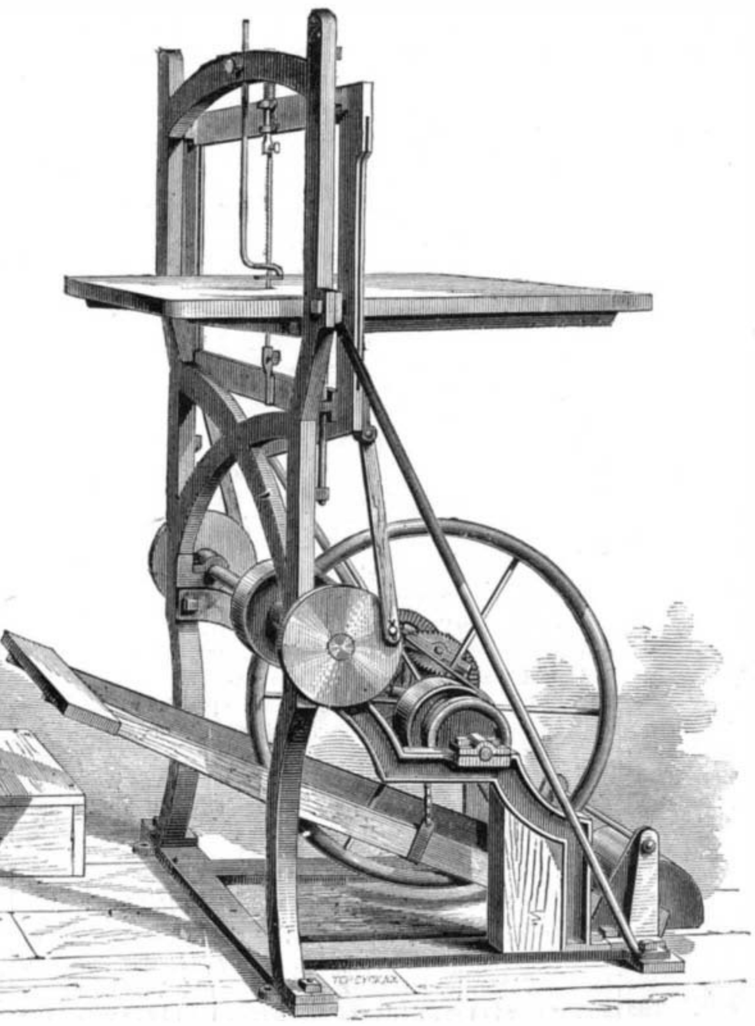
FOOT POWER JIG SAW.

It will be remembered that, towards the beginning of the present volume, we presented an application of the "vertical multiplier" to the band saw. We now lay before our readers still another arrangement of the same ingenious and labor-saving device, this time, however, in connection with the jig saw.

The machine is fully represented in our illustration; and as a detailed explanation of the multiplier, without the aid of which the operation by foot power of the saws to which it is applied would be practically impossible, can be found in Volumes XXII. and XXVI. of this journal, we have only in the present article to refer to the general capabilities of the invention. Forty steps of the treadle produce 546 and a fraction movements of the saw; or, in other words, the motion transmitted by the gearing is as 1 to 13·6, about. At a trial in our presence the blade made its way through work of two inches in thickness, hard ash wood, with great rapidity, and was actuated by the sawyer merely throwing his weight upon the treadle, a motion which, we were informed, could be continued for a long period without fatigue.

This device, as indeed are all applications of the multiplier, is especially designed to meet the wants of shops in which there is no steam power. It occupies but two and a half by three and a half feet of floor space, has two feet swing, is four and a half feet high, and is strong and durably constructed. The low price at which the manufacturers offer it will render it particularly adaptable to the needs of amateurs and mechanics and cabinetmakers. For further particulars address the Combined Power Company, No. 23 Dey street, New York city.



