though still extensively used by the Chinese throughout the mines, has given way among Americans, and the more enterprising class of miners, to more summary methods for separating the gold from the pay-dirt; its use being superseded by far more efficient implements; and among them, as next in importance to the cradle, was introduced the "Long-Tom."

THE LONG-TOM.

It was not long after the pan and cradle were in general use, that it became apparent that some more expeditious mode was required for washing the gold from large quantities of earth. Men were not satisfied with the slow, one man system, the use of pan or cradle; but something must be done, some invention made of an implement by the use of which the united efforts of individuals, as companies, could be made available and profitable.

The tom varies much in size, depending on the number of men intending to use it. It is an oblong box or trough about twelve feet in length, open at the top and usually at both ends; but always at the lower end. It is about eight inches in depth, and at the upper end from one foot to two feet in width; but increasing to nearly double that width at the middle, from thence its sides are parallel to the lower end. The bottom of this broad portion for a distance of from three to six feet from the end, is made of strong, perforated sheet iron, in every respect similar to the sieve or hopper of the cradle, but of much heavier iron. The tom is not straight upon its bottom the whole length; but the sheet iron portion is turned upward as it approaches the lower end, so that the depth of the tom is diminished at that end to less than three inches. The object of this is that the water may all pass through the sieve or tom-iron without running over the top.

Under this perforated iron portion is placed a riffle-box, similar in principle to the bottom of a cradle; but larger, and alike with the tom, always to remain stationary or immovable while in use.

MINING WITH THE LONG-TOM.

The tom is now placed in a proper position, having reference to the dirt to be washed, generally as near the ground as possible, having to admit of the "tailings" passing off freely. The riffle-box is first fixed in proper position, then the iron-bottomed portion of the tom placed over it, with its open or narrow end several inches the highest. Water is now let on, either in open troughs of wood, or through canvas hose, which by its force, carries the dirt when put in, down the tom; and while two or more men are employed shoveling the dirt into the tom at the upper end, one man at the side of the lower end, with hoe or shovel in hand, receives the dirt as brought down by the water; and after being violently stirred and moved about upon the perforated iron bottom until all has passed through it that will, the residue of stones and coarse gravel is thrown out by the shovel.

The manner of saving the gold by the riffle-box, is precisely the same in principle as that of the cradle, with this advantage over it; that the falling of streams of water through the tom iron serve to keep the sand upon the bottom of the riffle-box stirred up and loose, permitting the gold the more easily to reach the bottom, where it is retained by the riffle-bars; while the lighter matter, sand and pebbles, pass off with the water and are called "tailings."

Sometimes thirty or fifty feet or more of sluice boxes are attached to the tom at the upper end, and the dirt is shoveled in along the whole length, to be carried down to the tom by the force of the water, there to receive its final stirring up.

Toms are particularly adapted to nearly level grounds, or where there is not sufficient fall to admit of the still more efficient mode of gold washing with sluices.

SLUICING.

This is a mode of mining particularly adapted to those localities where it

becomes desirable to wash large quantities of dirt, and where the descent is sufficient to operate advantageously.

To get at a proper understanding of this method of mining, seems to require a description of the "sluice box." This is merely an open trough, usually made of three inch boards—a bottom and two sides; twelve or fourteen feet in length, and from twelve inches to forty in width, and sawed purposely for this use, two inches wider at one end than at the other. The sides of these troughs are secured from spreading by cleets nailed across the top; and from splitting at the bottom, by similar cleets on the under side.

A continuous line of these troughs or "sluice boxes," the smaller and lower end of each, inserted for three or four inches into the larger end of the next one below, form the "sluice," and being placed upon the ground or other supports, with a proper descent; the dirt, by whatever mode is adopted to remove it thereto, and into the sluice, either by shoveling, or the power of the hydraulic as hereafter described, is, by the force of a larger body of water than is usually used in tomming, conveyed through a continuous line of from fifty to several hundred feet in length, and when the descent is sufficient, the whole mass of dirt, from the finest particles, to stones and boulders of four or five inches in diameter, go rattling down by their own gravity and the force of the water, the entire length of the sluice.

Where the descent is not quite sufficient for this, forks and shovels are used along the sluices to loosen up and finally to throw out such of the larger stones and rocks as the water cannot force through them; as shown in the engraving.

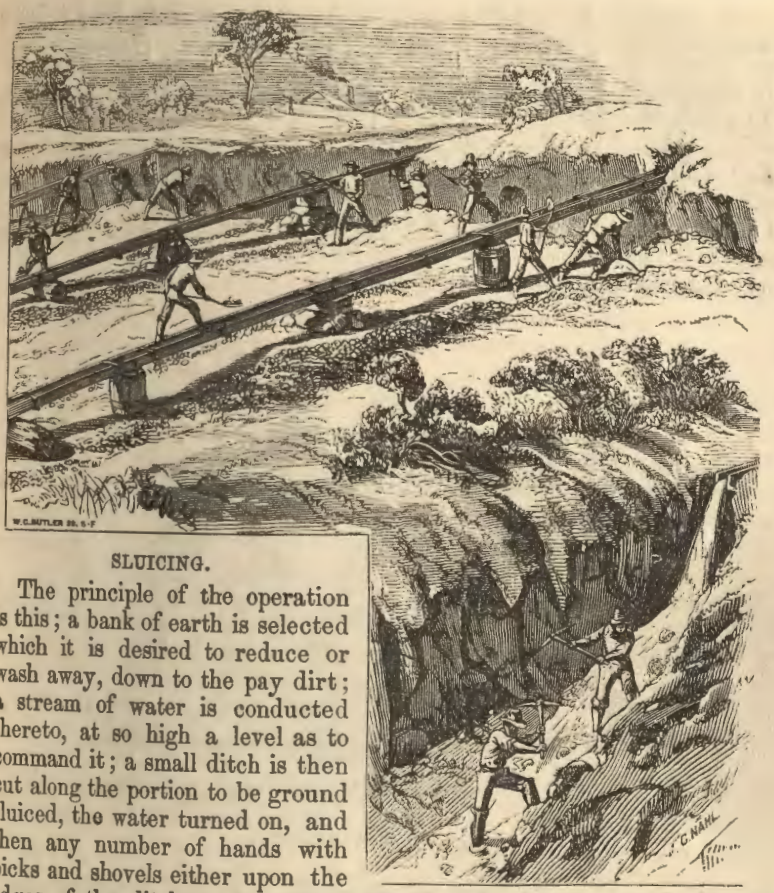
There are different appliances attached to the bottoms of these sluices, inside, for the purpose of saving or catching the gold in its passage down the sluice, such as riffles of a great variety of patterns, and false bottoms, perforated or split in pieces, the interstices of which are admirably adapted to the saving of fine gold.

