of as great a length as 450 yards, each of them carrying 350 parachutes of 17.2 square feet area. As half of these are in action at the same time, the total working area for the two cables is 5,860 square feet. This immense area furnishes a considerable amount of power even in a river of feeble current. Comparing this with a floating water wheel of the type sometimes employed, and supposing this to have only 172 square feet of working area, such a wheel must have a length of 46 feet, a diameter of 23 feet, and seventy-two floats, each $2\frac{1}{2}$ feet wide. The enormous dimensions thus required for a comparatively small working area point sufficiently clearly to the advantage which remains on the side of the parachute motor.

The general arrangement of the system is shown in the engraving. Behind the return pulleys, D D, are attached cords, A A, with some parachutes strung upon them. These present their openings to the current and preserve the tension of the connecting ropes. At the further end of each cord is a board, B, which is kept in a vertical plane, but lying at a slight angle to the direction of the current; and this acts to keep the two moving ropes apart from each other. The two return pulleys are, however, connected by a line, E, which can be shortened or lengthened from the pontoon, and in this way the angle of inclination between the two ropes can be varied if required. A grooved pulley presses upon the trailing span at the moment before it reaches the circumference of the drum. It is mounted on a screwed spindle, which is depressed by a nut, and thus makes the wet rope grip the outside of the drum in a thoroughly efficacious manner.

The author has made a theoretical investigation of the power which may be developed by the system, and has worked out tables by which, when the velocity of the current and the other elements of the problem are known, the power developed by any given number of parachutes can be at once determined. We do not reproduce this investigation, which takes account of the resistance of the returning parachutes and other circumstances, but will content ourselves with quoting the final equation, which is as follows: $T = 0.328 S V^2$. Here T is the work done in H. P., S is the total working area in sq. m., and V is the velocity of the current in m. per sec. Taking $V = 1$, and $S = 1$ sq. m., which is by no means an impracticable quantity, we have $T = 0.328$ H. P. per sq. m. We may check this result by the equation given, in English measures, by Rankine—"Applied Mechanics," p. 398—for the pressure of a current upon a solid

body immersed in it. This equation, $F = 1.8 m A \frac{v^2}{2g}$, where

m is the weight of a unit of volume of the fluid—say 62 lb.—A is the area exposed, and v the relative velocity of the current. Mr. Jagn finds that the maximum of efficiency is obtained when the rope moves at one-third the velocity of the stream. If this velocity be 3 feet per second, we shall have $v = 2$, and we then get $F = 7$ lb. per sq. ft. very nearly. Now 1 sq. meter = 10.76 sq. ft., and a speed of 1 ft. per second (which is that of the rope) is 60 ft. per minute. Hence the H. P. realized in the same case as that taken $7 \times 10.76 \times 60$

above will be $\frac{33,000}{0.137} = 0.137$ H. P. The difference between the two values is very large, but Rankine, of course, depends entirely on the value of the constant 1.8, which is quite empirical, and is for a flat band instead of a hollow parachute. Taking, however, his smaller figure, and an area of 544 square inches, which Mr. Jagn has actually employed, we get a gross power of $= 0.137 \times 544 = 74.5$ H. P. Hence it will be seen that the amount of power which can be realized by the system is far from being inconsiderable.

Lastly, we may point out that the durability of the apparatus will be considerable. There is no wear except at the moment when the rope is passing round the drum, and even then there need be no slipping or grinding. The apparatus worked in the Neva was in very good condition after running for four months day and night. After five months about one fifth of the parachutes had to be replaced, but after seven months the hemp rope still showed no signs of wear. We think we have said enough to show that for certain purposes, and especially, as we have already mentioned, for irrigation purposes, the new motor is well worthy of a careful and extended trial. It may be questioned even whether we have not here the germ of an idea which may hereafter enable us to solve one of the most interesting and important of engineering problems, viz., the utilization of the great store of power provided for us twice daily in the ebb and flow of the tide.—*The Engineer.*

IMPROVED SHAFTING LATHE.

Our engraving represents a new departure in shaft turning lathes, and is the result of thirty years' experience in the manufacture of shafting, with many years' study, to perfect a machine of the greatest practical capacity and efficiency.