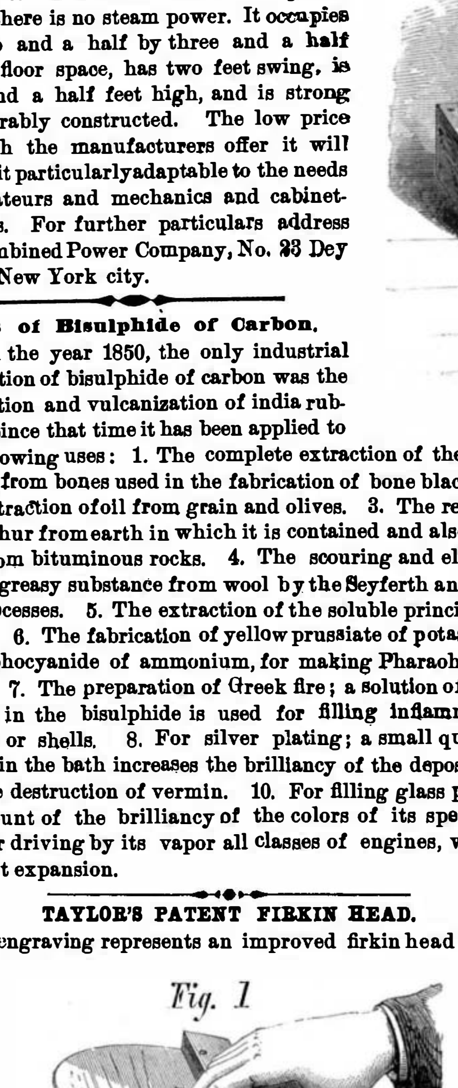
FOOT POWER JIG SAW.

Uses of Bisulphide of Carbon.

Until the year 1850, the only industrial application of bisulphide of carbon was the dissolution and vulcanization of india rubber. Since that time it has been applied to the following uses: 1. The complete extraction of the fatty matter from bones used in the fabrication of bone black. 2. The extraction of oil from grain and olives. 3. The removal of sulphur from earth in which it is contained and also bitumen from bituminous rocks. 4. The scouring and elimination of greasy substance from wool by the Seyferth and similar processes. 5. The extraction of the soluble principle of spices. 6. The fabrication of yellow prussiate of potash, and of sulphocyanide of ammonium, for making Pharaoh's serpents. 7. The preparation of Greek fire; a solution of phosphorus in the bisulphide is used for filling inflammatory rockets or shells. 8. For silver plating; a small quantity placed in the bath increases the brilliancy of the deposit. 9. For the destruction of vermin. 10. For filling glass prisms, on account of the brilliancy of the colors of its spectrum. 11. For driving by its vapor all classes of engines, with or without expansion.

TAYLOR'S PATENT FIRKIN HEAD.

Our engraving represents an improved firkin head which



is claimed to save cooperage and to facilitate inspection of the contents, a fact of importance when the latter contains butter, fruit, or other perishable substance. It is depicted in the illustration as applied to a butter keg, which may be thus caused to serve as a "return pail," an especially advantageous arrangement for shippers and commission merchants. The invention is equally adapted for barrels, etc.

The head consists of two pieces of wood, A and B, cut as indicated by the inner dotted lines in Fig. 2. At one end and underneath, they are connected by a strip of springy wood, C. To the piece, A, are secured the cleats, D, below and, E, above the device. The portion, B, is held only by the wood spring, C, and a single nail passing through both cleats, and shown at the right in Fig. 2, so that it is movable and may be brought nearer or further from the part, A, thus narrowing or widening the space between. On the upper side of this part, B, is pivoted a button, F, the inner end of which is rounded and takes against the edge of the cleat, E. By moving the outer extremity of the button, its inner end pushes upon the cleat, E, and thereby forces the two portions of the head apart.

To operate the device, a groove is previously made as usual, within the inner upper part of the barrel. The hand grasps the head, as shown in Fig. 1, the button, F, being turned parallel to the cleat, E, and the fingers pressing the parts, A and B, together. When the head is placed in the groove, it is expanded as above described by moving the button, F, so that it lies at right angles to the cleat, E. The edges of the cover are thus forced tightly into the groove, and the apparatus thus completely closes the barrel, effectually preventing the entrance of dirt or insects. A screw or nail through the outer end of the button, F, holds all the parts firmly in place during transportation. To remove the head, the operation above described is simply reversed.