These sluices are sometimes "run," as it is termed, for many days together before "cleaning up;" when this is done the false bottoms or riffles are removed, the sluices "washed down," and the gold secured by being carefully swept down the whole length of the sluice into a pan, to be more thoroughly cleaned by "panning out."

This is doubtless of all others the most expeditious mode of mining or separating the gold from the dirt that has yet been discovered, and where it can be adopted is doubtless the best.

GROUND SLUICING.

Among the more important operations connected with gold mining upon an extensive scale, is "ground sluicing." Localities are often found in which the largest portion of the gold lies upon, or near the "bed rock;" above which may rest a depth of earth of many feet, containing no gold, or so small a quantity compared with the mass of dirt, that it would not pay either to wash in sluices or for the expense of removal in any other way than by ground sluicing.



SLUICING.

The principle of the operation is this; a bank of earth is selected which it is desired to reduce or wash away, down to the pay dirt; a stream of water is conducted thereto, at so high a level as to command it; a small ditch is then cut along the portion to be ground sluiced, the water turned on, and then any number of hands with picks and shovels either upon the edges of the ditch or by getting directly into the stream of water, pick away and work down the banks and bottom, to be dissolved and carried away by the water, while the gold that may be contained in it, settles down without being conveyed or lost, to be finally saved by being passed through the ordinary sluice.

When the process is solely for the purpose of removing the top strata of earth in which no gold or pay dirt is found, down to that which will pay, it is called "stripping," by ground sluicing. Often however when no pay is expected from the stripping process, the miner is unexpectedly cheered by finding in the top dirt more gold than sufficient to pay all the expenses of the operation.

SINKING A SHAFT.

The mining region of California in its physical conformation is made up to a great extent of immense ridges and hills, with gulches and ravines intervening, and all underlaid by what is usually termed "bed rock." In

very many places this bed rock assumes upon its surface the form of basins deep beneath the great earth ridges, and these basins are frequently found to be exceedingly rich in their golden deposits.

To reach the bed rock in these positions, two methods are adopted; "sinking shafts" and "running tunnels."

To "sink a shaft,"—a shaft being a perpendicular opening in the earth usually from four to six feet in diameter—the same means and appliances are ordinarily used as in sinking a deep well; which in fact it much resembles, except that it is seldom walled up as wells are, nor is water desired in them; but which unluckily too often occurs.

SINKING A SHAFT.

Sometimes a "streak" or strata of pay dirt is reached, before arriving at the bed rock, and is termed a "lead." When the lead is followed horizontally to the right or left from the shaft, it is termed "drifting;" and when the bed rock is reached, if operations are continued they are all done by drifting.

The pay dirt is raised to the surface by the same means that are used in sinking the shaft, the principal of which is, the windlass and bucket, or tub. Sinking shafts is often performed solely with the view of prospecting, in the cheapest and most expeditious manner, the bed rock, before proceeding to the greater expense, but more efficient mode, of working these deep hill claims by "tunneling." But this is not always the case; for shafts are sometimes sunk upon flats to a great depth, and the entire process of mining out all beneath, conducted through the shaft; in aid of which steam engines are often employed.

TUNNELING.

Tunnels are usually commenced upon hill sides, or near the bottom of

gulches and ravines, and are run in nearly horizontal. Commencing at the surface upon the proper level, or what is supposed will prove to be the proper level, when the basin of the hill or pay dirt is reached, an open cut is first made into the hill, until a sufficient depth is attained to enable the tunnel to be commenced, with enough of earth or rock overhead to sustain itself in the form of an arch, or if of earth only, and inclined to cave in, then to be supported by "timbering" at a height scarcely sufficient to clear a tall man's head when standing upright.

The tunnel is now commenced, and usually from five to seven feet in width. When only earth and detached stones or boulders are met with, it often becomes necessary to "timber up," as the tunnel progresses; which is done by setting strong posts about three feet apart on each side, and opposite to each other; and these supporting a cross timber above, and on these one or more plank are laid which support the roof; sometimes the sides are necessarily planked also.

RUNNING A TUNNEL.

In very many instances the tunnel is "driven" by picking and blasting through solid bed rock many hundred feet in length, requiring a great expenditure of time, labor, money and perseverance. To convey from the tunnel, the excavated portions of rock, stones and earth, the wheelbarrow was formerly in general use, and is even now in many places; but with the more systematic, a narrow railroad is constructed as the work progresses, on which is run a suitable car, the bottom of the tunnel having the necessary grade to enable a loaded car to be propelled outwardly easily by man power.