The principal points of difference from a common engine lathe are readily distinguished, among which may be mentioned the absence of centers and tail stock, a traveling head with hollow driving spindle, and a stationary tool rest and water tank. By dispensing with a tail stock a much shorter bed may be used, and the hollow driving spindle enables any length shaft to be turned with one setting of the tools. The tool rest is so arranged as to allow of perfect lubrication of the tools, keeping the shaft cool, and at the same time

holding it perfectly rigid and strong; the operator is not required to travel the length of the bed, but remains near the driving belt, feed gearing, etc. Power is communicated to the driving spindle by means of a sliding pinion on a splined rod inside the bed, the driving belt and gears being at the end.

The driving head, after having traveled the length of the bed and turned a shaft, is returned by a quick feed, and stops automatically, allowing nearly time enough for the operator to grind tools and be ready with another shaft, thus economizing the time completely.

Wood, Jennison & Co., Worcester, Mass., are the makers, and they say that with a good quality of iron they have turned three hundred feet of two inch iron in ten hours.

POWER STRAIGHTENING MACHINE.

The machine is provided with a pair of rolls at each end of the bed, which are adjustable for different lengths of shaft, and are made to revolve by power applied through suitable gearing and a splined rod inside the bed; the bar of iron being placed on the periphery of the rolls receives a rotary motion by friction, and shows the crooked places in the same way and with the same ease as though rotating on centers in the usual manner; vertically adjustable blocks are arranged in the base of the press to support the iron; power is applied by means of gearing to a splined rod at the back of the machine, on which is a sliding clutch connecting, at the will of the operator, with an eccentric; the eccentric conveys motion and power through a link to the elbow joint

POWER STRAIGHTENING MACHINE.

at the front of the press, which forces a plunger down against the iron.

Sufficient adjustment is provided for different sizes of iron by turning a nut at the top of the press.

Any point in the length of the bar can be reached by moving the press on the bed. Any length of iron can be straightened, and the most laborious and disagreeable work in the process of making shafting is rendered easy and rapid. Made by Wood, Jennison & Co., Worcester, Mass.

HYDRAULIC MINING IN CALIFORNIA.

By GEORGE O'BRIEN.

OUR knowledge of the primitive operations of the aboriginal inhabitants of the globe in pursuit of gold is barely traditional, as we are only aware that from very early times the precious metal was collected and highly prized by them. And that they chiefly extracted the visible gold, which existed in prodigious quantities on or closely beneath the surface of the earth, and of its being particularly abundant in Asia and Africa. But we can draw more positive conclusions as we survey remains of the rude but effective contrivances used by them in later, but still remote, periods, with full evidence as to the extent of their operations, in the numerous perpendicular shafts located at short distances from each other, over large areas of auriferous gravel in India, as well as from precisely similar memorials of ancient workings which remain also further demonstrations, in the abandoned "hill diggings," and shifted beds, and beds of rivers, in Peru South America, flowing between the sea and coast ranges of the Andes, descending in a northeasterly direction to the river Amazon, and that their much coveted and enormous productions were the accumulated riches of the Incas, trans-

ferred as spoils of war to their Spanish conquerors in the sixteenth century. And for similar explorations in the same class of depositions we have the experiences of our own times, and which explain by comparison all the previous operations alluded to.

Thus in the year 1849, after the cession of the northern portion of Mexico to the United States of North America, the rich mineral district of California was at once invaded by hardy and intelligent bands of mining adventurers from all parts of the world, who, with little other means at their disposal but pick, shovel, and pan, soon fell on the productive bars of rivers and rich ravines where the gold was trapped, derived from its original birthplaces, where it had been sparsely disseminated, to be dispersed by the subsequent disintegrations and denudations of the mountains themselves, and deposited in a disengaged form for the first corner; and so perfect were sometimes these concentrations, in certain localities where water once streamed, that, divested of its earthy matrix, the cleansed pure metal was found deposited, detained by its superior specific gravity, on the bare rock, and only hidden from vision by a slight covering of vegetable mould. In this manner, as an example of such concentration, a "pot" or "find" (in mining parlance) to the value of £10,000 was collected in a space of 15 square yards, or within the limits of a particular "mining claim," at the foot of Mokulume Hill, in a southern county of California, soon after the territorial transfer from Mexico. And in search of such locations we must account for the numberless shafts which still exist both in India and Peru, and sometimes sunk within a few feet of each other, passing

through the alluvium to a depth of 40 feet to the bed rock.