Patented March 26, 1873. For further particulars relative to sale of rights, etc., address the manufacturers, Messrs. Taylor & Co., Ashland, Va.

The Loss of the Steamship Atlantic.

We continue to receive a multitudinous correspondence on this subject, and are pleased to find that our editorial, on page 241 of the current volume, has elicited the attention of inventors. We make the following extracts from letters received during the past few days:

F. D. J. suggests the construction of boats, one for each passenger, of rubber, with sides and ends of double material, air tight, with a tube for inflating the bag-like parts above the water line, all around the boat. Stationary ribs (of rubber?) could be stretched from gunwale to gunwale, and a passenger could secure himself in the boat, and be thrown into the sea or swim away from the wreck, and continue to float even when perfectly exhausted.

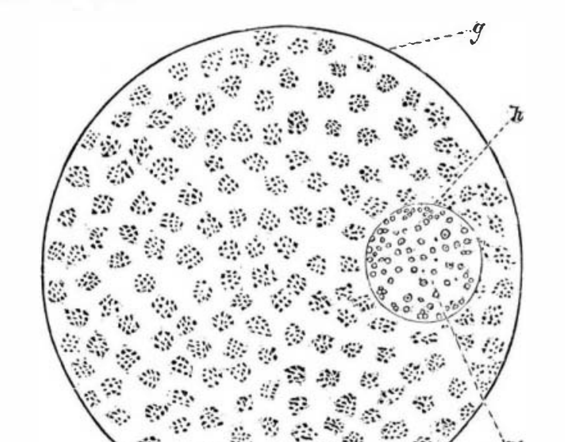
"A Riveter" speaks of the much vaunted water-tight compartments of which ship owners talk largely in advertisements. He worked in a ship-building yard at Port Glasgow, Scotland, for ten years, and he states that he has never seen a ship built with water-tight compartments. With regard to one vessel in particular, every one employed on her expected she would sink; and when finished, she sailed for India with a cargo of railroad iron and went down four days after leaving port. Another ship built in Glasgow, in 1865, was described by the men employed on her as "a coffin for somebody;" she was built of bad iron and badly put together. The correspondent has also worked on coal boats, built at Chester, Pennsylvania, which were constructed with poor materials and workmanship. He speaks highly of the metal used in iron boats built at Buffalo, but utterly condemns their workmanship. He also censures the building of the steamers of the American line from Philadelphia to Liverpool, stating that they are not well riveted, and that some of them are not caulked above water line, and that their bulkheads will not be water-tight. Putty is used in coating them, and the writer would not like to risk his life in the vessels.

J. L. G. dissents from our opinion that boats are not to be depended on, and would limit our statement to boats heretofore in use. He censures the lifeboats carried by ocean steamers, as they do not right and bale themselves instantly; and asks us to publish a description of any that fulfills these requirements. "But it may be said that the difficulty exists in launching the boat safely. Very truly, a life boat to be depended upon must have the capacity of launching itself; or, in other words, an officer must be able to launch the boat safely and instantly, with himself and several seamen in it, in any kind of sea, in such a way that there is no possibility of mishap either in crushing the boat against the side of the vessel, in swamping, or in carrying a line. Some four years since, another inventor and myself turned our attention to this subject, and, by costly experiments and great labor, finally succeeded in doing two things; the first was the production of such a boat and means of launching it, as above described in every respect, to the entire satisfaction of the Board of Supervising Inspectors of Steam Vessels, who said in their report that the boat was perfect in all that the inventors claimed for it. The second thing we accomplished, still more effectually, if possible, was to so thoroughly impoverish ourselves that any further inventions from us are out of the question, as is also pressing our invention into use: although its superiority is not questioned by any who see its operation, nor are we able to resist the attempt, that has been and is now being made by government officials, to appropriate the result of our labors to their own credit. From this showing, you will see that you are wrong in the last two sentences of the article referred to, that, 'after being invented and proved capable, the law is strong enough to compel its introduction into general use.'"

THE WONDERS OF THE EGG.—SECOND LECTURE.