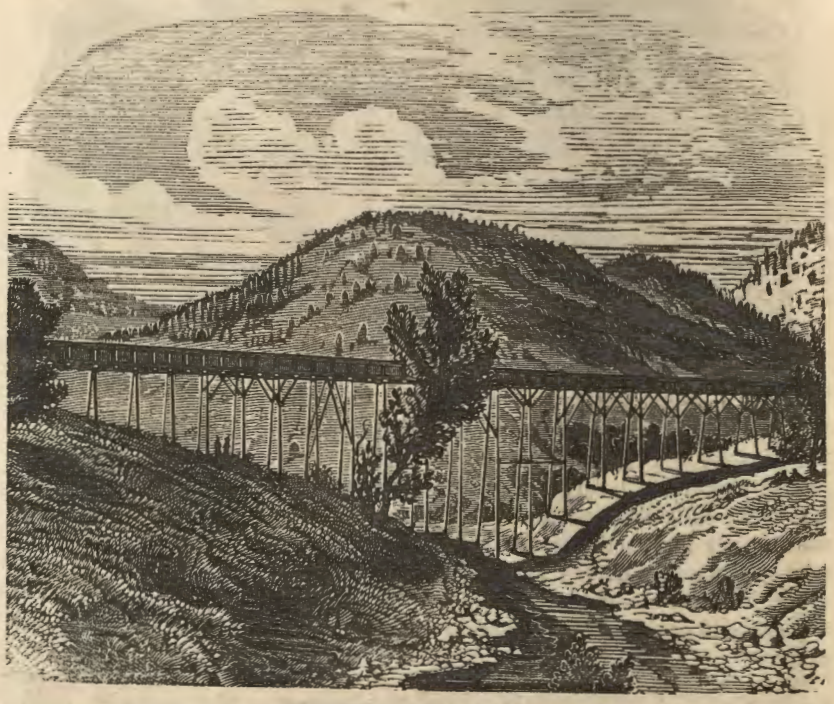
When the pay dirt is reached, a division is made of the excavated portion on being brought out, into that which is, and is not, pay dirt, and as often as expedient when water is procurable, it is washed by sluicing in the usual manner.

FLUMING.

Only those who are familiar with the physical formation of the mountain and gold region of California, have anything like an adequate idea of the

vast amount of labor expended, in the construction of the artificial water-courses that supply our mining canals and ditches with water from the mountain streams.

To hear of the construction of a hundred miles of mining ditch, conveys but a feeble conception of the magnitude of the enterprise, or the difficulties to be overcome. The mountain country from which the supply of water is obtained, does not consist of slope upon slope, or of successive tables of comparatively level land, and rising one upon another; but from the foothills the mountains rise to the height of from seven to nine thousand feet, in one uninterrupted succession of immense ridges, lying in every conceivable direction and position, with intervening gorges or cañons of corresponding depth; and by this we mean, of very great depth; many of the mountain streams occupying and rushing down cañons, whose sides are almost perpendicular walls of rock, and often three thousand feet or more in height, and along which the pedestrian can only make his way for a hundred yards together, by taking to the bed of the stream.



FLUMING OVER A GORGE.

It is from such cañons that the water is mostly obtained for the supply of our mining canals and ditches; and it is not unusual that from three to ten miles of wooden flume is required at the upper end, before the water can be brought out of the cañon sufficiently high to overtop or command the ridges and foothills of the lower country, in which the mines and placers are principally found.

FLUMING IN A CANON.

To lift, as it were, the waters from these deep cañons, or rather to convey them at a fall of from five to twenty feet to the mile, out of them, often requires many miles of flume constructed entirely of wood, because the steep sides have not, in many places, a single inch of earth in which to excavate a ditch; and even the rocky sides often so high and steep as to require the flume to be constructed upon trestle-work, a hundred or more feet in height; and even in some instances actually suspended by iron work, upon the smooth face of almost overhanging rocks and precipices; the workmen are let down and suspended by ropes from above, while prosecuting their arduous labors.

Then again, the flume is made to span a vast gorge sometimes, and in places supported by timber work from beneath; at others, by suspension from the sides; and in its tortuous course, running up and crossing adjacent gorges, perhaps to take in the waters of some small tributary, and then again heading for and coursing along the great main cañon, leaping as it were, from point to point of jutting crag and cliff, until at last it reaches the more earthy side or summit of the ridge, there to be at once used for gold washing, or milling puposes, or conveyed by ditches in countless ramifications to the lower mining world; and these enterprises constitute the great fulcrum of our mining prosperity.

SUSPENSION BRIDGE, ACROSS BRANDY GULCH.

RIVER MINING.

When it becomes desirable to chain the mountain torrent, which is heedlessly rushing past, and turning it out of its natural channel, that the glit-

MEN ENGAGED IN WORKING OUT THE RIVER'S BED AFTER TURNING THE STREAM INTO THE FLUME.

FLUMING SCENE ON SCOTT'S RIVER.

tering gold, lying in the river's bed, may be transferred thence to the buckskin purse of the miner, he talks the matter over with some confidential, and trustworthy, and hardworking companions, when they mutually agree that "there is gold there—sure," if they can only get it.

The ways and means are accordingly devised; sometimes by making up a company of eight, ten, or twenty, or any other desirable number; and as the cost will be about so much, each member of the company has to contribute his share of the amount agreed upon, as the work progresses. Should it cost less or more—generally it is the latter—the proportion is diminished or increased by assessments, according to the number of shares. At other times a number of men, who live together on the same bar, and who, being well acquainted with each other, and tolerably well informed what the other possesses, will raise whatever timber or tools may be required, from among themselves, and "get along as well as they can, for the balance"—which often is but very indifferently—and go to work with a will to accomplish their object.