These mining adventurers soon extended their explorations over the other recently acquired territories, and built Virginia City, the capital of Montana, with the gold derived from the alluvium of a river channel which they excavated; and its inhabitants were the founders of an institution called the Vigilance Committee, with "Lynch law," and by it ruled supremely for many years. But their surface diggings, by the manual operations alone of multitudes, were soon exhausted in every direction, and then their energies and powers of invention were dedicated to discover and explore deeper and more permanent depositions, along the western slopes of the Sierra Nevada, the Andes of the Western Territories, and which originally were without doubt several miles higher than they are at the present time—probably 20,000 feet above the sea-level—and of which, or whatever superior elevation they formerly had, the greater portion of it has already been removed, by the continuous natural action of centuries, to form there, as elsewhere, the plains and prairies of the earth, burying and diverting by the mutation the ancient river system, whose sources of supply were consequently extinguished by the removal of these altitudes. These denudations and subsequent depositions have been caused by alternations of temperature and combined action of air, water, and time since the creation of the world; and powerful demonstrations of these transformations instruct us in all directions, if we care to observe them. Thus in "Little Cottonwood" ravine, in the Wahsatch range of mountains in Utah Territory, lie isolated in the center of the valley huge masses of metamorphic granite, some blocks of which weigh individually thousands of tons, and were dislodged from the hills—which on either side are of limestone formation—with no visible granite in them, having been undermined by the removal of their pulverized basis by denudation, and which is the material now forming the table lands, the foundation, of Salt Lake City. The blocks of granite, having alone resisted the atmospheric changes, were precipitated into the valley beneath, and the Mormons are now constructing their cathedral church from these granitic remains.

The melting of the snow which formerly capped all these ranges of mountains furnished the water that once flowed in the extinguished channels of ancient rivers, and whose now diverted waters were also the powerful agent to assist in causing these marvelous alternations; and by the means of hydraulic mining we can advance our feeble knowledge on the subject.

These mighty changes have gradually been accomplished, and the accumulated denudations of the mineral zones have defended themselves by strata of crystallized silicates of quartz of various thicknesses, and thus in places beneath such system of defense, or by their own concretion, have preserved in many localities a thickness of from 500 to 600 feet of conglomerate, but without this necessary cementation its further removal is very certain when again attacked by water. An example of this continuous process is very observable in "Death Valley," Lower California, where a width of about 100 miles has been filled up from the hills to the gulf of same name, invading and occupying its former bed; and this activity is still proceeding, and a temporary

IMPROVED SHAFTING LATHE.

formation of tableland above it is in course of removal, although already overgrown with forest trees, which are toppling over the side which is being attacked. But eternal snow now only covers a small portion of these Sierras, and a period of comparative repose may be expected, as the distribution has already been far advanced by the excessive reduction of the mountains.

The deep and extensive depositions which I now attempt to describe attracted the early attention of the mining adventurers, and were called "hill diggings," but not being properly understood were therefore not immediately operated upon, and remained in abeyance, while the lower, richer, and more manifest alluvials endured. They were designated "blue gravel," the color being due to the action of sulphuret of iron and other salts, the cementing auxiliaries requisite to form the hard conglomerate, and on exposure to the atmosphere changes color to yellow and violet, losing also its firmness by oxidation.

The "great blue lead" is another important mining term and designates the alluvium found reposing in a well-defined channel on the bed rock, being the well-worn path of an ancient river; and it is obvious that the material in these channels should be richer than the general mass beyond their limits.