[BY PROFESSOR AGASSIZ.—CONCLUSION.]

If we pass now to the bird, we find in the ovary eggs which can in no way be distinguished from those observed in the ovary of the mammal, only we find in the former a much larger number. Besides those very small ovarian eggs, there are larger ones—eggs rising to dimensions so considerable that they are not only visible to the naked eye, but may be handled with facility. A mature egg in the ovary of the hen is about the dimension of a small walnut. It has no shell, no white; but it is a bulk of yolk inclosed in a vitelline membrane, containing a germinative vesicle with germinative dots. The amount of yolk is very great. If we examine the yolk, we find that its whole substance is made up of cells. This fact at once suggests a further inquiry as to the constitution of the fluid contained in the vitelline egg of the mammalia. The question would be answered differently by different investigators. But unquestionably the mature ovarian egg of the bird differs from that of the mammal in the larger amount of yolk it contains, and in the fact that the whole mass of yolk consists in the accumulation of cells in such numbers that they are counted by myriads. These cells may be traced under the microscope. In absence of a well drawn hen's egg, I give a mature ovarian egg of the snapping turtle, which may answer for this purpose.

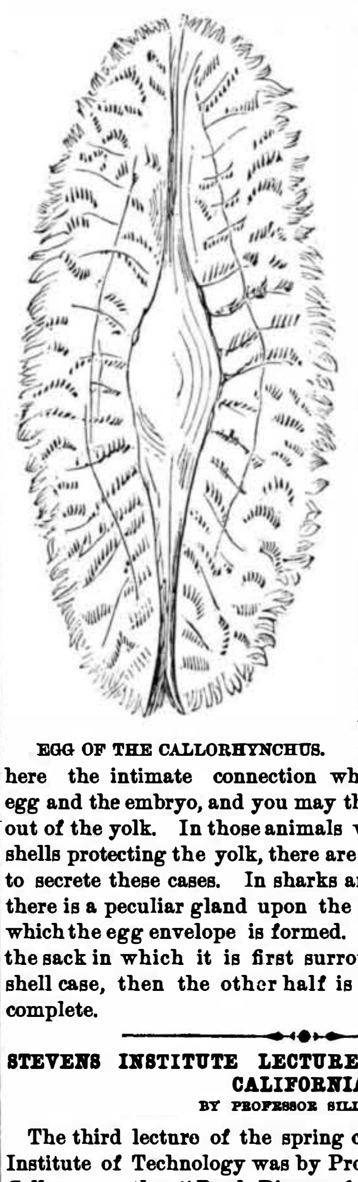


(a, b, c, d, e, f, Mesoblasts or contents of Purkinjean vesicle, magnified 100 diameters. g, Vitelline membrane. h, Purkinjean vesicle. i, Contents of Purkinjean vesicle.)

Suppose I should represent an ovarian egg of the hen enlarged so that the germinative vesicle alone would appear as large as a whole ovarian egg at the time of maturity: we should find that the whole of the yolk consists either in little granules or in little vesicles resembling each other so much as almost to force us to the conclusion that these vesicles are only granules which have swollen and become hollow. By the side of these smaller vesicles are others somewhat larger, containing themselves a vesicle and granule, that is to say, having the true character of ordinary cells. The whole mass of the yolk consists of such granular vesicles and true cells. The yolk is, in fact, an accumulation of cells in various stages of growth. This large yolk, this large ovarian egg of a hen, with its contents, was itself at one time so small as to escape the natural power of the human eye. We can place a portion of the ovary of the hen under the microscope and have at the same time in the field small eggs which cannot be seen with the natural eye and other eggs perceptible in different degrees; and we find that the smallest are just like the eggs of mammalia, containing a transparent fluid with granules floating in it, while others contain cells already to be distinguished, and others are full of cells so large as to make the whole mass opaque. The peculiar color of the hen's egg in all its stages leaves no doubt that the cells —at least those within the egg—are formed by the swelling of the yolk particles and their subsequent growth into larger vesicles containing a fluid in which the elements of a perfect cell are finally matured. We are certainly justified in saying that they are cells, and that the vitelline cells are of the number which arise from the enlargement of solid granules, these granules being animal particles secreted by the organs in which they arise.