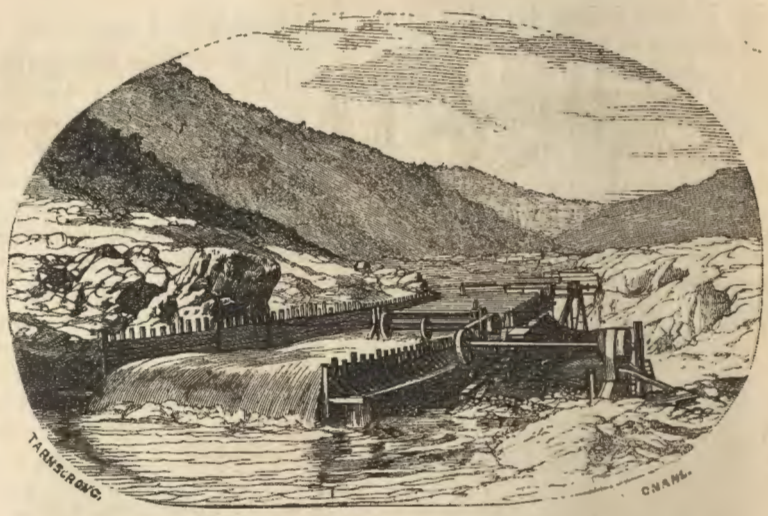
To do this, sometimes, a race has to be dug; at others, a flume has to be built, requiring to be of sufficient capacity to take in the whole amount of water running in the river. This being done, a dam has to be constructed across the river, that shall be water-tight, or nearly so. To build this dam, very often requires that men work in the water, which is generally very cold, for, as it comes from the melting snows, it cannot be expected to be very warm; at least, before the river is very low, and men seldom wait for that —they therefore enter the river; and by rolling up large boulders into a line for building a wall, they turn the water from one side towards the flume on the other, and when one wall is thus rudely but substantially constructed,

another is built behind it; when all the light floating sand is cleaned out, that it may not be in the way of making the space water-tight between the walls; a clayey soil is then filled in and well tramped, until the dam is tight, and the water is running through the race or flume. Sometimes a tree or log is felled across the stream, (if one can be found long enough to reach, and in the right place,) when slabs or split timbers are put in, in an inclined position, and either nailed or pinned to the log, when the whole space in front is filled up with clayey soil and fine bows of trees until it is made water-tight.

VIEW NEAR LANCHAPLANA, MOKELUMNE HILL.

The river now being turned into the race, wheels are erected across it, and pumps are attached, by which the water still remaining in the river's bed is pumped out. Now river mining is commenced in real earnest; men begin to remove boulders, wheel out rocks, fix toms or sluices, and take out the precious metal, if there is any. (The writer has seen as high as five thousand two hundred and twenty-seven dollars taken out from behind a boulder, in a single pan of dirt.)

Should the fall rains be late before commencing, every opportunity is given to work out the river claims to advantage—or at least to test them sufficiently either to work or abandon them. If, on the contrary—as frequently occurs—the rains should come early, the whole of the summer's labor and expense are swept away before a dollar can be taken out. Many men are thus left penniless, after the toil and hope of a long and scorching summer. Taking the losses with the gain, it is very questionable whether more gold has not actually been invested in river mining, than has ever been taken out.