"Rim rock" is the boundary line of the banks of the old channel, and, like the bottom, is well worn and corrugated by the running water into cavities and "pot holes," where the force of the stream eddied. The width of these channels varies from 60 to 400 feet, and the cement near the rim and bottom is always richer than elsewhere. The wider and deeper channels generally course from N. to N.W. The richest and most explored belt of gold-bearing alluvium in California lies between the South and Middle Yuba Rivers, commencing near Eureka, in Nevada county, and extends downwards to Smartsville and Timbuctoo, in Yuba county, a distance of 40 miles; and from among snowy mountains the country falls gradually from where the ravines or canons are cut by the actual rivers, which are 2,000 feet beneath the auriferous gravel and region near Smartsville, and 2,000 feet above the Yuba River, where snow is unknown, and near its terminus the ancient river bed courses more westerly than it does above it, and crosses Yuba below Timbuctoo, where the auriferous depositions disappear. The whole distance of 40 miles has been ransacked by the earlier adventurers, and around the village of Timbuctoo was a center famed for its wonderful yield of gold, obtained chiefly in the ravines, in holes, and depressions in the bed rock. These hollows detained the concentrations of the denudated alluvium from the altitudes, and were generally closely beneath the surface, and by such guidance and means of discovery the miners traced the gold up the ravines to their sources in the lofty mounds and deposits, or hills of cemented conglomerate, near Eureka in Nevada county; and by constructing canals from a higher level began the new system of "hydraulic mining" and washing, and gradually extended their operations over the area of the metallic zone mentioned, of 40 miles long by 20 wide, using the Yuba River below Timbuctoo to receive and discharge the tailings, or refuse from their operations. The result in gold was considerable, but the system is from its violent nature difficult to control, by presuming to handle and remove such huge depositions in order to collect the richest material. The idea was bold, being an anticipation of Nature's operations; but the equitable disposal of the "tailings" in a cultivated country is impossible, as the silt runs down the rivers, creating banks and bars in their channels, obstructing navigation and agricultural arrangements.

General Description of Hydraulic Mining.

The first work to be accomplished, after calculating that the amount or value of the material to be operated upon is sufficient to guarantee the cost of the undertaking in general, is the construction of a canal or canals, to convey the requisite volume of water from the fountain-head, and of sufficient elevation to command the ground to be worked upon, having also in view the levels of the necessary tunnels and shafts as outlets for the discharge of the gravel through them, these being engineering operations requiring much skill and labor to avoid useless after-cost.

Aqueducts of considerable elevation have to be constructed across deep valleys, and the speculation is at all times problematical, as the ground cannot be properly tested until the water arrives upon it, and disputes may arise between the shareholders of the canal and the mining company, ending frequently in the one devouring the other, unless the two interests be quickly amalgamated.

The starting point should be the lowest level, or "bed rock," on the white cement in the ancient channel, which is probably the original silt collected in it, and is harder than the conglomerate above it, which is more easily removed. The courses of these beds can be easily traced by landmarks and undulations, and occasional exposures of the bed rock at low levels; also trial shafts are sunk in various places in search of it, to a depth of 100 feet, passing through blue gravel. The grades of these beds are not steep, being from 10 to 40 feet per mile as of an ordinary river, and the calculated thickness of the alluvial conglomerate is about 600 feet in many places across the ridge between the South and Middle Yuba River across the Columbia.

The power of the water for the operation is dependent on a given volume deposited in a reservoir, and at sufficient elevation above the points of discharge, as on this depends effectivity to tear down the gravel. It is delivered to the miner by huge pipes made of wrought iron, and laid down to follow the curvatures of the surface of the ground; and the pipe I now treat of, belonging to the Excelsior Water Company, has a diameter of 40 inches on a length of 6,000 feet, and 20 inches on the rest of its length of 3,000 feet, being 9,000 feet in all; and this large pipe forms an inverted siphon across a valley, following on the gravel, to the top of the hill into the reservoir.

These pipes offer advantages over wooden aqueducts for spanning chasms, and also to avoid coursing the sides of valleys; being also cheaper to construct in general, and less liable to accidents from fire and storms, and have the convenience for conveying the water from point to point, as the work of excavation advances, necessitating the removal of portions of the aqueduct forward. The watershed, or reservoir, of the Excelsior Company embraces the valley of the South Yuba and its affluents, and the entire cost of its eight amalgamated canals was \$750,000 dollars.