At this stage of the ovarian egg, that is, when it has acquired the vitelline membrane, the germinative vesicle and germinative dot also acquire certain dimensions differing in different animals and are or may be fecundated. This fecundation consists in the contact of sperm cells with the yolk bag. What the influence of that contact is, nobody has been able to trace. (The way in which the spermatic particles reach and penetrate the egg we shall consider hereafter.) It is from that time that the changes date which lead toward the formation of a new being. But the egg of the hen when fecundated has not yet completed its growth. The hen's egg, as we know it, has a shell, and a delicate membrane lining the shell, and a layer of white albumen surrounding the yolk. All these parts are formed after the egg has been fecundated. So you see that the life of the egg, in this class of animals, is something independent, as it were, within certain limits, from the growth of these essential portions of the egg which lead to the formation of the new being. Why is it that the egg must be laid in that condition in order to lead more directly to the growth of the young: why it is that in the bird the germ lies dormant in the egg, after the egg has been laid, until a certain temperature is applied to it: I cannot explain, but those are conditions which always accompany the formation of the germ in birds, and its final development into a new being. In mammalia—to show you how great a contrast exists between these two classes—the ovarian egg is not dropped when the germ begins its growth, but is retained until the germ has acquired certain dimensions, a certain stage of development which varies according to species. Every one knows that our opossum brings forth young so delicate and so imperfectly developed that they require protection from the mother long after birth. They become attached to the teats of the female and hang there for a number of weeks before they are capable of shifting for themselves. Other animals are born already covered with hair, but are blind, as in the case of cats; while others are born so that they are capable of walking away at once, as is the case with horses or cattle. However great may be the similarity between the eggs of different animals, there are marked specific differences in their subsequent development. And these are not variable features; they are implied in the very existence of the species in which they occur. They are specific differences in the growth and development of animals, as characteristic as any ultimate differences in their adult condition. Let us now pass to the class of reptiles. The scaly reptiles—that is, turtles, lizards, and serpents—bring forth eggs similar to those of birds. They arise in the ovary in a similar way and produce by successive growth yolks of a similar bulk, as do the birds. While, however, all these eggs are surrounded with a shell after fecundation, the egg is not necessarily laid, as in birds, in order to bring forth the new being. The bird brings forth its young by incubation, setting upon the eggs, and transmitting to them by its own warmth the temperature needed for their final development. For the egg of the reptile, that temperature is usually derived from surrounding conditions. It is true that a few kinds of reptiles, the python for instance, set upon their eggs and transmit to them a higher temperature from their body; but this is not usually the case. Some reptiles deposit their eggs in the sand, where they are hatched out under the influence of the summer heat; others do not lay their eggs until the young have completed their growth, when the new being is born, and the egg shell afterward or about the same time. Others lay eggs from which the living young are hatched in a very short time. The European viper can readily be made to lay its eggs or retain them and bring forth living young, by a simple increase or diminution of the temperature to which it is exposed at a certain stage in the growth of the germ. The egg-laying animals are called oviparous; but those reptiles which bring forth living young are as much oviparous as the rest, for the process of growth is the same, whether the egg is hatched out in the mother or not. The other reptiles, such as frogs and salamanders, spawn. That is, they lay eggs of small dimensions in large numbers, surrounded only by the albuminous envelope, without a shell, and these eggs are fecundated after they are laid. You see here what a marked difference there is between those naked reptiles and scaly reptiles. On account of this and other differences, they have been separated into two classes—the scaly reptiles as reptiles proper, and the naked reptiles as batrachians or amphibians.

When we pass to the eggs of fish, we find there marked differences also, and the most striking are those to which I have already alluded, among the sharks, skates and chimeras, the eggs of which are enveloped in a horny covering, formed after fecundation. We have among these animals the same differences as obtain among scaly reptiles, namely, that with some the egg is laid, and the process of hatching takes place a considerable period after the laying, while in others the egg is not laid until the young has completed its growth and may be born in a condition capable of swimming.



EGG OF THE CALLORHYNCHUS.