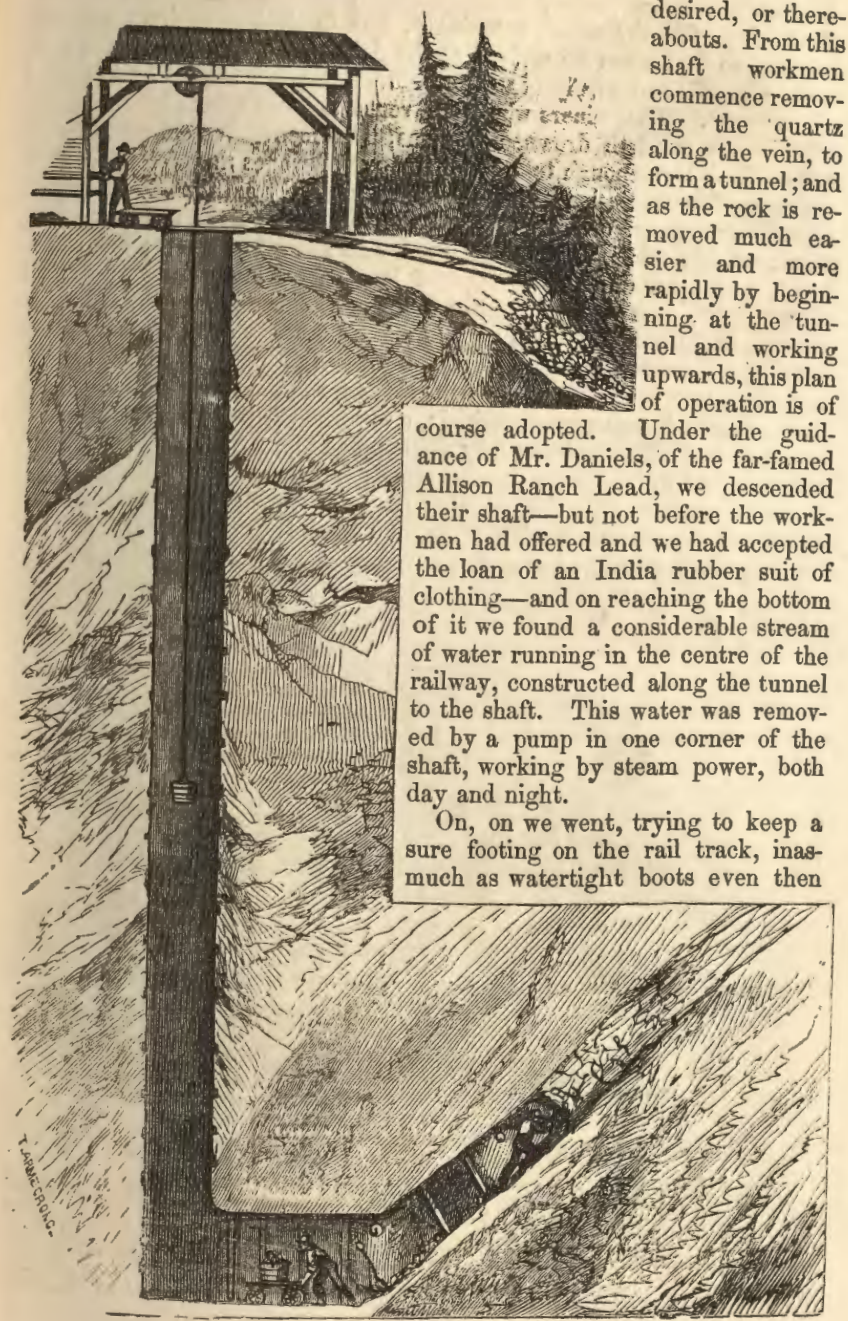


QUARTZ MINING.

Quartz mining having ceased, as a speculation, to become a business of profit and permanency, is again enlisting the attention and confidence of all classes to its importance.

MEXICANS BREAKING THE QUARTZ.

As the position of a quartz lead in the mountain is generally at an angle of from twenty to fifty degrees, the most common method of working it is to sink a perpendicular shaft at a sufficient distance from the line where the vein is seen to "crop out" on the surface, and strike the angle at the depth



SINKING A SHAFT.

desired, or thereabouts. From this shaft workmen commence removing the quartz along the vein, to form a tunnel; and as the rock is removed much easier and more rapidly by beginning at the tunnel and working upwards, this plan of operation is of course adopted. Under the guidance of Mr. Daniels, of the far-famed Allison Ranch Lead, we descended their shaft—but not before the workmen had offered and we had accepted the loan of an India rubber suit of clothing—and on reaching the bottom of it we found a considerable stream of water running in the centre of the railway, constructed along the tunnel to the shaft. This water was removed by a pump in one corner of the shaft, working by steam power, both day and night.

On, on we went, trying to keep a sure footing on the rail track, inasmuch as watertight boots even then

became a very necessary accompaniment to the India-rubber clothing. Drip, drip, fell the water, not singly, but in clusters of drops and small streams, so that when we arrived at the drift where the men were at work, we had a sufficient supply of water for drinking purposes (!) in the pockets of our coat. The miners who were removing the quartz from the ledge, looked more like half drowned sea-lions, than men. We did not make ourselves inquisitive enough to ask the amount of wages they received, but we came to the conclusion that they must certainly earn whatever they obtained. Stooping, or rather half lying down upon the wet rock, among fragments of quartz and props of wood, and streams of water; with pick in hand, and by a dim but waterproof lantern, giving out a very dim and watery light, just about bright enough, or rather dim enough, and watery enough, as Milton expresses it, "to make darkness visible," a man was at work, picking down the rock—the gold-bearing rock—and which, although very rich, was very rotten, and consequently not only paid well, but was easily quarried, and easily crushed; and although this rock was paying not less than three hundred and fifty dollars per ton, we could not see the first speck of gold in it, after a diligent search for that purpose.

At the bottom of the drift another man was employed to shovel the quartz into a tub standing on a railway car, and push it to the shaft, where it was drawn up and taken to the mill.

FEEDING THE MILL.

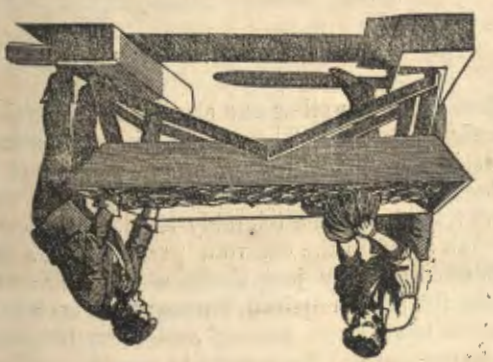
After the quartz is emptied from the cart into the yard, the large pieces are broken by hand to about the size of a man's fist, or a little smaller: they are then shoveled, with the dust and finer portions of rock, upon an inclined table or "hopper" at B, on which a small stream of water is conveyed through a pipe from above, and by which the quartz is washed down the hopper to a solid cast-iron bed-plate at H, and beneath the stampers.

The stampers at A and I being elevated by convex arms attached to a revolving shaft at K, when at the required height, fall suddenly down upon the quartz; and being shod with heavy cast-iron, which, added to the stampers, make the whole weight of a single one from six hundred to a thousand pounds, crushes the rock to powder upon which it falls.

In front of the stampers at D is a very fine seive or screen, against and through which the water, gold and pulverized quartz are constantly being splashed by the falling of the stampers; and should the rock not be pulverized sufficiently fine to pass through these discharge-screens it again falls back upon the bed-plate to receive another crushing from the stampers. If, however, it is reduced fine enough to pass through, it falls upon an apron at E, or into an "amalgamating box" containing quicksilver, and into which a dash-board is inserted that all the water, gold, and tailings may pass *through* the quicksilver contained in the amalgamating box, to an inclined plane or blanket-table, below. Across and above the apron, or amalgamating box, a small trough is fixed at O, with holes in the bottom, for the purpose of distributing clean water equally on the apron, or into the amalgamating box, and by which the pulverized rock, and gold not saved above, is washed down to the blanket-tables at F.