The rainfall during three years in the mountains averaged 49 inches annually, while the medium in the same period did not exceed 20 inches in the plains beneath. The height of the reservoir above the tailing, or Yuba River, is 393 feet; and the height of the head above the floor, or outlet sluiceway, of the Blue Gravel Mining Company was 197 feet.

The exact quantity of water required to wash every class of gravel is difficult to estimate, but no quantity or pressure would be excessive if properly arranged. The measurement

of water is effected by miner's inches, by allowing it to flow from the reservoir of the seller to the purchaser through a box 10 or 12 feet square, with divisions to obtain a quiet head, with a slide or opening capable of adjustment to any required measure; thus an opening of 25 inches by 2 inches, with a quiet head of 6 inches above the middle of the orifice, would give 50 inches, or about 89,259 cubic feet of water, flowing during ten hours per day, being an amount necessary for a first-class operation. The capability of the Excelsior Canal in rainy seasons reached to a delivery in twenty-four hours, to the various mining companies, of 21,120,000 cubic feet of water, or 8,000 miner's inches, and the value of the water paid for by the Blue Gravel Company in forty-three months ending November 9, 1867, was 157,261 dollars, being at the rate of 15 cents of a dollar per miner's inch; and the proportion of water used to wash down 989,165 cubic yards of gravel was 17,074,758 cubic yards, or 17 1/4 cubic yards of water to 1 cubic yard of gravel; and when at work the quantity of gravel daily moved was 1,298 cubic yards, and the estimated cost to move one cubic yard of gravel was 5 and 3/4 cents of a dollar. But in the face of contingencies the Blue Gravel Company moved 1,000,000 cubic yards of gravel in four years, or at the rate of 250,000 cubic yards per annum, and the cost of washing each cubic yard stands thus:

	Cents.
Cost of water, at 15 cents per miner's inch....	5-77
Cost of labor, gunpowder, sluices, and superintendence.....	16-10
	21-87
Or 21 3/4 cents of a dollar per cubic yard.	

Thus the gravel should contain gold to the value of 22 cents of a dollar per cubic yard to cover cost, and the value of the gravel referred to ranged from 20 to 45 cents per cubic yard; and the cost of work done in shafts and tunnels, in the said Blue Gravel Company's Mining claim, reached 100,000 dollars. But with the cost of the necessary canals paid for by the Excelsior Water Company apart, the total cost amounted to about 1,000,000 dollars, and we must note that the latter company sold water to other mining companies.

The gross yield in gold of the Blue Gravel Company in four years was 837,399 dollars, and in the year 1866 the returns from the Blue Gravel Company paid all the costs of the developments; but in 1867 assessments were paid by the owners to meet the deficiency arising from the cost of sinking two new shafts, and driving fresh tunnels on the lowest levels, which evidently contain on the bed rock the richest concentrations.

In smaller mining adventures of this description, involving less capital, large profits have been made in the gold-bearing zone treated of, by also not having invested in costly canals, which would not have repaid the latter investment; and thus it is evident that the water companies are dependent blindly on the prosperity of the miners.

I will now more minutely describe the actual mining operations. The mining ground being selected, a tunnel is projected from the nearest and most convenient ravine, so that the starting-point on the bed rock toward the face of the ravine shall approach the center of the material to be removed at a gradient of 1 in 10 to 1 in 30. The dimensions of such tunnels are usually 6 feet in width by 7 in height, and continuing in contact with the hard river-bed, for the greater ease of excavation, collection of gold, and conservation of quicksilver amalgam.

These tunnels vary in length from a few hundred feet to a mile, and some of the longer ones occupying from one to seven years in execution, at a cost of from 10 to 60 dollars per foot of frontage. The tunnel of the Blue Gravel Company, with length of 1,358 feet, cost in labor alone 70,000 dollars, but it could now be driven for 35,000 dollars, as skilled labor is cheaper now than then. The grade in this tunnel is about 12 per cent., and the end of the tunnel is designed to be 170 feet of elevation, and reaching to a point beneath the surface of the gravel which is being operated upon, and where a shaft or incline is sunk to or through the bed rock or gravel, until it intersects the tunnel.