I will show you some of these curious eggs. This is an egg of the callorhynchus, the central part of which is pea shaped or cylindrical, as is the cavity in which the yolk is contained, and there is a flat appendage to the egg case by which the egg is enabled to attach itself to submarine bodies. In a good many of the sharks and skates, as already remarked, the egg is not laid before the young has completed its growth and so far completed it as to have acquired its full form. The yolk may then hang like a bag below the body, and be gradually absorbed into it, serving as nourishment for the young until it entirely disappears. [This was illustrated in the last lecture, page 276.] You may see here the intimate connection which exists between the egg and the embryo, and you may that say the embryo grows out of the yolk. In those animals which have coverings or shells protecting the yolk, there are always peculiar organs to secrete these cases. In sharks and skates, for instance, there is a peculiar gland upon the track of the oviduct in which the egg envelope is formed. The egg is received in the sack in which it is first surrounded by only half the shell case, then the other half is formed, and the egg is complete.

STEVENS INSTITUTE LECTURES.—GOLD MINING IN CALIFORNIA.

BY PROFESSOR SILLIMAN.

The third lecture of the spring course before the Stevens Institute of Technology was by Professor Silliman, of Yale College, on the "Dead Rivers of the Sierra Nevada and Hydraulic Mining for Gold." He began by describing the characteristics of the country, along the line of the Union Pacific Railroad, through which the traveler passes in his journey to the gold regions of the far West. Our notions of the Rocky Mountains receive a rude shock on beholding the almost insensible slope which leads us for more than 800 miles along the valley of the River Platte, where the ascent is not over 12, 14 or 16 feet to the mile, and we advance towards the summit without being aware of mounting unless we have perchance an aneroid barometer to tell us so. Yet our government was induced to pay a subsidy of $16,000 per mile for the construction of the Union Pacific Railroad on account of imaginary difficulties. This was as far as Cheyenne, where, it was agreed, the Rocky Mountains really began. From that place to the Black Hills, the subsidy amounted to $32,000 a mile; but the traveler, unaided by the barometer, would be utterly unable to discover the fact that he was not upon a level plain. Passing through the Great American Desert, we come to the continental divide at Sherman, about 9,000 feet above the sea level, to the head waters of the Green River, and arrive in the plain of the Great Salt Lake, joining the Central Pacific at Ogden, still over 4,000 feet above the level of the sea. On examining the sloping banks of the great basin before us, we can distinctly trace the successive outlines of the ancient shores of the great inland sea, which must have risen about 1,200 feet above the present level, and whose waters, by concentration of their saline matter, have produced the present Salt Lake. Continuing our journey, we pass lofty ranges of mountains, some of them 10,000 feet high and running parallel in a northeastern and southwestern direction. Finally we come to the majestic snow-capped wall of the Sierra Nevada, which separates us from the Pacific Ocean. This region we find characterized by precipitous ascents, majestic pine forests and deep cañons. Here we meet with real engineering difficulties. In a country where a slight fall of snow is 16 feet and a heavy one 100 feet deep, and where huge avalanches slide down the rocks, the railroad tracks have to be protected by means of snow sheds of solid timber, which, however, as effectually shut out the view from the passenger as though he were a letter in a mail bag. Smooth and rounded rocks everywhere bear witness to the action of glaciers, which existed there on a vast scale. Along these rugged mountains, the perseverance of the early miners constructed roads for the transportation of all the necessaries of life to the seemingly inaccessible regions where their claims lay, and these roads will ever be monuments to their herculean energy.

In one of the basins left by an ancient glacier, is situated that magnificent sheet of water known as Lake Tahoe. So clear are its waters that fish can be seen swimming in it at a depth of fifty feet, and that the photograph exhibited upon the screen by the lecturer clearly showed the boulders on the bottom. Von Schmidt has contrived a plan to supply San Francisco with water from this lake, whose surface is over 6,000 feet above the level of the Pacific.