These tables simply consist of a flat sluice, generally about two feet in width by six inches in depth, and upon which a coarse blanket is spread for the purpose, principally, of saving the auriferous sulphurets, and which will not amalgamate with the quicksilver. Some companies, however, depend chiefly upon the apron and blankets for saving the whole of the gold, and do not use quicksilver above the blanket-tables.

The blankets are allowed to remain upon the tables from ten to thirty minutes, according to the quality of the rock being crushed; that which is rich requiring the change about every ten or fifteen minutes, and that which is poor every twenty or thirty minutes. When a change is desirable the

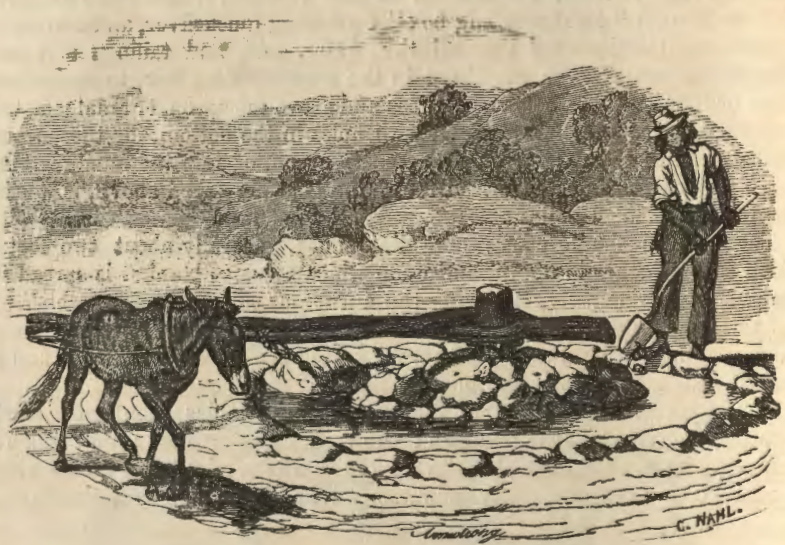


WASHING THE BLANKETS.

blankets are carefully rolled up and placed in a bucket, or small tub, and carried to the "vat"—not, however, before another is spread upon the table

—where they are carefully washed. In order to test the quality of the rock being crushed, the contents of the blanket are frequently washed into a *batea*, or broad Mexican bowl, and prospected.

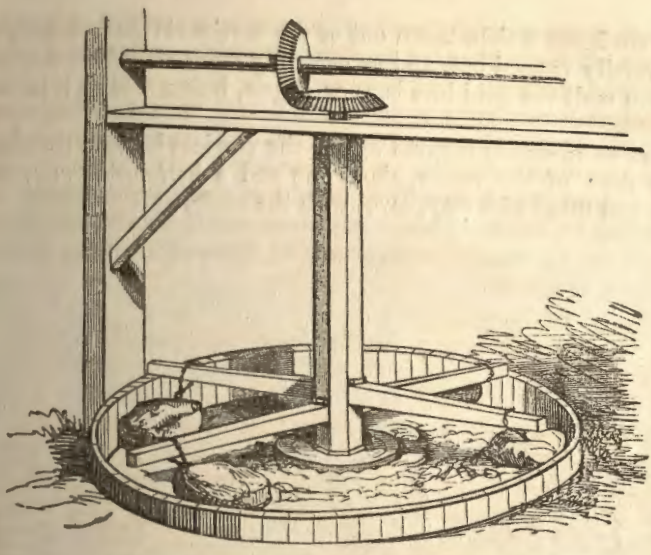
The materials contained in the blanket vats are saved in a box made for that purpose, or thrown into a heap, or taken at once to some kind of amalgamating machine — and there is scarcely a couple of mills in the State where the same process exactly is used; as each superintendent of a mill supposes that he has made some improvements in *his* mill entirely unknown or unpracticed by others; at all events he flatters himself that *he* saves more gold than his neighbor.



THE MEXICAN RASTRA.

One of the first used, as well as one of the most useful and most important, is the Mexican Rastra. Though rude in its construction and simple in its working, it is one of the most effectual methods of saving the gold which has yet been discovered. The Mexican method of constructing these is to lay a circular track of stone tolerably level, with a low wall around the outside of the track; and in the centre a post made of a tree cut off at the required height, and generally just above a crotch or arm; another small tree is then cut in the shape required, for making a horizontal shaft; to this is attached one or more large stones; and these being drawn around by donkey or mule-power, grind the quartz to powder. Of course, as gold is the heaviest it naturally seeks the lowest places, and as quicksilver is always put in with the quartz the gold becomes amalgamated with it.

The Mexican rastra has been improved some little in its construction and adaptation to our wants; and in many cases mule-power has been superseded by steam; but the principle remains about the same.



THE IMPROVED MEXICAN RASTRA.