The object of this laborious operation is obvious, as the long tunnel becomes a sluiceway, and through the whole length of which sluice boxes are laid, for the double motive of carrying off the material and saving the gold, and for this purpose a trough of strong planks is placed in the tunnel, 2 1/2 feet wide, and with sides high enough to contain the stream.

The pavement of the trough is generally laid of blocks of wood 6 inches in thickness, cut across the grain, and placed on their ends, to the width of the sluiceway. The wooden blocks are usually alternated with sections of stone pavement, the stones being set endwise, and in the interstices between the stones and wooden blocks quicksilver is distributed, and as much as 2 tons of this metal is required to charge a long sluice. The water in the canal is brought by aqueducts, or other means, to the head of the mining ground, having an elevation of 100 to 200 ft. above the lowest level of the mining ground and is finally conveyed to it by iron pipes, sometimes sustained on a strong incline of timber.

These pipes are of sheet iron, of adequate strength, riveted at the joints, and measure from 12 to 20 inches in diameter, and communicate at the bottom with a strong prismatic box of cast-iron, on the top and sides of which are openings for the adaptation of flexible tubes, made of very strong fabric of canvas, strengthened by cording, and terminating in nozzles of metal of 2 1/2 to 3 inches in diameter. From these nozzles the streams of water are directed against the face of the gravel to be washed, exercising incredible effectivity.

The volume of water employed varies of course with the work to be done; but it is not uncommon to see four such streams acting simultaneously on the same bank, each conveying from 100 to 600 inches of water per hour—1,000 miner's inches being equal to 106,600 cubic feet of water per hour, constantly exerting its force under a pressure of 90 to 200 pounds to the square inch, varying with the height of the column.

Under the continuous action of this enormous force, aided by the softening power of the water, large sections of the gravelly mass are dislodged, and fall with great violence, the debris speedily disintegrating and disappearing under the resistless force of the water, and is hurried forward in the sluices to the mouth of the shaft, down which it is precipitated with the whole volume of turbid water. Boulders of 100 to 200 lb. in weight are dislodged and shot forward by the impetuous stream, accompanied by masses of the harder cement which meet in the fall, and by the concussion from the great boulders the crushing and pulverizing agency required is found to disintegrate it. The heavy banks, of 80 feet and upward, are usually worked in two benches, the upper never being so rich as the lower, and also less firm, and therefore worked away with greater rapidity.

The lower section is much the more compact, as this stratum on the bed rock being strongly cemented resists great pressure, and even sometimes the full force of the streams of water, until it has been loosened by gunpowder or other explosives. For this purpose adits are driven in on its foundation-point of from 40 to 70 feet and more from the face of the bank, and drifts are extended at right angles therefrom to a short distance on each side of the adit, and in these drifts a large quantity of gunpowder is placed (from 1 to 3 tons), and fired at one blast, having been previously built in with masonry. And in this manner the compact conglomerate is broken up, and then the water easily completes its work. Sometimes in the soft upper strata the systems of tunnel is extended, as in a coal-mine, by cross alleys, leaving blocks which are afterward washed away, and then the whole mass settles, and is disintegrated under the influence of water. The wooden sluices in the tunnels already described are often made double for the convenience of "cleaning up" one of them, while the other remains in action. The process of cleaning up is performed according to the quantity and richness of the material worked upon, at intervals of twenty to forty days, and consists in removing the pavement and blocks from the bed of the sluice, and then gathering all the amalgam of gold and rich dirt collected, and replacing the locks in the same way as at first. Advantage is taken on this occasion to reverse the position of the blocks and stones when they are worn irregularly, or substitute new ones for those which are worn through. The mechanical action of the washing process on the blocks is of course very rapid and severe, requiring complete renewal of them once in eight to ten weeks. Some miners prefer a pavement of egg-shaped stones set like a cobble-stone flooring, the gold being deposited in the interstices. Most of the sluiceways are, however, paved with rectangular wooden blocks, with or without stones as described. Standing at the mouth of one of the long tunnels in full action, any person unaccustomed to the process is struck with astonishment, amounting almost to terror, as the muddy mass sweeps onward, bearing in its course the great rolling boulders, which add their din to the roar of the water, the whole being precipitated down a series of falls, at each of which it is caught up again by new sluices of timber, lined like the first, and so onward and downward many hundreds of feet until the level of the river is reached, at a distance of about a half mile or more from the mouth of the first tunnel.