Passing, in our downward course, through the Bloomer Cut, we see rising above us on both sides huge walls of gold-bearing gravel; but gold is present in such small quantities that a cubic yard scarcely yields over twenty cents' worth. Before considering the means by which even so small a proportion is made to pay, the lecturer threw on the screen pictures of the early methods employed by the California miners. At first, a pick, a shovel, an iron pan and a rifle were all the necessary outfit, and the gold seeker would take his panful of gravel to the nearest running water. Here the gravel was washed out and the grains of gold, which sank quickly to the bottom of the pan by reason of their greatly superior weight, were gathered. Sometimes the gravel was winnowed in a blanket, where water was scarce. The first improvement was to separate the coarse from the fine by means of a rocking sieve, through which running water washed the gold into a trough beneath filled partly with quicksilver. The gold combined with this, and the sand was carried off by the water. When enough gold was collected in the quicksilver, it was strained through a buckskin bag, and then the gold which remained in the bag was separated from the remaining portion of the mercury by heat.

It soon struck the more intelligent miners that they were only gleaning in a field where nature herself had reaped before; that the streams of water in those regions had been cutting their way through auriferous rock and washing it on a grand scale; and that, by turning these rivers from their course, they would find the results of nature's washings. This grand conception was carried out in many instances, and the professor's views upon the screen amply illustrated the immense labor expended in the construction of ditches for turning rivers from their course and laying dry their former beds. The water of the rivers being forced into a narrower channel accumulated sufficient force to drive water wheels for pumping out the deep places of the river beds and laying bare the accumulated treasures.

When we come to the valley of Dutch Flat, we see for the first time extensive operations for the working of deep lying hill diggings or "placers." Enormous amounts of money have been expended in bringing from a distance the water power which is so necessary everywhere for the washing of the gravel. Sometimes flumes or aqueducts were constructed, 140 feet high upon timber, each stick of which represented the full length of a mountain pine. Water companies were formed, which derived enormous incomes from the rents paid by miners to whose placers the water was distributed. Now, however, the precarious wooden structures have been replaced by huge pipes of boiler plate iron; and with the supply from these, the miner washes out the gravel of his claim clear down to the solid rock, using what is called the "water gun," a knuckle-joint nozzle throwing a solid stream six inches in diameter for a distance of 200 feet, with about one tenth the velocity of a cannon ball. The washed out gravel is no longer sifted by hand; it passes along its natural course with the water through sluices made of wooden blocks and furnished with quicksilver, into which the gold rapidly sinks, while the sand moves on.

The lecturer then cast upon the screen a drawing of the famous Table Mountain of Calaveras, whose steep walls reminded me of the Palisades. This flat mountain is composed of basaltic rock, filling up the channel of an ancient river which formerly rolled over golden sands. The Table Mountain may be considered as nature's monument to this "dead river." The hidden river channel was discovered by some of the earlier miners; and, by a divination which was almost inspired, these untaught men formed correct notions as to the geological character of the mountain, and expended thousands of dollars in getting at the gold on the river bottoms by means of laboriously constructed tunnels through the hard rock.

The deposits of auriferous gravel are so vast in extent as to be almost inexhaustible; but so small is the percentage of the gold they contain that the adventurer no longer finds any chance of getting rich quickly, and the deposits can be worked profitably only by associate capital, where a legitimate outlay of money will bring a legitimate return.

The lecture was profusely illustrated by means of views upon the screen.

SCIENCE RECORD.—NEW EDITION.

The first editions of 1872 and 1873 having both become exhausted, a new edition of each has just been published. The demand for the work has been very great, and universal praise has been bestowed upon it. Condensed descriptions and engravings of the most important inventions and discoveries in science in the years 1871–2, with steel plate portraits and biographies of a number of men distinguished in science, are contained in these annuals, of over 500 pages each. Price by mail, cloth, $2.00; library binding, $2.50. In ordering, state for which year. Price for both, when ordered together, cloth, $3.75; library, $4.50. Address Munn & Co., publishers, office SCIENTIFIC AMERICAN.

OIL OF VITRIOL.—The manufacture of Nordhausen sulphuric acid is still going on in Bohemia, at the works of Von Starcu, where large quantities of iron pyrites are transformed into so called "stone of vitriol," from which the oil of vitriol is derived by distillation in clay retorts. About 1,500 tuns are annually produced