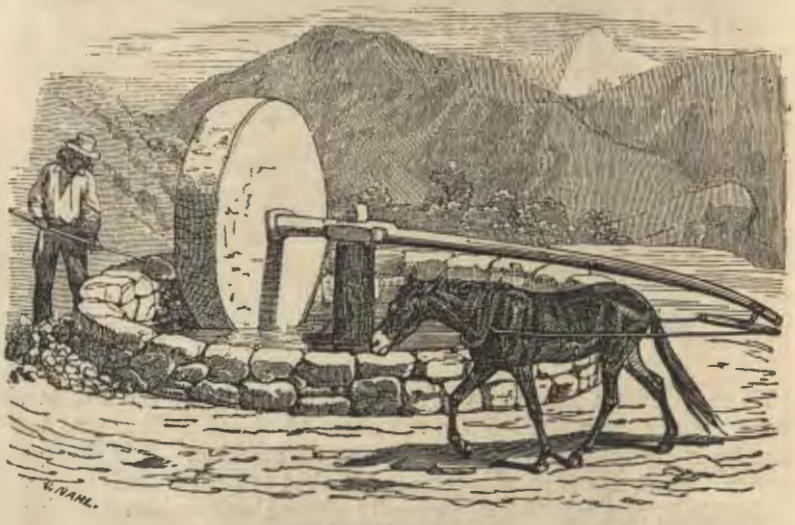
When the rastra is properly prepared, a "batch" of about five hundred pounds is generally emptied into one about ten feet in diameter; but the quantity is always regulated by the size of the machine. It is then ground very fine by means of the drag-stones attached to arms fixed in the perpendicular shaft, and which are generally given about eight revolutions per minute. At this rate it will require from three to four hours to grind a batch sufficiently; but this is somewhat regulated by the grit and weight of the drag-stones. About three quarters of an hour before the whole is thoroughly ground, a sufficient quantity of quicksilver is added; but the amount is regulated by the richness of the quartz in process of grinding. If, for instance, the five hundred pounds of tailings placed in the rastra is supposed to contain about three quarters of an ounce of gold, about one ounce of quicksilver is generally used—or about twenty-five per cent. more of the latter than the former. Some judgment is required in this — too much quicksilver being a disadvantage, inasmuch as the amalgam should be kept hard to make it effectual in saving the gold. Quicksilver should also be kept very free from grease, as it cannot be too clean; and should invariably be well retorted every time it is used.

About ten minutes before the grinding is finished, about sixteen buckets of water are poured into the rastra, to the quantity named, and the same motion continued, the whole appearing like muddy water. This is then bailed out, or run off quickly. Five hundred pounds more of the quartz are then added, and the process repeated, adding the same portion of quicksilver to every batch.

This is kept on for one, two, three, or even four weeks, according to the richness of the quartz, or the taste and wants of the owner. The larger the amount contained in the rastra, the more gold is there saved, in proportion, to the ton.

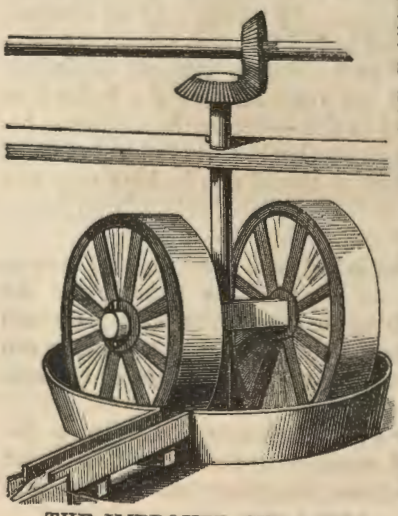
The amalgam is then taken out of the crevices in the bottom of the rastra, and carefully panned out, and as carefully retorted. After this, most business men melt the gold into bars or ingots, before sending it to the mint to be coined.

Before commencing to grind again, the crevices between the stones covering the floor of the rastra, about one and a half inches wide, are tightly packed and filled with clay, level with the stone.



THE CHILI MILL.

This mill as used in Chili, and from whence its origin and name are derived, is nearly as simple in its construction as the rastra, with the walls a little higher, and more regular; and, instead of the "drag-stones," a large stone wheel, attached to the horizontal shaft, is used for grinding the rock. Into this mill a small stream of water is constantly running, a portion of which is forced out at each revolution of the wheel. The gold is saved by means of quicksilver on the bottom of the mill, in the same manner as in the rastra.



THE IMPROVED CHILI MILL.

To make this principle more subservient to the purposes of quartz mining, and better adapted to the requirements of a faster age and people, the "improved Chili Mill" was invented. This consists of two heavy cast-iron wheels, from three to five feet in diameter, and from ten to fifteen inches in thickness:

these revolve on an axle, moving steadily round in a circular iron basin about a foot in depth, into which the tailings from the blanket tables are conveyed, and ground to powder.

As these improved mills are generally worked by steam, the speed attained, and the work accomplished, of course very far exceeds the old process.

INSIDE OF A QUARTZ MILL AT GRASS VALLEY.

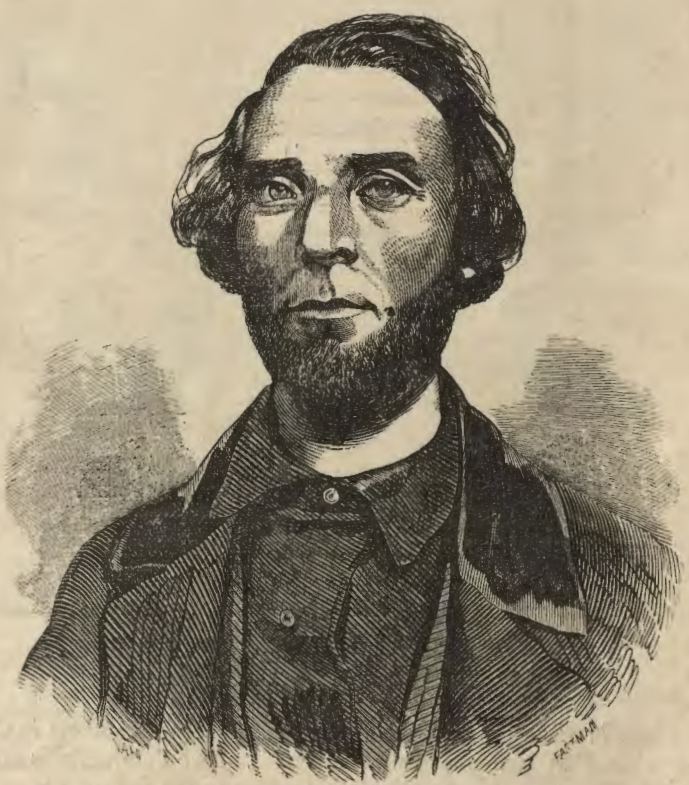
[*From an Ambrotype by Woods & Michaels.*]