At each of these new falls of 25 to 50 feet the process of comminution begun in the first shaft is carried on, and a fresh portion of gold obtained. Rude as this plan of saving gold appears to be, more gold is procured by it than by any other method of washing yet devised for this process of work, and the economical advantages obtained by it cannot be surpassed, as it would be impossible to handle such vast quantities of material in any other way, and we can compare the cost of washing and handling a cubic yard of auriferous gravel by it as follows:

	Dollars.
By manual labor with the pan.....	15 00
“ “ with rocker.....	3-75
“ “ with the long tom.....	75
By the hydraulic process.....	15

But this process, even if effective or profitable as a mining operation, may be prejudicial to the interests of the general public, if conducted on a large scale, as the vast quantity of material which it so suddenly removes is merely shifted into the shallows beneath, to be redistributed by every freshet to points lower and lower down until it reaches the sea-coast, creating bars at the mouths of rivers in its course, and changing the hydrography of harbors—as it has done with the Bay of San Francisco by its silt.

The hills behind, torn up and washed by the gold miner, are abandoned as desolate and irredeemable; and the costly canals, constructed with peculiar conveniences for mining purposes, eventually fall into disuse from being too expensive to maintain or alter for general agricultural uses.—*Journal of Science.*

THE TREATMENT OF CHOLERA.

FROM the host of remedies and suggestions that are now deluging the European medical press, we select the following from Dr. Henry A. Rawlins, in the *London Med. Times*, July 12, 1884:

The man suffering from cholera has been suddenly deprived by diarrhoea of an enormous quantity of the fluid part of his blood. This loss is one of simple transudation, increasing as the powers of life decrease. This sudden loss produces intense prostration, and renders the heart powerless to perfect the circulation. The body, thus deprived of oxygen, speedily runs into decomposition, even before life is extinct. Have we any agent by which we can collect and press forward these scattered and lethargic drops of blood to the heart, and enable it to renew the circulation, and with it the blessings of oxygen to the body? My reply is emphatically—Yes! Flannel bandages from the toes to the trunk, around the abdomen, and from the fingers to the body, will effect this object perfectly. Remark that the effect is gradual, increasing with every turn of the roller, but would be in full force in about twenty minutes. By thus exposing the blood in the lungs to the action of oxygen in its diluted form, as it is in the air, instead of pure oxygen, the reaction would neither be too rapid nor too dangerous. In confirmation of my views, I have this day learned that it is the custom in India to wear a double roll of flannel around the abdomen, as a preventive to cholera. The other advantages resulting from the use of the flannel bandages are:

1. That they prevent the escape of heat from the body of the poor creature who is already in a state of refrigeration.
2. By their firmly and equally grasping both flexor and extensor muscles alike, they are steadied, and rendered much less likely to be affected with spasmodic action or cramp.

3. By their steady elastic pressure and support of about 160 pounds, they persistently keep up and sustain the circulation of the blood, which they had previously restored.

4. That the oxygen thus well secured to the blood will, I believe, prove quite sufficient to neutralize the original poison, and also destroy its effects.

5. That this much can at least be claimed for their use—that they remove from nature a stumbling-block, which prevented her from exercising her marvelous recuperative powers. Diluted sulphuric acid is the best medicine to arrest the flux from the bowels, acting also as a tonic. It should be given in five-minim doses about every half hour, with rice gruel. By adopting this plan, the natural process is brought about, that of the starch being converted into grape sugar. Plenty of white of egg, well whipped up, so as to nourish the body and convey oxygen into the stomach, which it will appropriate, should be given. Opium, in small