The methods of saving the gold which passes over the blankets in the tailings, are almost as numerous as are the mills where the quartz is crushed. The principal, however, is to allow the tailings to run down a series of inclined tables, or sluices, at the end of each of which is often placed a wood trough, or iron pan, containing quicksilver, into which they flow, when the gold falls into the quicksilver on the bottom, and is there retained; while the light material floats over the edge of the trough or pan into another

sluice, at the end of which is another pan, where the same process is repeated. The sluices, or inclined tables, are generally fitted up with "patent riffles" across the bottom, filled with quicksilver. After the tailings have passed through the whole series of sluices they are sometimes worked through the improved Chili Mill, or other machine; but are oftener allowed to run into a large vat, from which the water flows off while the tailings settle at the bottom. These are then thrown into a heap and allowed to "rust," preparatory to other processes at some future time.

THE HYDRAULIC.

By far the most efficient system of mining yet known, for hill diggings, is the Hydraulic; for the discovery of which California is indebted to Mr. Edward E. Matteson, formerly of Sterling, Windham county, Connecticut.



EDWARD E. MATTESON.

Mr. M. first commenced the use of this method at American Hill, Nevada, in February, 1852, and such was the success attending its operation that

THE HYDRAULIC METHOD OF MINING.

others around him immediately began to adopt it; and it is now in general use throughout the mining districts of the State.

Water being conveyed by canals and ditches, around and among the hills and mountain sides where mining is carried on, it is thence distributed from the main canal by smaller ditches to the mining claims requiring it.

Here it is run from the small ditch into a trough fixed upon tressel work, which is often technically termed the "Hydraulic Telegraph;" or, run in heavy duck hose upon the ground, to the edge of the claim, thence over the edge and down the almost perpendicular bank to the bed rock, or bottom of the claim, where it lies coiled about on the rock and dirt like a huge serpent. As the upper end of the hose is much larger than the lower end, the water running in, keeps it full to the very top; and the weight of this water, escaping through a pipe attached to the lower end of the hose, in a similar manner to that of a fire engine, plays upon the bank with great force and effect, washing it rapidly away.

There are sometimes stratas of gravelly cement in the bank which are exceedingly hard and difficult to wash away, even with the immense force given by the weight of from fifty to two hundred and twenty feet of fall, which the water contained in the hose receives from above.

The most efficient manner of washing down these banks is by undermining them near the rock, when large masses—frequently many tons in weight—"cave down" and not only break themselves to pieces by the fall, but unfortunately often bury the too venturesome miner beneath them. It is in this kind of mining so many accidents have occurred; and when we read in the newspapers of the day that Mr. so and so was badly injured—or killed—by the "caving of a bank," we may know it is generally in such places.

If the reader will please refer to the engraving he will see a stream of water running over the bank, which is often required effectually to cleanse and remove the large quantities of earth and rocks washed down by the pipe, and convey them to the sluice, down which they pass, and in which the gold is principally saved, although large amounts of the golden dust lie among the earth and stones, but a few feet from whence they were washed.

After "cleaning up" the rock and "washing down" the sluice, the precious contents are swept into a pan where they are carefully panned out. After the day's work is done the miner repairs to his cabin to build his fire, cook and eat his supper, dry his dust, and blow out the black sand.

Sometimes when a man has been covered up by the bank falling upon him, not only the stream generally used in the claim, but often the entire contents of the ditch are thus turned on, and with the assistance of every miner who knows of the accident, it is used for sluicing him out, and which is by far the speediest and best method for his deliverance.

The "hydraulic process" removes and washes immense masses of earth that would otherwise be useless and its working unprofitable, thus making it not only one of the most useful and effectual, but almost an indispensable method of mining for gold in California.

PLACER MINING TWO HUNDRED YEARS AGO. NO. 1.

PLACER MINING TWO HUNDRED YEARS AGO.

(1.) The miner who carries the matter to be washed in the rattar.
(2.) The parts of the rattar more visible that in the other sculpture.
(3.) Washer who governs the rattar.
(4.) The upper and lower falls of the rattar.
(5.) The plain boards (or hearth) on which they fall.
(6.) He that stirs the muddy water from both fallings.
(7.) The tub wherein that which falleth from the hearth is to be washed.

PLACER MINING TWO HUNDRED YEARS AGO. NO. 2.

The above drawing represents the sieve hung up by heavy chains to a frame. The dirt is thrown on it from a wheelbarrow. A stream of water pours on it, and a man shakes the sieve and throws out the large stones. The dirt and gold falls upon a board sloping backwards, precisely like the "apron" of the common rocker, and then upon a "long tom" or "sluice," some fifteen feet or more in length, with gutters or cleets in it. The "tailings" fall into a square box, where they are stirred with a hoe, and the settlings were finally washed again in a large tub, as clay used to be "puddled" in the Southern Mines.

The old description, together with the fact that the belt-pump now used for drainage, and the common rocker, were ancient Chinese inventions, go to prove the truth of the saying, that most new discoveries are merely recoveries of things of value from the oblivion of past ages.

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